A Note for Public Reviewers

Thank you for your interest in this 2018 update of the Congenital Muscular Torticollis Clinical Practice Guideline. We welcome your comments with regard to clarity, omissions, or implementation feasibility. As you read through the document, there are a few items to note:

1. The document has undergone a first round of review and revision by 16 stakeholders representing a variety of health professions. This public review will be its 2nd review.
2. Wherever you read (URL.TBA), know that the website will be determined by July 1 and the actual Web address will be inserted in the final publication.
3. The document is currently 131 pages; please note that the final version will be significantly shorter when laid out for Pediatric Physical Therapy. Additionally, some of the tables may only be available as supplemental online documents. Nevertheless, it is a large document in order to cover the content and meet standards for transparent guidelines. We do appreciate the time you will take to read it and comment.
4. Figure 1. Referral Flow Diagram, Figure 2. Classification of Severity and Management, and Table 8. The 2018 CMT CPG Summary of Action Statements will be published as stand alone or downloadable pages, so they are easier to reference and print.
5. We recognize that not all treatment approaches to CMT intervention that may be used by PTs are reviewed in this document. The nature of an evidence based clinical practice guideline, and the accepted methodologies for systematic review, require that only those approaches supported by peer-reviewed studies are addressed. If you don’t see an approach that you might use, it is because we found no peer reviewed literature describing its principles, its application or its outcomes. If you are aware of such literature, please send your comments with the citation for the work you believe we missed.
6. Please remember that this is a draft. All comments will be reviewed with decisions maintained by the Guideline Development Group and edits made as appropriate. Thus, it would be prudent to carefully read of the final publication in Pediatric Physical Therapy, planned for the Fall 2018 issue.

All comments must be submitted to torticolliscpg@gmail.com by June 15, 2018.

Thank you again for your interest and commitment to the review process for this guideline.

Sandra L. Kaplan PT, PhD
Colleen Coulter PT, DPT, PhD, PCS
Barbara Sargent PT, PhD, PCS

PHYSICAL THERAPY MANAGEMENT OF CONGENITAL MUSCULAR TORTICOLLIS:
AN EVIDENCE-BASED CLINICAL PRACTICE GUIDELINE FROM
This clinical practice guideline is open for public comment prior to submission for formal publication. Comments or concerns may be sent to torticolliscpg@gmail.com by June 15, 2018 for consideration by the authors. Please reference the line numbers for specific issues.
THE AMERICAN PHYSICAL THERAPY ASSOCIATION
ACADEMY OF PEDIATRIC PHYSICAL THERAPY

Sandra L. Kaplan PT, DPT, PhD
Colleen Coulter PT, DPT, PhD, PCS
Barbara Sargent PT, PhD, PCS

ABSTRACT

Background: Congenital muscular torticollis (CMT) is a postural deformity evident shortly after birth, typically characterized by lateral flexion/side bending of the head to one side and cervical rotation/head turning to the opposite side due to unilateral shortening of the sternocleidomastoid muscle (SCM); it may be accompanied by other neurological or musculoskeletal conditions. Infants with CMT should be referred to physical therapists to treat these postural asymmetries as soon as they are identified.

Purpose: This update of the 2013 CMT clinical practice guideline (CPG) informs clinicians and families as to whom to monitor, treat, and/or refer, and when and what to treat. It links 17 action statements with explicit levels of critically appraised evidence and expert opinion with recommendations on implementation of the CMT CPG into practice.

Results/Conclusions: The CPG addresses: referral; screening; examination and evaluation; prognosis; 1st choice and supplemental interventions; consultation; discontinuation from direct intervention; reassessment and discharge; implementation and compliance audits; flow sheets for referral paths and classification of CMT severity; and research recommendations.
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Comments or concerns may be sent to torticolliscpg@gmail.com by June 15, 2018 for consideration by the authors.
Please reference the line numbers for specific issues.
DOCUMENT ORGANIZATION

This 2018 Congenital Muscular Torticollis Clinical Practice Guideline (2018 CMT CPG) is intended as a reference document to guide physical therapists (PT), families, health care professionals, and educators to improve clinical outcomes and health services for children with congenital muscular torticollis (CMT), and to inform future research. Accepted international methodologies of evidence-based practice were used to systematically search for peer reviewed literature, assign levels of evidence (Table 1), summarize the literature, formulate action statements, and assign grades for each action statement (Table 2).

Table 3 summarizes the 17 action statements with their 2018 status. They are organized under four major headings: Education, Identification and Referral of Infants with Asymmetries/CMT; Physical Therapy Examination and Evaluation of Infants with Asymmetries/CMT; Physical Therapy Intervention for Infants with CMT; and Physical Therapy Discontinuation, Reassessment, and Discharge of Infants with CMT. Following the summary table, descriptions of the CPG purpose, scope and methods are followed by each action statement with a standardized profile of information based on the Institute of Medicine’s criteria for transparent clinical practice guidelines.(ref: http://nationalacademies.org/hmd/reports/2011/clinical-practice-guidelines-we-can-trust.aspx)

Research recommendations are placed within the text where the topics arise, and are collated at the end of the document. Evidence tables on measurement, the first choice interventions, supplemental interventions, and long term follow-up are available online at (URL.TBA)

LEVELS OF EVIDENCE AND RECOMMENDATION GRADING CRITERIA

Table 1: Levels of Evidence

This clinical practice guideline is open for public comment prior to submission for formal publication. Comments or concerns may be sent to torticolliscpg@gmail.com by June 15, 2018 for consideration by the authors. Please reference the line numbers for specific issues.
This clinical practice guideline is open for public comment prior to submission for formal publication. Comments or concerns may be sent to torticolliscpg@gmail.com by June 15, 2018 for consideration by the authors. Please reference the line numbers for specific issues.
Recommendation grades A-C are consistent with the levels of evidence in the BRIDGE-Wiz software deontics. BRIDGE-Wiz is designed to generate clear and implementable recommendations consistent with the Institute of Medicine (IOM) recommendations for transparency. These include: a standardized content outline of a title; a recommendation with an observable action statement; indicators of the evidence quality and the strength of the recommendation; a list of benefits, harms and costs associated with the recommendation; a delineation of the assumptions or judgments made by the guideline development group (GDG) in formatting the recommendation; reasons for intentional vagueness in the recommendation; quality improvement, implementation and audit ideas; and a summary and clinical interpretation of the evidence supporting the recommendation. Theoretical/Foundational (Grade D) and Practice Recommendations (Grade P) are not generated with BRIDGE-Wiz. Grade D is based on basic science or theory, and Grade P is determined by the GDG to represent current best physical therapist (PT) practice or exceptional situations for which studies cannot be performed. Research recommendations identify missing or conflicting evidence, for which studies might improve examination and intervention efficacy, or minimize unwarranted variation.

Status Definitions
These terms are used in the Summary of Action Statements table to indicate changes from the 2013 CMT CPG.

- **New** – an action statement that was not in the prior version.
- **Upgraded with new evidence** - the action statement has a stronger grade than previously with new references.
- **Downgraded with new evidence** - the action statement has a weaker grade than previously with new references.
- **Revised and updated** - the action statement has been reworded for clarity with new references.
- **Revised; no new evidence** - the action statement has been reworded for clarity with no new references.
- **Reaffirmed and updated** – the action statement is unchanged but has new references.
- **Reaffirmed; no new evidence** - the action statement is unchanged and has no new references.
• **Retired** – an action statement that is withdrawn.
Table 3: SUMMARY AND STATUS OF ACTION STATEMENTS FOR THE 2018 CONGENITAL MUSCULAR TORTICOLLIS CLINICAL PRACTICE GUIDELINE

<table>
<thead>
<tr>
<th>Action Statement</th>
<th>Status</th>
<th>Page</th>
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<tbody>
<tr>
<td>EDUCATION, IDENTIFICATION AND REFERRAL OF INFANTS WITH CONGENITAL MUSCULAR TORTICOLLIS (CMT)</td>
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<tr>
<td><strong>P. Action Statement 1: EDUCATE EXPECTANT PARENTS AND PARENTS OF NEWBORNS ON POSITIONING.</strong> Physicians, nurse midwives, prenatal educators, obstetrical nurses, lactation specialists, nurse practitioners or physical therapists should educate and document instruction to all expectant parents and parents of newborns, within the first 2 days of birth, on the importance of symmetrical positioning, supervised prone/tummy play when awake 3 or more times daily, full active movement throughout the body, and the role of pediatric physical therapists in the comprehensive management of postural preference and optimizing motor development. (Evidence quality: V; Recommendation strength: Best Practice)</td>
<td>New.</td>
<td>23</td>
</tr>
<tr>
<td><strong>A. Action Statement 2: ASSESS NEWBORN INFANTS FOR ASYMMETRIES/CMT.</strong> Physicians, nurse midwives, obstetrical nurses, nurse practitioners, lactation specialists, physical therapists or any clinician or family member must assess and document the presence of neck and/or facial or cranial asymmetry within the first 2 days of birth, using passive cervical rotation and/or visual observation as their respective training supports, when in the newborn nursery or at site of delivery. (Evidence Quality: I, Recommendation Strength: Strong)</td>
<td>Revised and updated.</td>
<td>26</td>
</tr>
<tr>
<td><strong>B. Action Statement 3: REFER INFANTS WITH ASYMMETRIES/CMT TO PHYSICIAN AND PHYSICAL THERAPIST.</strong> Physicians, nurse midwives, obstetrical nurses, nurse practitioners, lactation specialists, physical therapists or any clinician or family member should refer infants identified as having postural preference, reduced cervical range of motion, sternocleidomastoid masses, and/or craniofacial asymmetry to their primary physician and a physical therapist with expertise in infants as soon as the asymmetry is noted. (Evidence Quality: II, Recommendation Strength: Moderate)</td>
<td>Reaffirmed and updated.</td>
<td>28</td>
</tr>
<tr>
<td><strong>PHYSICAL THERAPY EXAMINATION AND EVALUATION OF INFANTS WITH ASYMMETRIES/CMT</strong></td>
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<tr>
<td><strong>B. Action Statement 4: DOCUMENT INFANT HISTORY.</strong> Physical therapists should obtain and document a general medical and developmental history of the infant, including 9 specific health history factors, prior to an initial screening. (Evidence Quality: II,</td>
<td>Revised and updated.</td>
<td>31</td>
</tr>
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</table>
B. **Action Statement 5: SCREEN INFANTS FOR NON-MUSCULAR CAUSES OF ASYMMETRY AND CONDITIONS ASSOCIATED WITH CMT.** When infants present with or without physician referral, and a professional, or the parent or caretaker indicates concern about head or neck posture and/or developmental progression, physical therapists with infant experience should perform and document screens of the neurological, musculoskeletal, integumentary and cardiopulmonary systems, including screens of vision, gastrointestinal history, postural preference and the structural and movement symmetry of the neck, face and head, trunk, hips, upper and lower extremities, consistent with state practice acts. (Evidence Quality: II-IV, Recommendation Strength: Moderate)

B. **Action Statement 6: REFER INFANTS FROM PHYSICAL THERAPIST TO PHYSICIAN IF INDICATED BY SCREEN.** Physical therapists should document referral of infants to their physicians for additional diagnostic testing when a screen identifies: non-muscular causes of asymmetry (e.g. poor visual tracking, abnormal muscle tone, extra-muscular masses); associated conditions (e.g. cranial deformation); asymmetries inconsistent with CMT; or if the infant is older than 12 months and either facial asymmetry and/or 10-15 degrees of difference exists in passive or active cervical rotation or lateral flexion; or the infant is 7 months or older with an sternocleidomastoid mass; or if the side of torticollis changes. (Evidence Quality: II, Recommendation Strength: Moderate)

B. **Action Statement 7. REQUEST IMAGES AND REPORTS.** Physical therapists should request and include in the medical record all images and interpretive reports, completed for the diagnostic workup of an infant with suspected or diagnosed CMT, to inform prognosis. (Evidence Quality: II, Recommendation Strength: Moderate).

B. **Action Statement 8: EXAMINE BODY STRUCTURES.** Physical therapists should perform and document the initial examination and evaluation of infants with suspected or diagnosed CMT for the following 7 body structures:
- Infant posture and tolerance to positioning in supine, prone, sitting and standing for body symmetry, with or without support, as appropriate for age. (Evidence quality: II; Recommendation strength: Moderate)
- Bilateral passive range of motion (PROM) into cervical rotation and lateral flexion. (Evidence quality: II; Recommendation strength: Moderate)
### B. Action Statement 9: Classify the Level of Severity

Physical therapists and other health care providers should classify and document the level of CMT severity, choosing one of eight proposed grades (Figure 2), based on infant’s age at examination, the presence of a SCM mass, and the difference in cervical rotation PROM between the left and right sides. (Evidence Quality: II; Recommendation Strength: Moderate)

Upgraded with new evidence.

| 50 |

### B. Action Statement 10: Examine Activity and Developmental Status

During the initial and subsequent examinations of infants with suspected or diagnosed CMT, physical therapists should examine and document the types of and tolerance to position changes, and motors development for movement symmetry and milestones, using an age appropriate, valid and reliable standardized test. (Evidence quality: II; Recommendation strength: Moderate)

Revised and updated.

| 54 |

### B. Action Statement 11. Examine Participation Status

The physical therapist should obtain and document the parent/caregiver responses regarding:

- Whether the parent is alternating sides when breast or bottle feeding the infant. (Evidence quality: II; Recommendation strength: Moderate)
- Sleep positions. (Evidence quality: II; Recommendation strength: Moderate)
- Infant time spent in prone. (Evidence quality: II; Recommendation strength: Moderate)

Revised and updated.

| 56 |
• Infant time spent in equipment/positioning devices, such as strollers, car seats or swings. (Evidence quality: II; Recommendation strength: Moderate)

**B. Action Statement 12: DETERMINE PROGNOSIS.** Physical therapists should determine and document the prognosis for resolution of CMT and the episode of care after completion of the evaluation, and communicate it to the parents/caregivers. Prognoses for the extent of symptom resolution, the episode of care, and/or the need to refer for more invasive interventions are related to: the age of initiation of treatment, classification of severity (Figure 2), intensity of intervention, presence of comorbidities, rate of change and adherence with home programming. (Evidence Quality: II, Recommendation Strength: Moderate)

**PHYSICAL THERAPY INTERVENTION FOR INFANTS WITH CMT**

**B. Action Statement 13: PROVIDE THESE FIVE COMPONENTS AS THE FIRST CHOICE INTERVENTION.** Physical therapists should provide and document these five components as the first choice intervention for infants with CMT:

- Neck PROM. (Evidence quality: II; Recommendation strength: Moderate)
- Neck and trunk AROM. (Evidence quality: II; Recommendation strength: Moderate)
- Development of symmetrical movement. (Evidence quality: II; Recommendation strength: Moderate)
- Environmental adaptations. (Evidence quality: II; Recommendation strength: Moderate)
- Parent/caregiver education. (Evidence quality: II; Recommendation strength: Moderate)

**C. Action Statement 14. PROVIDE SUPPLEMENTAL INTERVENTION(S), AFTER APPRAISING APPROPRIATENESS FOR THE INFANT, TO AUGMENT THE FIRST CHOICE INTERVENTION.** Physical therapists may provide and document supplemental interventions, after evaluating their appropriateness for treating CMT or postural asymmetries, as adjuncts to the first choice intervention when the first choice intervention has not adequately improved range or postural alignment, and/or when access to services is limited, and/or when the infant is unable to tolerate the intensity of the first choice intervention, and if the physical therapist has the appropriate training to administer the intervention. (Evidence Revised and updated. 68
<table>
<thead>
<tr>
<th>Quality: I-IV, Recommendation Strength: Weak)</th>
<th>Revised and updated.</th>
<th>74</th>
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<tr>
<td><strong>B. Action Statement 15. INITIATE CONSULTATION WHEN THE INFANT IS NOT PROGRESSING AS ANTICIPATED.</strong> Physical therapists who are treating infants with CMT or postural asymmetries should initiate consultation with the infant’s physician and/or specialists about other interventions when the infant is not progressing as anticipated. These conditions might include: when asymmetries of the head, neck and trunk are not starting to resolve after 4-6 weeks of initial intense treatment or after 6 months of treatment with only moderate resolution. (Evidence Quality: II, Recommendation Strength: Moderate)</td>
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<tr>
<td><strong>PHYSICAL THERAPY DISCONTINUATION, REASSESSMENT, AND DISCHARGE OF INFANTS WITH CMT</strong></td>
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<tr>
<td><strong>B. Action Statement 16: DISCONTINUE DIRECT SERVICES WHEN THESE 5 CRITERIA ARE ACHIEVED.</strong> Physical therapists should discontinue direct physical therapy services and document outcomes when these 5 criteria are met: PROM within 5 degrees of the non-affected side; symmetrical active movement patterns; age appropriate motor development; no visible head tilt; and the parents/caregivers understand what to monitor as the child grows. (Evidence Quality: II-III, Recommendation Strength: Moderate)</td>
<td>Revised and updated.</td>
<td>77</td>
</tr>
<tr>
<td><strong>B. Action Statement 17: REASSESS INFANTS 3-12 MONTHS AFTER DISCONTINUATION OF DIRECT SERVICES, THEN DISCHARGE IF APPROPRIATE.</strong> 3-12 months following discontinuation from direct physical therapy intervention OR when the child initiates walking, physical therapists who treat infants with CMT should examine postural preference, the structural and movement symmetry of the neck, face and head, trunk, hips, upper and lower extremities, and developmental milestones to assess for reoccurrence of CMT and evidence of atypical development. (Evidence Quality: II, Recommendation Strength: Moderate)</td>
<td>Revised and updated.</td>
<td>79</td>
</tr>
</tbody>
</table>
PHYSICAL THERAPY MANAGEMENT OF CONGENITAL MUSCULAR TORTICOLLIS:
AN EVIDENCE-BASED CLINICAL PRACTICE GUIDELINE FROM THE AMERICAN PHYSICAL THERAPY ASSOCIATION ACADEMY OF PEDIATRIC PHYSICAL THERAPY

INTRODUCTION

Purpose of the 2018 Congenital Muscular Torticollis Clinical Practice Guideline

The American Physical Therapy Association (APTA) Academy of Pediatric Physical Therapy (APPT) supports the development of clinical practice guidelines (CPG) to assist pediatric physical therapists (PTs) with the identification and management of infants and children with participation restrictions, activity limitations and body function and structure impairments, related to developmental, neuromuscular, cardiorespiratory and musculoskeletal conditions, as defined by the World Health Organization’s (WHO) International Classification of Functioning, Disability and Health (ICF) (www.who.int/classification/icf/en/). In general, the purpose of a CPG is to help PTs know who, what, how and when to treat, and who and when to refer, and to whom.

Congenital muscular torticollis (CMT) is a postural deformity evident shortly after birth, typically characterized by lateral flexion/side bending of the head to one side and cervical rotation/head turning to the opposite side due to unilateral shortening of the sternocleidomastoid muscle. This CPG for physical therapy management of infants with CMT is intended as a reference document to guide PTs, families, health care professionals, and educators to improve clinical outcomes and health services for children with CMT, and to inform the need for continued research related to physical therapy management of CMT. Current conventions are to update CPGs every 5 years to maintain listing on the National Guideline Clearinghouse (https://guidelines.gov/help-and-about/summaries/inclusion-criteria): this document replaces the 2013 Congenital Muscular Torticollis (2013 CMT CPG).³

Specifically, for infants (birth to 12 months) and very young children with CMT, the purposes of this 2018 CMT CPG are to:
● Update the evidence and guidance for PTs’ management of CMT, including education, screening, examination, evaluation, diagnosis, reasons to refer, classification, prognosis, interventions, outcome measurements, discontinuation, discharge and reassessment.

● Update evidence on common CMT limitations of body functions and structures, activity and participation, and where possible, aligns descriptions with ICF terminology (Appendix 1-ICF/ICD 10 Codes).

● Update a CPG for PTs, physicians, families and caregivers, other early childhood or healthcare service providers, academic instructors, clinical instructors, students, policy makers and payers, that describes, using internationally accepted terminology, best current practice of pediatric PT management of CMT across health care settings, including prenatal classes, newborn nurseries, physician offices, outpatient pediatric physical therapy offices, and early intervention programs.

● Identify areas of research necessary to strengthen the evidence for CMT management.

Background and Changes in the Updated CPG on Congenital Muscular Torticollis

The 2013 CMT CPG\(^3\) set standards for the identification, referral and physical therapy management of CMT, allowing practices to: align documentation with the recommended measures,\(^4\) develop a clinical decision algorithm,\(^5\) and provide guidance for intervention and follow-up.\(^6\) Implementing the 2013 CMT CPG recommendations has been shown to improve outcomes.\(^7\) Studies on CMT published since the 2013 CMT CPG, in combination with clinician feedback, warranted a review of the evidence and its impact on the original recommendations.

The following changes to the 2013 CMT CPG were made in this 2018 CMT CPG.
• A recommendation was added to educate expectant parents and parents of newborns on the importance of symmetrical positioning, prone play and the role of PTs.
• The recommendation to classify severity was upgraded with a level II study that established good reliability for grading.\(^8\)
• The 7 grades were increased to 8, with a \textit{very late} category for all infants >12 months of age, and to correct an omitted line to allow classification of \textit{early mild} in 3-6 month olds and the figure was simplified.
• The major groupings for classification were revised from \textit{Early or Late Identification/Intervention} to \textit{Early, Later and Very Late PT Evaluation/Intervention}, to place the emphasis on classifying severity based on the infant’s age at the PT evaluation.
• Thirteen recommendations were revised for clarity and updated with new literature, 2 recommendations were reaffirmed and updated with new literature, 1 recommendation was upgraded from Practice to Moderate strength, and no recommendations were retired.
• All action statements now include individualized recommendations for quality improvement, implementation and audit. The 2013 CMT CPG section on \textit{Implementation and Audit Recommendations} at the end of the document provided general recommendations for implementing the guideline as a whole. The 2018 version has 2 additional headings in each Action Statement Profile. The \textit{Quality Improvement} section provides a rationale for why that recommendation is important to implement; that is, what aspect of health care services or delivery will improve if the action statement is fully implemented. The \textit{Implementation and Audit} section provides examples of focused recommendations for implementing and monitoring the action statement to ensure quality improvement.
• There are 4 evidence tables in this version. \textit{Studies on Measurement Approaches} and \textit{Studies on the First Choice Intervention} are updated with new evidence. \textit{Studies on Supplemental Interventions} and \textit{Studies on Long-Term Follow-Up} are new additions.
• Sections from the 2013 CMT CPG omitted from this update include the historical background on classic studies that identified the types and incidence of CMT, and the rationale for developing the 2013 version.\(^3\)
The Scope of the Guideline

The 2013 CMT CPG was based on a systematic review of literature through May 2013. The 2018 CMT CPG is based on a systematic review of literature from January 2012 through September 2017, and a supplemental systematic review through May 2018. It is assumed throughout the document that the PT has newborn and early childhood experience.

The CPG addresses these aspects of CMT management in infants and very young children:

- Parent education to prevent or identify postural preference and the role of pediatric physical therapy in its management.
- Diagnostic and referral processes.
- Importance of early assessment and referral of infants with asymmetries/CMT to physician and physical therapists.
- Reliable, valid, and clinically useful screening, examination and evaluation procedures that should be documented.
- Determination of a severity classification and a prognosis for intensity of PT intervention and duration of care.
- First choice physical therapy intervention, including dosage guidance, and supplemental interventions.
- Conditions under which a child should be referred to the infant’s physician and/or specialist for consideration of additional tests and interventions.
- Prognosis if CMT is treated with conservative interventions, or treated with other interventions, and the consequences of CMT left untreated.
- Criteria for discontinuation of direct PT intervention, the importance of a reassessment, and criteria for discharge.
- Important outcomes of intervention and patient characteristics affecting outcomes.

Statement of Intent

This guideline is intended to inform clinicians, family members, educators, researchers, policy makers and payers. It is not intended to be construed or to serve as a legal standard of care. As rehabilitation knowledge expands, clinical guidelines are promoted as syntheses of current research and provisional proposals of recommended actions under specific conditions. Standards...
of care are determined on the basis of all clinical data available for an individual patient/client and are subject to change as knowledge and technology advance, patterns of care evolve, and patient/family values are integrated. This CPG is a summary of practice recommendations that are supported with current published literature that has been reviewed by expert practitioners and other stakeholders. These parameters of practice should be considered guidelines only, not mandates. Adherence to them will not ensure a successful outcome in every patient, nor should they be construed as including all proper methods of care or excluding other acceptable methods of care aimed at the same results. The ultimate decision regarding a particular clinical procedure or treatment plan must be made using the clinical data presented by the patient/client/family, the diagnostic and treatment options available, the patient’s values, expectations and preferences, and the clinician’s scope of practice and expertise. The guideline development group (GDG) suggests that significant departures from accepted guidelines should be documented in patient records at the time the relevant clinical decisions are made.

METHODS
The GDG was approved by the APPT to update the 2013 CMT CPG in accordance with the reaffirmation requirements of the National Guideline Clearinghouse, (https://www.guideline.gov/help-and-about/summaries/inclusion-criteria) and Academy procedures. 10 The purpose, scope and content outline builds on the 2013 CMT CPG survey methods; its content validity is further supported by evidence of the integration of recommendations into practice. 6

Search Strategy
This CPG update is based on a systematic review (January 2012 – September 2017) on the physical therapy evidence for diagnosis, prognosis and intervention of CMT to inform the 2013 CMT CPG.9 Please refer to Heidenreich et al.9 for details of the search strategy, study selection, study appraisal, data extraction, and results for the 20 studies that informed the 2018 CMT CPG: 14 studies informed prognosis and 6 studies informed intervention.

To assure that the updated CMT CPG utilized the most current evidence, a comprehensive search of 5 databases (CINAHL, Cochrane Library, PsycInfo, PubMed, Web of Science) was performed from September 2017 to May 2018 by the GDG with the single search term “torticollis” resulting in 199 studies. No filters were applied for study type or language.
Selection Criteria
Studies meeting the following 3 criteria were included: participants included infants and children diagnosed with CMT; studies informed the PT management of CMT; all study designs. Studies were excluded based on the following 5 criteria: they focused only on plagiocephaly; dissertations and abstracts; not published in English; no statistical analysis of results; were included in the 2013 CMT CPG or the recent CMT systematic review by Heidenreich et al.

Study Appraisal and Data Extraction
Of the 199 studies, 2 studies informed the management of CMT as related to PT, but were not included in the 2013 CMT CPG or the recent CMT systematic review by Heidenreich, Johnson, Sargent. One was a study on the measurement properties of the Classification of CMT Severity grades that was appraised using the COSMIN checklist. One study was an intervention study that was appraised using the APTA’s Critical Appraisal Tool for Experimental Intervention Studies (CAT-EI) and the Cochrane Risk of Bias for intervention studies. Two reviewers completed appraisals of 3 articles to establish inter-rater reliability with at least 90% agreement on each appraisal tool. The two reviewers then appraised each study independently, scores were compared for agreement, and discrepancies were resolved via discussion.

Data was extracted to maintain consistency with the 2013 CMT CPG and the recent CMT systematic review by Heidenreich, Johnson, Sargent. Table 4 - Studies on Measurement Approaches includes the study by Oledzka, Kaplan, Sweeney, Coulter, Evans-Rogers. Table 5: Studies on First Choice Intervention includes 1 new study from the systematic review. Table 6: Studies in Supplemental Interventions includes the Keklicek, Uygur study and 5 new studies from the systematic review. Table 7: Studies of Long Term Follow-Up include 4 new studies from the systematic review. Strengths and limitations of the evidence are included in the aggregate evidence quality and supporting evidence and clinical interpretation section of each action statement.

Recommendation Formulation
Each 2013 recommendation was evaluated for its currency and consistency with the updated literature. The clinical and professional experience of the GDG, trends in practice changes, and the reported impact of the 2013 CMT CPG informed the decision to reaffirm, revise or upgrade
an existing recommendation. The new recommendation on Education is consistent with professional roles to prevent conditions as well as treat them.

**External Review Process**

External review is consistent with the IOM recommendations for Trustworthy Guidelines. The purposes are to ensure clarity, quality and comprehensiveness of the CPG, and to identify potential bias, lapses in logic or alternative perspectives. A first draft of the 2018 CMT CPG was reviewed by 16 stakeholders representing medicine, pediatric nursing, midwifery, parents of infants with CMT, methodologists, PT practice, research, and knowledge translation. Both a rating scale to assess clarity and implementation feasibility and an open ended invite for comments and edits were used to gather feedback. Of the 17 statements, 15 were rated as clear and 12 as feasible by at least 75% of the reviewers. After addressing the 1st round of suggested edits, the document was posted for public review on the APPT website; invitations to review were distributed to APPT members via Academy electronic newsletters, regional director notices to share the link, and direct email notices of volunteers. Non-members could review if notified by APPT members. Suggested edits were addressed and the final draft was submitted to the Pediatric Physical Therapy journal for editorial review. Modifications based on the comments included clarification or expansions of the facilitators and barriers to implementation of individual action statements and use of consistent terminology throughout the document. Many reviewers reinforced plans for knowledge translation, through the production of parent and medical support documents and downloadable selected figures and tables.

**Language**

The 2013 CMT CPG is referenced the first time it appears and is used without reference after that. In contrast, this document is referred to as the 2018 CMT CPG. Additionally, we use the generic phrase ‘infant’s physician’ to reference pediatricians, referring physicians, family physicians or any other primary health care provider.

**CONGENITAL MUSCULAR TORTICOLLIS**

**Incidence and Progression of Congenital Muscular Torticollis**
Congenital muscular torticollis (CMT) is a common pediatric musculoskeletal condition, described as a postural deformity of the neck evident at birth or shortly thereafter. Synonyms include fibromatosis colli for the mass type,\textsuperscript{14,15} wry neck,\textsuperscript{16} or twisted neck.\textsuperscript{17} It is typically characterized by a head tilt to one side or lateral neck flexion, with the neck rotated to the opposite side due to unilateral shortening or fibrosis of the sternocleidomastoid (SCM) muscle. It may be accompanied by cranial deformation (CD),\textsuperscript{18} developmental dysplasia of the hip (DDH),\textsuperscript{19} brachial plexus injury,\textsuperscript{20-22} foot or lower extremity anomalies,\textsuperscript{23-25} and less frequently, presents as a head tilt and neck rotating to the same side, or as a bilateral condition.\textsuperscript{26} The incidence of CMT ranges from 1.3\%\textsuperscript{27} to 16\%\textsuperscript{18} of infants, and may occur slightly more frequently in males.\textsuperscript{27,28} Congenital muscular torticollis may be present at birth when selected morphologic and birth history variables converge, such as in larger babies, breech presentation and/or the use of forceps during delivery,\textsuperscript{29} or it may evidence itself during the first few months,\textsuperscript{18,24} particularly for those with milder forms.

Congenital muscular torticollis is typically categorized as three types: postural, muscular, and SCM mass CMT. Postural CMT presents as the infant’s postural preference\textsuperscript{25,30} but without muscle or passive range of motion (PROM) restrictions and is the mildest presentation. Muscular CMT presents with SCM tightness and PROM limitations. Infants with a SCM mass, the most severe form of CMT, present with a fibrotic thickening of the SCM and PROM limitations.\textsuperscript{31} Since 2013, CMT has also been graded using 7 levels of severity distinguished by age at evaluation, type of CMT, and the presence or absence of a SCM mass.\textsuperscript{3} In general, infants identified early with postural CMT have shorter treatment episodes. Those identified later, after 3-6 months of age and who have a SCM mass, typically have the longest episodes of conservative treatment, and may ultimately undergo more invasive interventions.\textsuperscript{31,32}

Physicians or parents may be the first to notice an asymmetry, and physicians may provide the initial instructions about positioning and stretching to the parents.\textsuperscript{33} The American Academy of Pediatrics (AAP), in its Bright Futures Guidelines For Health Supervision of Infants, Children, and Adolescents publication, recommends checking the newborn for head dysmorphia or abnormal shape at 1 week and skull deformities at 1 month, but does not specify checking the neck for symmetry until 2 months, when the term torticollis is first mentioned.\textsuperscript{34} If the asymmetry does not resolve after initial exercise instructions by the physicians, infants are typically then referred to physical therapy (PT).\textsuperscript{33} While this pattern of identification and
eventual referral to PT is described in the literature, the GDG is in strong agreement with the AAP Policy on surveillance; that physicians should be providing developmental surveillance for all infants at every well-child preventative care visit from birth and throughout the first 6 months,35 such that infants with any persistent postural asymmetries are referred as early as possible for PT intervention.

Physical therapy management of CMT is comprehensive focusing on the following five components as the first choice intervention: neck PROM, neck and trunk active range of motion (AROM), development of symmetrical movement, environmental adaptations, and parent/caregiver education. Earlier PT intervention is more quickly effective than intervention started later.36 If started before 1 month of age, 98% achieve near normal range within 1.5 months, but waiting until after 1 month of age prolongs the PT episode of care to about 6 months, and waiting until after 6 months can require 9-10 months of PT intervention, with progressively fewer infants achieving near normal range.37

Reports of untreated CMT are rare,38,39 but there are descriptions of unresolved or reoccurring CMT in older children or adults, who later undergo botulinum neurotoxin therapy injections,40-42 or surgery for correction of movement limitations, consequent facial asymmetries,39,43-46 or pain.47 The incidence of spontaneous resolution is unknown, and there are no documented methods for predicting who will resolve and who will progress to more severe or persistent forms.

Finally, CMT has been associated with cranial deformation,48 DDH,49 brachial plexus injury,20-22 foot deformities,24 early motor delays,50,51 which may impact function and cosmesis,52 and temporomandibular joint dysfunction.53 Thus, early identification and treatment is critical for early correction, early identification of secondary or associated impairments, and prevention of future complications.

**Importance of Early Referral**

The evidence is strong that earlier intervention results in the best outcomes and decreased episodes of care,36,37,54 so early referral is the ideal. A referral flow diagram is provided (Figure 1) that outlines the possible referral and communication pathways based on time of observation, identification of non-muscular causes of asymmetry, prior models and current literature.20,42,55-58
The referral flow diagram is divided into 2 distinct time frames: Birth to 2 days, representing the newborn period, and 3 days and older, representing the typical time after discharge to home. During the newborn period, many different healthcare providers may observe the infant because they are involved in the birth and/or postnatal care. These healthcare providers are in the ideal position to observe the symmetry of the head on the shoulders and screen for passive and active movement limitations. After the infant is at home, the most likely observers will be the primary physician and the parents or other caregivers. Regardless of who performs the initial screen, infants with asymmetry should undergo an evaluation to rule out non-muscular causes of CMT. If CMT or a persistent postural preference is diagnosed, the infant should be referred to a pediatric PT.

Early referral to a pediatric PT translates to earlier intervention and prevention of secondary sequelae. Additionally, reducing the episode of care and avoiding additional or more invasive interventions is cost effective. Preliminary evidence suggests that treatment by a PT may be more efficient in achieving symmetrical movements than when parents are the sole providers of home exercise programs, further supporting early referral to PT.

EDUCATION, IDENTIFICATION AND REFERRAL OF INFANTS WITH ASYMMETRIES/CONGENITAL MUSCULAR TORTICOLLIS (CMT)

P. Action Statement 1: New. EDUCATE EXPECTANT PARENTS AND PARENTS OF NEWBORNS ON POSITIONING. Physicians, nurse midwives, prenatal educators, obstetrical nurses, lactation specialists, nurse practitioners or physical therapists should educate and document instruction to all expectant parents and parents of newborns, within the first 2 days of birth, on the importance of symmetrical positioning, supervised prone/tummy play when awake 3 or more times daily, full active movement throughout the body, and the role of pediatric physical therapists in the comprehensive management of postural preference and optimizing motor development. (Evidence quality: V; Recommendation strength: Best Practice)

Aggregate Evidence Quality: Clinical experience of the GDG.

Benefits:
- Increases parent/caregiver self-efficacy in caring for their newborn.
- Informs parents on the importance of supervised tummy time to optimize motor development within the first 6 months.
• Teaches parents/caregivers to initiate early surveillance for postural preference and to bring concerns to the infant’s physician, or, in states with direct access, to a pediatric PT.
• Informs parents about the role of pediatric PTs in providing a comprehensive and supportive plan of care to manage postural preference associated with CMT and cranial deformation (CD).
• May reduce the episode of care and improve outcomes if postural preference is identified and comprehensively managed early.

Risk, Harm, Cost:
• May increase parent/caregiver anxiety about the potential for CMT and CD.
• May marginally increase the cost of care if prenatal educators, labor and delivery personnel, or postnatal care providers do not incorporate education into usual care.
• May increase time needed to spend with a newborn and parents during appointments.

Benefit-Harm Assessment: Preponderance of Benefit
Value Judgments: A preponderance of evidence supports that early identification of postural preference and CMT results in shorter episodes of care and full resolution of asymmetries. The GDG feels that if parents know how to survey their newborn during the first months of life, how to encourage tummy time during awake periods, and are empowered to report their concerns to their physician, that asymmetries could be reduced more quickly or even prevented.

Intentional Vagueness: Prone positioning for supervised play up to 3 times a day is the recommendation for newborns because the amount of time awake is limited, though the need to start prone positioning right away for short periods should be reinforced. As time awake increases, infants should be placed for supervised prone play as often as tolerated and practical.

Role of Patient/Parent Preferences: Due to the amount of information that parents of newborns receive during the first days of parenthood, they may benefit from multiple educational opportunities before and after the baby’s arrival. Parents may prefer receiving instruction using different modes of delivery (by video, brochure) or by different healthcare providers (with those they already have a relationship with or as part of prenatal care), or at different phases in their pre to post natal experience.

Exclusions: None

Quality Improvement:
• Pre-Post natal education for parents on postural preference and the benefits of early intervention may shorten the episode of care or improve outcomes if an infant is diagnosed and referred to PT early. This is especially true for parents of multiples, who may be at greater risk than singletons.

Implementation and Audit:

• PTs need to do outreach to ensure that health professionals, including but not limited to physicians, nurse midwives, prenatal educators, obstetrical nurses, lactation specialists, nurse practitioners, doulas, and early intervention providers have an accurate understanding of the role of pediatric PTs in the comprehensive management of postural preference and optimizing motor development, and resources for how and to whom to refer parents.
• Pediatric PTs can provide community education on the prevention and management of postural preference, including CMT and CD.
• Pediatric PTs should distribute the APPT summary brochures on CMT (URL.TBA) to health care providers or parents as appropriate, and educate them about how to access them online.
• Pediatric PTs should collaborate with the relevant health care providers in their clinical setting to develop a pathway for parent education to ensure that it is provided both before and within the first 2 days of birth.
• Audits of the provision of education to expectant parents and parents of newborns can be completed by quality assurance officers.

Supporting Evidence and Clinical Interpretation:

The first step in the American Academy of Pediatrics’ policy on surveillance for developmental disorders is to “elicit and attend to parents’ concerns about their child’s development”. 35 Porter, Qureshi, Caldwell, Echevarria, Dubbs, Sullivan 63 conclude that surveillance does not happen universally, such that others, including parents, should be educated on early surveillance. A mixed methods study determined that 90% of mothers are educated about infant supine sleeping positions, but instruction on awake prone play or rotating prone and supine was only received by 27% of mothers postpartum, and 2 months later, only 8% of mothers used prone positioning during awake time, with 70% positioning only 1-2 times per day. 64 The success of the back-to-sleep campaign 65 has demonstrably reduced cases of sudden infant death syndrome; however,
many ascribe parental adherence to supine positioning, and concomitant avoidance of prone positioning for infant play, as a contributing factor to an increase in CMT. Early and frequent parent education to monitor for asymmetry and about the importance of ‘prone for play’ or tummy time, in addition to ‘supine or back to sleep’, may help to reduce or prevent asymmetries from developing, particularly when postural preferences are apparent.

R. Research Recommendation: Studies are needed on the impact of education on:
- Health care providers and their knowledge of pediatric PTs’ roles in managing postural preference.
- Parents/caregivers about the parental experience of receiving this education.

A. Action Statement 2: Revised and updated. ASSESS NEWBORN INFANTS FOR ASYMMETRIES/CMT. Physicians, nurse midwives, obstetrical nurses, nurse practitioners, lactation specialists, physical therapists or any clinician or family member must assess and document the presence of neck and/or facial or cranial asymmetry within the first 2 days of birth, using passive cervical rotation and/or visual observation as their respective training supports, when in the newborn nursery or at site of delivery. (Evidence Quality: I, Recommendation Strength: Strong)

Action Statement Profile

Aggregate Evidence Quality: Level I based on the odds ratios for prediction of CMT from facial asymmetry (OR 21.75, CI 6.60-71.70) and plagiocephaly (OR 23.30, CI 7.01-70.95), and level II evidence that starting treatment before 6 weeks of age yields greater reductions in SCM thickness than starting after 6 weeks.

Benefits:
- Early identification of infants at risk for CMT or other conditions that may cause asymmetries.
- Early onset of intervention for infants with CMT if referred.
- Reduced episode of care to resolve CMT, with consequent reduction in costs.
- Reduced risk of needing more invasive interventions (botulinum neurotoxin therapy or surgery) in the future.

Risk, Harm, Cost:
- Potential of over-identification of infants may increase costs.
• Potential of increasing parent anxiety.

**Benefit-Harm Assessment:** Preponderance of Benefit

**Value Judgments:** None

**Intentional Vagueness:** None

**Role of Patient/Parent Preferences:** While parents may not be skilled in infant assessment, mothers who are breastfeeding may notice that the infant has greater difficulty feeding on one side, or may notice asymmetry in photographs, and these observations should trigger range of motion (ROM) screening by an attending clinician.

**Exclusions:** None

**Quality Improvement:**

- Documentation of an assessment for cervical ROM and postural symmetry provides uniform data for more effective communication among clinicians and settings, and for uniform data entry in patient registries.
- Early examination can detect asymmetries and support earlier referral to PTs who can provide a comprehensive plan of intervention and follow-up.

**Implementation and Audit:**

- PTs should share the 2018 CMT CPG or the summary brochures (URL.TBA) with physicians and other referral sources in their geographic area, highlighting this recommendation and the importance of early cervical ROM screening.
- Training of or the development of clinical pathways for health professionals who see the infant at birth may be needed to ensure that a cervical ROM assessment occurs within the first 2 days of delivery.
- Documentation forms or electronic records may need revision to reflect the cervical ROM and postural symmetry screen.
- Audits of newborn charts may indicate if patterns of examination are changing.

**Supporting Evidence and Clinical Interpretation**

The intent of this action statement is to increase early identification of infants with CMT for early referral to PT. Newborns (up to the first 3 days of life) can be easily screened by checking for full neck rotation (chin turns past shoulder to 100 degrees) and lateral flexion (ear approximates shoulder) while stabilized in supine during the first postnatal exam. Newborns are at higher risk for CMT if their birth history includes a combination of longer birth body
length, primiparity, and birth trauma (including use of instruments for delivery), facial asymmetry and cranial deformation. Odds ratios from multiple logistic regression for these five factors are, from highest to lowest: plagiocephaly 23.30, CI 7.01-70.95; facial asymmetry 21.75, CI 6.60-71.70; primiparity 6.32, CI 2.34-17.04; birth trauma 4.26, CI 1.25-14.52; birth body length 1.88, CI 1.49-2.38. This indicates that infants with asymmetrical heads or faces have as much a 22-fold increase in abnormal sonogram for CMT; primiparity a 6-fold increase; birth trauma a 4-fold increase; and birth body length an almost 2-fold increase. No one item predicts CMT alone, but the presence of 2 or more of the above risk factors warrants referral for preventative care and parent education.

The importance of early identification of CMT is well supported. Physicians and PTs in Canada agree that infants identified with CMT should receive formal intervention. When intervention is started at earlier ages, it results in shorter episodes of care and greater reductions in SCM thickness that, anecdotally, may have financial, psychological and quality of life implications for the family.

**R. Research Recommendation:** Studies are needed to determine:

- Whether routine screening at birth increases the rate of CMT identification or increases false positives.
- The barriers to early referral of infants with CMT to PT.

**B. Action Statement 3: Revised and updated. REFER INFANTS WITH ASYMMETRIES/CMT TO PHYSICIAN AND PHYSICAL THERAPIST.** Physicians, nurse midwives, obstetrical nurses, nurse practitioners, lactation specialists, physical therapists or any clinician or family member should refer infants identified as having postural preference, reduced cervical range of motion, sternocleidomastoid masses, and/or craniofacial asymmetry to their primary physician and a physical therapist with expertise in infants as soon as the asymmetry is noted. (Evidence Quality: II, Recommendation Strength: Moderate)

**Action Statement Profile**

**Aggregate Evidence Quality:** Level II evidence supports that when intervention is started earlier, it takes less time to resolve the ROM limitation, there are greater reductions in SCM thickness and there is less need for subsequent surgical intervention. Authors suggest...
that stretching interventions are easier for parents to administer when infants are younger, before the neck musculature strengthens and cooperation declines.37, 61

**Benefits:**

- Early differential diagnosis to determine that the postural asymmetry is due to CMT versus another medical condition, such as a visual impairment or reflux.
- Earlier intervention to resolve limited ROM and asymmetries more quickly.
- Early parental education to facilitate symmetrical development and self-efficacy with home programs.
- Greater infant tolerance with intervention in the first few months of life.

**Risk, Harm, Cost:**

- Increased cost for treatment of asymmetries that some suggest may spontaneously resolve.

**Benefit-Harm Assessment:** Preponderance of Benefit

**Value Judgments:** Early referral to PT ensures early onset of intervention, which strongly correlates with shorter episodes of care, greater success of conservative measures, and thus can lower overall costs of care. A pediatric PT will also screen and follow the infant for developmental delays, feeding challenges, and environmental factors that may be associated with or contribute to postural preference or CMT.

**Intentional Vagueness:** For infants suspected of other causes of asymmetries, i.e. bony anomalies, fractures, neurological conditions, or extra-muscular masses, PTs should collaborate with the infant’s physician to make a definitive diagnosis of CMT prior to onset of PT interventions. The focus and prioritization of interventions may change depending on the type of limitations the infant presents with (e.g. neurological, musculoskeletal, cardiopulmonary, integumentary and/or gastrointestinal).

**Role of Patient/Parent Preferences:** Infant tolerance with stretching is easier in the first 2 months than when started after the infant develops greater head control,61, 68 thus infant cooperation is greater and parent adherence to home programs may be optimized. Later referrals put additional stress on parents to adhere to stretching recommendations.

**Exclusions:** Infants suspected of having non-muscular conditions that might cause asymmetrical or torticollis posturing should be fully examined by the appropriate specialists to rule out confounding diagnoses prior to initiating PT.
Quality Improvement:

- Following this recommendation will reduce delays in referrals to PTs who can provide a comprehensive plan of intervention and follow-up to ensure that the primary caregivers can adhere to the recommended interventions.

Implementation and Audit:

- Training of health professionals and early intervention providers who see infants in early infancy may be needed to ensure that infants are appropriately and quickly referred to PT. Health professionals may be reluctant to refer right away if they perceive parents as being overwhelmed during those early weeks; however, earlier referral translates to better outcomes.
- Audits of the age at which parents first noticed the CMT, the date of referral and the age of first PT examination will provide objective measures of delays between identification and referral to PT, and delays between referrals and the 1st scheduled PT examination.
- PTs should share the 2018 CMT CPG or the APPT summary brochures (URL.TBA) with physicians, early intervention providers and other referral sources in their geographic area, highlighting this recommendation and the supporting evidence for early referral.
- Clinical pathways for examination and referral processes may reduce delays in the onset of PT services by prioritizing infants with asymmetry/CMT for PT examinations. PTs may need to collaborate with administrators and non-medical professionals to ensure that these infants receive immediate referrals in the pathway, either internally or through external referrals.

Supporting Evidence and Clinical Interpretation:

Clinicians involved with the delivery and care of infants are in the ideal position to assess the presence of CMT. If screening for CMT occurs routinely at birth, infants who are at high risk for CMT, or who have identified SCM tightness or masses, can have PT initiated when the infant is most tolerant of interventions. CMT may not appear until several weeks post delivery, thus, the 1 month well baby check-up by the physician may be the first point of identification. Early treatment for infants with postural preference or confirmed diagnoses of CMT have excellent outcomes, with >95-100% only needing stretching\textsuperscript{32, 54} or techniques that facilitate functional activation of weak neck muscles.\textsuperscript{68} The earlier intervention is started, the shorter the duration of intervention\textsuperscript{31, 32, 37} and the need for later surgical intervention is significantly reduced.\textsuperscript{54, 59, 69} In
contrast to recommendations to provide stretching instruction to the parents when CMT is identified at birth, and only refer to PT at 2 months of age if the condition does not resolve, recent studies suggest that early PT reduces the time to resolution by approximately 1 month versus 3 months for parent-only stretching, that infants become more difficult to stretch as they age and develop neck control, and that earlier intervention can negate the need for later surgery.

Physical therapists address a broad range of developmental and environmental factors that influence outcomes, such as parental ability to comply with the home exercise programs, distance from the clinical setting, feeding positions, and the infant’s motor and developmental progression. Since developmental delays are detectable at 2 months in infants with CMT, and the delays may be more related to time spent in the prone position, instruction to parents and early modeling of prone play time may help to negate potential developmental lags that can occur with CMT.

**R. Research Recommendations:**

- Studies are needed to clarify the predictive baseline measures and characteristics of infants who benefit from immediate follow-up, and to compare the cost benefit of early PT intervention and education as compared to parental instruction and monitoring by physicians.
- Longitudinal studies of infants with CMT are needed to clarify how the timing of referral and initiation of intervention impact body structure and functional outcomes, and overall costs of care.

**PHYSICAL THERAPY EXAMINATION AND EVALUATION OF INFANTS WITH ASYMMETRIES/CMT**

**B. Action Statement 4: Revised and updated. DOCUMENT INFANT HISTORY.** Physical therapists should obtain a general medical and developmental history of the infant, including specific health history factors, prior to an initial screening. (Evidence Quality: II, Recommendation Strength: Moderate)

**Action Statement Profile**

**Aggregate Evidence Quality:** Level II cohort and outcome studies

**Benefits:**
• A complete history of the pregnancy, delivery, known medical conditions, developmental milestones and daily management of the infant can provide information important to the PT diagnosis, prognosis and intervention.

Risk, Harm, Cost: None

Benefit-Harm Assessment: Preponderance of Benefit

Value Judgments: None

Intentional Vagueness: None

Role of Patient/Parent Preferences: Parents/caregivers can provide much of the history through interview and preadmission information packets; however, obtaining medical records may provide specifics that oral histories may not.

Exclusions: None

Quality Improvement:

• Documentation of the 9 specific health history factors provides uniform data for more effective communication among clinicians and settings, and for uniform data entry in patient registries.

Implementation and Audit:

• Create parent/caregiver report forms that are completed prior to the initial examination to assist with collecting the 9 items.
• Documentation forms or electronic records may need revision to reflect the 9 specific health history factors.
• Audit the completeness of history documentation.

Supporting Evidence and Clinical Interpretation:

In addition to documenting the standard intake information (e.g. date of birth, date of examination, gender, birth rank, and reason for referral or parental concerns, general health of the infant, and other health care providers that are seeing the infant) the PT should specifically document the following 9 birth and health history factors.

• Age at initial visit.\textsuperscript{36, 59, 70}
• Age of onset of symptoms.\textsuperscript{24, 70}
• Pregnancy history including maternal sense of whether the baby was ‘stuck’ in one position during the final 6 weeks of pregnancy.\textsuperscript{23}
• Delivery history including birth presentation (cephalic or breech presentation)\textsuperscript{24, 71, 72} or low birth weight.\textsuperscript{71}
• Use of assistance during delivery such as forceps or vacuum suction.\textsuperscript{18, 21, 28, 54}
• Head posture/preference\textsuperscript{18, 25, 73, 74} and changes in the head/face symmetry.\textsuperscript{18, 24, 28, 48, 69}
• Family history of torticollis or any other congenital or developmental conditions.\textsuperscript{75, 76}
• Other known or suspected medical conditions.\textsuperscript{20, 74}
• Developmental milestones appropriate for age.\textsuperscript{50, 51, 77}

R. Research Recommendation: Studies are needed to clarify how the health history factors influence PT diagnosis, prognosis, and intervention.

B. Action Statement 5: Revised and updated. SCREEN INFANTS FOR NON-MUSCULAR CAUSES OF ASYMMETRY AND CONDITIONS ASSOCIATED WITH CMT. When infants present with or without physician referral, and a professional, or the parent or caretaker indicates concern about head or neck posture and/or developmental progression, physical therapists with infant experience should perform and document screens of the neurological, musculoskeletal, integumentary and cardiopulmonary systems, including screens of vision, gastrointestinal history, postural preference and the structural and movement symmetry of the neck, face and head, trunk, hips, upper and lower extremities, consistent with state practice acts. (Evidence Quality: II-IV, Recommendation Strength: Moderate)

Action Statement Profile
Aggregate Evidence Quality: Level II-IV from cohort and outcome studies, and expert clinical consensus.

Benefits:
• Thorough screening can identify asymmetries and determine their consistency with CMT.
• Screening for other causes of asymmetry (e.g. DDH, clavicle fracture, brachial plexus injury, congenital and/or genetic conditions) facilitates referral to specialists.
• For infants treated for other conditions (i.e., brachial plexus injuries, reflux, and DDH) associated with higher risks for developing CMT, parents can receive preventative instruction for CMT.
• In states where PTs may screen and/or treat without physician referral, infants may receive services more quickly.
Risk, Harm, Cost:
- The cost of a PT screening if the infant is not already being treated for other conditions.
- The risk that PTs without infant experience may miss or misidentify non-muscular causes of asymmetry.

Benefit-Harm Assessment: Preponderance of Benefit

Value Judgments: In some geographic locations or practice settings, particularly where direct access to PT is permitted, PTs may be the first to screen an infant for postural asymmetries. Infants may present for reasons other than head or neck postures, but observing overall symmetry is an element of a thorough PT screen.

Intentional Vagueness: None

Role of Patient/Parent Preferences: None

Exclusions: None

Note: This Action Statement is clarified to include conditions for referral after examination that were originally in Action Statement 14 but are more appropriate in this statement.

Quality Improvement:
- Documentation of screens of the neurological, musculoskeletal, integumentary and cardiopulmonary systems provides uniform data for more effective communication among clinicians and settings, and for uniform data entry in patient registries.
- Systematic screening ensures that non-muscular causes of asymmetry or associated conditions are ruled out or that timely referral for additional testing occurs.

Implementation and Audit:
- Documentation forms or electronic records may need revision to reflect the data collected from the screens.
- Clinicians may require training to enhance consistency and reliability of the system screens.
- Audit the incidences in which system screens are positive for potential non-muscular causes of CMT or potential associated conditions.

Supporting Evidence and Clinical Interpretation:
It is within the scope of PT practice to screen for non-muscular causes of CMT in the neuromuscular and musculoskeletal systems, including testing for ocular cranial nerve integrity and coordination, abnormal tone, orthopedic alignment and developmental delay. The screen is
performed to rule out non-muscular causes of observed asymmetrical posturing\textsuperscript{20, 73, 74, 78} and to determine whether the PT should refer for physician consultation immediately or continue with a detailed examination for CMT. The screen is conducted through parent report and observation of the infant in different positions. Elements of the screen to document include:

**History:** per parent report as described in Action Statement 4.

**Systems Screen:** Per the APTA Guide to Physical Therapist Practice,\textsuperscript{78} a systems screen traditionally examines the following four domains. For infants with CMT, a gastrointestinal history should be added.

**Musculoskeletal Screen:** Screen for symmetrical shape of the face, skull, and spine;\textsuperscript{17, 53} symmetrical alignment of the shoulder and hip girdles with particular attention to cervical vertebral anomalies, rib cage symmetry,\textsuperscript{56} and DDH;\textsuperscript{48} symmetrical PROM of the neck; and palpation for SCM masses or restricted movement.\textsuperscript{79}

**Neurological Screen:** Screen for abnormal or asymmetrical tone, retention of primitive reflexes, resistance to movement, cranial nerve integrity, brachial plexus injury; temperament (irritability, alertness); achievement of age appropriate developmental milestones\textsuperscript{20, 42, 56, 74, 77, 79} inclusive of cognitive and social integration within the family setting.\textsuperscript{80} Perform a visual screen comprised of symmetrical eye tracking in all directions, noting visual field defects and nystagmus as potential ocular causes of asymmetrical postures.\textsuperscript{42, 79, 81}

**Integumentary Screen:** Screen for skin fold symmetry of the hips\textsuperscript{23, 74} and cervical regions;\textsuperscript{82, 83} color and condition of the skin, with special attention to signs of pressure and trauma that might cause asymmetrical posturing.\textsuperscript{74}

**Cardiorespiratory Screen:** Screen for symmetrical coloration, rib cage expansion and clavicle movement to rule out conditions that might cause asymmetrical posturing (e.g. brachial plexus injuries, Grisel’s syndrome),\textsuperscript{74, 76} check for acute upper respiratory tract distress.\textsuperscript{22, 84} The infant should be alert and appropriately vocal, without wheezing.

**Gastrointestinal History:** Interview the parents for an infant history of reflux or constipation,\textsuperscript{22} or preferential feeding from one side,\textsuperscript{25} both of which can contribute to asymmetrical posturing.

**Reasons for Consultation or Referral:** The following are the basis for consultation with the infant’s physician or other specialists.
• Cranial deformation and/or facial asymmetry, including plagiocephaly and brachycephaly.\textsuperscript{17, 18, 29}

• Atypical presentations, such as tilt and turn to the same side, or plagiocephaly and tilt to the same side.

• Abnormal tone.\textsuperscript{22, 74, 79}

• Late onset torticollis at 6 months or older, which can be associated with neurological conditions, tissue mass, inflammation or acquired asymmetry.\textsuperscript{22, 74}

• Visual abnormalities including nystagmus, strabismus, limited or inconsistent visual tracking, and gaze aversion.\textsuperscript{74, 79}

• History of acute onset, which is usually associated with trauma or acute illness.\textsuperscript{20, 85}

• Suspected DDH.\textsuperscript{19, 49, 74, 86, 87}

• Changes in the infant’s color during screening of neck PROM.

• If the infant is older than 12 months on initial screening and either facial asymmetry and/or 10-15 degrees of difference exist in active or passive cervical rotation or lateral flexion ROM; or the infant is older than 7 months on initial screening and a SCM mass is present.

\textbf{R. Research Recommendation:} Studies are needed to identify the precision of screening procedures specific to CMT.

\textbf{B. Action Statement 6: Revised and updated. REFER INFANTS FROM PHYSICAL THERAPIST TO PHYSICIAN IF INDICATED BY SCREEN.} Physical therapists should document referral of infants to their physicians for additional diagnostic testing when a screen identifies: non-muscular causes of asymmetry (e.g. poor visual tracking, abnormal muscle tone, extra-muscular masses); associated conditions (e.g. cranial deformation); asymmetries inconsistent with CMT; or if the infant is older than 12 months and either facial asymmetry and/or 10-15 degrees of difference exists in passive or active cervical rotation or lateral flexion; or the infant is 7 months or older with a SCM mass; or if the side of torticollis changes.

(Evidence Quality: \textsuperscript{II}, Recommendation Strength: \textit{Moderate})

\textbf{Action Statement Profile}

\textbf{Aggregate Evidence Quality:} Level II based on cohort follow-up studies of moderate size.

\textbf{Benefits:}

This clinical practice guideline is open for public comment prior to submission for formal publication. Comments or concerns may be sent to torticollispg@gmail.com by June 15, 2018 for consideration by the authors. Please reference the line numbers for specific issues.
• Infants with positive screen results are identified and can be co-managed with the infant’s physician and other specialists.
• Early coordination of care may resolve CMT more quickly and with less cost, as well as initiate appropriate intervention for conditions other than CMT.
• Parent support starts earlier for effective home programming, parent education, and the balance of intervention with parental needs to enjoy and bond with their infant.

Risk, Harm, Cost:
• Cost of care is increased in the cases when there is a false positive from screening results.
• Additional family stress due to concerns about the infant having more serious health conditions.

Benefit-Harm Assessment: Preponderance of Benefit

Value Judgments: Level II evidence demonstrates that earlier diagnosis of CMT is better, but there is no literature that documents the risks and consequences of a lack of immediate follow-up for the 20% of infants who have conditions other than CMT. While the recommendation strength is categorized as Moderate based on Level II evidence, the GDG believes that referral to the infant’s physician should be categorized as a MUST, when any non-muscular causes of asymmetry are identified to collaborate in the co-management of care of the infant who may have both CMT and other medical conditions.

Intentional Vagueness: In settings with direct access to PT services, parents may seek evaluation services for an infant with postural asymmetry without referral from the infant’s physician. In either case, a PT should initiate communication with the infant’s physician when any of the aforementioned conditions are present.

Role of Patient/Parent Preferences: None

Exclusions: None

Quality Improvement:
• Documentation of referral to the infant’s physician when the PT suspects a non-muscular cause of the asymmetry or associated medical conditions provides uniform data for communication across clinicians and settings, and ensures an accurate record of care.

Implementation and Audit:
• Consultations or referrals to the physician should include the results of the examination and a rationale for concerns underlying the consult or referral.
• Documentation forms or electronic records may need revision with indicators for referrals and rationales for referral.
• Audit the incidences in which referrals helped to identify non-muscular causes of CMT and associated conditions.

**Supporting Evidence and Clinical Interpretation:**
Up to 18% of cases with asymmetrical head posturing may be due to non-muscular causes, including Klippel-Feil, neurologic disorders, ocular disorders, brachial plexus injuries including clavicle fractures, paroxysmal torticollis that alternates sides, spinal abnormalities and SCM masses. Identification of presentations atypical of CMT warrant referral to or consultation with the infant’s physician.

**R. Research Recommendations:** Studies are needed to clarify the incidence of non-muscular causes of CMT and associated conditions, and how early referral impacts ultimate outcome.

**B. Action Statement 7. Revised and updated. REQUEST IMAGES AND REPORTS.**
Physical therapists should request and include in the medical record all images and interpretive reports, completed for the diagnostic workup of an infant with suspected or diagnosed CMT, to inform prognosis. (Evidence Quality: II, Recommendation Strength: Moderate).

**Action Statement Profile**
**Aggregate Evidence Quality:** Level II based on cohort and outcome studies.

**Benefits:**
• Images and imaging reports, when available, provide a comprehensive picture of the infant’s medical status, including comorbidities.
• Images provide visualization of the SCM muscle fiber organization, and the location and size of fibrotic tissue.
• Parents appreciate care that is coordinated and shared across disciplines.

**Risk, Harm, Cost:**
• Requesting reports may require additional time for the parents and/or the PTs.

**Benefit-Harm Assessment:** Preponderance of Benefit
Value Judgments: Per the APTA Guide to Physical Therapist Practice, requesting relevant clinical reports on an infant’s suspected or diagnosed condition is considered appropriate gathering of medical history.

Intentional Vagueness: None

Role of Patient/Parent Preferences: Parents need to formally release information for reports to be forwarded to the PT; parents may arrive with reports and images in their possession.

Exclusions: None

Quality Improvement:
• Document the request for and receipt of reports and images.

Implementation and Audit:
• Documentation forms or electronic records may need revision with indicators of requests for and receipt of images and reports.
• Audits the incidences in which a report or image helped to inform the prognosis or intervention choices.

Supporting Evidence and Clinical Interpretation: The current standard of care does not include routine imaging of infants with suspected or diagnosed CMT <1 year of age. Rather, infants are typically referred for imaging when there is a specific sign or symptom that raises concern, or there is a lack of progress despite close adherence to the intervention program. Reports and images from specialized exams or laboratory tests can rule out ocular, neurological, skeletal and oncological reasons for asymmetrical posturing. In particular, there is a growing body of research using sonoelastography or ultrasound imaging to quantify the size, shape, organization and location of fibrous bands or masses, and to assist with determining an appropriate plan of care and treatment duration. Ultrasound imaging can also indicate the amount of muscle fiber realignment that occurs over time. Emerging evidence suggests that infants with masses or abnormal fiber organization of the SCM are typically identified earlier but require longer episodes of care.

R. Research Recommendations: Studies are needed to determine who would benefit from imaging, at what time in the management of CMT images are useful, and how images effect the plan of care.
B. Action Statement 8: Revised and updated. EXAMINE BODY STRUCTURES. Physical therapists should perform and document the initial examination and evaluation of infants with suspected or diagnosed CMT for the following 7 body structures:

- Infant posture and tolerance to positioning in supine, prone, sitting and standing for body symmetry, with or without support, as appropriate for age. (Evidence quality: II; Recommendation strength: Moderate)
- Bilateral passive range of motion (PROM) into cervical rotation and lateral flexion. (Evidence quality: II; Recommendation strength: Moderate)
- Bilateral active range of motion (AROM) into cervical rotation and lateral flexion. (Evidence quality: II; Recommendation strength: Moderate)
- PROM and AROM of the upper and lower extremities, inclusive of screening for possible developmental dysplasia of the hip (DDH). (Evidence quality: II; Recommendation strength: Moderate)
- Pain or discomfort at rest, and during passive and active movement. (Evidence quality: IV; Recommendation strength: Weak)
- Skin integrity, symmetry of neck and hip skin folds, presence and location of a SCM mass, and size, shape & elasticity of the SCM muscle and secondary muscles. (Evidence quality: II; Recommendation strength: Moderate)
- Craniofacial asymmetries and head/skull shape. (Evidence quality: II; Recommendation strength: Moderate)

Action Statement Profile
Aggregate Evidence Quality: Preponderance of Level II studies based on well-conducted prospective and retrospective cohort follow-up studies of small to moderate sample sizes.

Benefits:
- Confirms the diagnosis of CMT and identifies other problems such as craniosynostosis, DDH, plagiocephaly, brachycephaly, scoliosis, or other orthopedic and medical conditions.
- Determines the extent of primary and secondary muscle involvement, to estimate prognosis.
• Establishes baselines to measure progress of ROM, strength and alignment, and infant’s ability to incorporate movement through available ranges.
• Facilitates systematic linking of interventions to identified impairments.
• Standardizes measurement and documentation of body structure limitations from CMT to evaluate group outcomes across clinical settings.

Risk, Harm, Cost:
• Examination of passive cervical rotation may result in SCM snapping or a sense of ‘giving way’ in approximately 8% of infants.31
• The infant may feel some discomfort or pain, and/or may cry4,101 due to restricted movement, discomfort with ROM tests, or intolerance of general handling.
• In infants with undiagnosed orthopedic conditions, (e.g. osteogenesis imperfecta, hemivertebrae, or cervical instability), there is a risk that overly aggressive testing of PROM could cause secondary injury, though this has not been reported.

Value Judgments: The evidence for selected measurement approaches varies in strength; however, measures of passive and active ROM, strength, and posture must be documented as part of any PT exam and are consistent with current standards of practice.78 For ROM measurement, the GDG recognizes that clinical practicality has to be weighed against the desire for the most reliable measures. Use of photography, head markers and other devices to increase measurement reliability may create undue burdens for the infant, the family and the PT in daily clinical practice. While there is only moderate to weak evidence to justify the measurement of cervical spine AROM, AROM of the upper and lower extremities, pain or discomfort, condition of the skin folds, condition of the SCM and cervical muscles, and head shape, a lack of evidence is not equated with a lack of clinical relevance. Further, documentation of these initial examination findings sets the baseline for regularly scheduled objective reassessment and outcome measurement.

Intentional Vagueness: There is no vagueness as to what should be documented. There is variability as to how selected body structures should be measured, due to the limited number of valid tools or methods.

Role of Patient/Parent Preferences: During testing, parents may perceive that the baby experiences discomfort or that testing positions could potentially harm the baby, resulting in requests to stop testing if the baby is crying. The clinician must be aware and responsive to the
parents’ perceptions; it is incumbent on the clinician to fully explain the importance of the measures and the safety precautions used, so that parents and infants can comfortably and accurately complete the testing procedures. Clinicians may need to provide the infant breaks during testing to obtain the baby’s best performance and most reliable measures. Including the parent in the test procedures may help elicit the infant’s best performance, calm the infant if under stress, and generally assist with building trust between the PT and the infant.

**Exclusions:** None

**Quality Improvement:**

- Documentation of the 7 elements provides uniform data for more effective communication among clinicians and settings, and uniform data entry in patient registries.

**Implementation and Audit:**

- Documentation forms or electronic records may need revision to reflect the 7 body structure elements.
- Additional equipment may need to be procured, such as an arthrodial protractor.
- Clinicians may require training to enhance consistency and reliability of the examination elements, specifically cervical PROM using an arthrodial protractor, cervical AROM using the Muscle Function Test and the stool test, pain assessment using the Face, Legs, Activity, Crying and Consolability (FLACC) scale, and craniofacial asymmetries using the Argenta classification scales.
- Use of pictures may require consent and storage procedures for HIPPA compliance.
- Audit the incidences in which body structure elements informed intervention.

**Supporting Evidence and Clinical Interpretation:**

Following a thorough history and screening to rule out asymmetries inconsistent with CMT, the PT conducts a more detailed examination of the infant. The following items appear as a checklist, but in practice, the PT simultaneously observes for asymmetries throughout all exam positions to reduce infant repositioning and increase infant cooperation.

- **General Posture:** Document the infant’s posture and tolerance to positioning in supine, prone, sitting and standing, with or without support, when CMT is suspected or diagnosed (Evidence Quality: II, Recommendation Strength: Moderate)
Observe the infant in all positions, documenting symmetrical alignment and preferred positioning or posturing. In supine, document the side of torticollis, asymmetrical hip positions, facial and skull asymmetries, restricted AROM, and asymmetrical use of the trunk and extremities as these are all typical of CMT.

In prone, document asymmetry of the spine or presence of scoliosis, the head on trunk, asymmetrical use of the extremities, and the infant’s tolerance to the position. In typically developing infants, greater time spent in prone while awake is positively correlated with higher Alberta Infant Motor Scale (AIMS) scores and fewer delays in achieving prone extension, rolling, unsupported sitting and fine motor control. In infants with CMT, positioning in prone at least 3 times per day is correlated with higher AIMS scores.

In sitting, supported sitting, and supported upright positions (e.g. holding the infant vertically in the air or supported standing as age appropriate), document asymmetrical preferential postures and compensations in the shoulders, trunk and hip.

If feasible, digital photography may be a fast, reliable method of measuring preferred positioning in supine. A baseline is drawn through the acromial processes and another is drawn through the midpoints of both eyes. The intersection angle of the eye line with the shoulder baseline provides an objective measure of preferred head tilt. Care needs to be taken not to record artifacts of the placement of the baby on the surface; photos should represent the typical posture that the baby repeatedly reverts to during the examination session.

- **PROM:** Document the infant’s passive cervical rotation and lateral flexion when CMT is suspected or diagnosed (Evidence Quality: II, Recommendation Strength: Moderate)

Both passive cervical rotation and lateral flexion / side bending should be measured bilaterally with an arthrodial protractor as described by Ohman. The severity of CMT is determined by the difference between the left and right PROM measures of cervical rotation. Cervical neutral needs to be maintained for all measures, but is easily compromised when the infant compensates with cervical rotation or extension movements at the end ranges. The PT visually checks the cervical neutral position, assuring that the infant’s nose, chin and visual gaze are directed forwards (neutral rotation), with the nose, mouth and chin vertically aligned (neutral
lateral flexion) and the ear lobes and base of the nares are horizontally level (neutral flexion-extension).\textsuperscript{109}

Passive cervical rotation should be measured with the infant in supine, head in neutral, and the nose aligned with the 90 degree vertical reference.\textsuperscript{28, 108} This approach with an arthrodial protractor is the most commonly referenced standard for measuring passive cervical rotation,\textsuperscript{18, 23, 24, 27, 28, 68, 108, 110} despite a lack of published data to support a reported inter-rater ICC = .71.\textsuperscript{29} The benefit of an arthrodial protractor is that the infant’s head is supported beyond the edge of the supporting table, allowing fuller neck rotation and removing the table surface as a possible barrier to full range. Cervical rotation can be measured reliably by the same rater (ICC = .87-.97) using a goniometer aligned along the support surface with the infant lying supine, or in the horizontal plane with children >2 years old if they can independently sit and cooperate;\textsuperscript{111} however, the values from the method used by Klackenberg, Elfving, Haglund-Åkerlind, Carlberg\textsuperscript{111} of 49-67 ± 4-9 degrees are distinctly lower than the 110 ± 6 degrees found by others.\textsuperscript{24, 108}

The clinical challenge of using either a goniometer or an arthrodial protractor is that they minimally require 2 adults; one to stabilize the infant’s trunk on the support surface (and this can be the parent/caregiver) and one to rotate the head/neck while measuring range. A 3\textsuperscript{rd} person may be needed to hold the arthrodial protractor in place unless it can be attached to the support surface or stabilized in a stand and calibrated to be level. The GDG strongly values the objective measurement of cervical rotation as a means of establishing a baseline for future comparison. Current practice surveys in New Zealand and Canada suggest that PTs often visually estimate, rather than measure rotation range with an instrument; the greatest barrier being the absence of a time efficient and reliable tool.\textsuperscript{33, 70}

Lateral flexion should be measured in supine with the shoulders stabilized, using an arthrodial protractor: The PT can either place their hands on the side of the head, or place one hand under the head and one hand on the baby's chest to palpate for trunk movement. The head should be in cervical neutral, avoiding neck extension or flexion. The head is laterally flexed until the ear contacts the stabilized shoulder\textsuperscript{111} while the opposite shoulder is stabilized; lateral flexion PROM typically reaches 70 ± 2.4 degrees with cheek size being the limiting factor.\textsuperscript{108} This method is reliable (ICC=.94-.98) when the measures are taken by the same person, using the same set up and procedure, and may be more accurate by 2-3 degrees than photographs taken of the same end range positions.\textsuperscript{111}
When testing cervical PROM, known orthopedic conditions may require modification or avoidance of tests (e.g. osteogenesis imperfecta, congenital hemivertebrae, or children with Down syndrome who have not been cleared for cervical instability). In these cases, the GDG recommends that testing for passive range use only very gentle guidance through the range, ending at the first palpable sign of resistance.

R. Research Recommendation: Reliable, valid and time efficient methods of measuring infant cervical PROM need to be developed, including lateral flexion, and large scale normative data of PROM should be established by age in months.

• AROM: Document the infant’s active cervical ROM. (Evidence Quality: II, Recommendation Strength: Moderate).

Active cervical ROM is considered an important indicator of symmetrical development and neck strength, and the infant’s integration of PROM for functional activities. Treatment to improve AROM is consistent with the goals of early intervention. Asymmetrical movements and movement compensations can indicate muscle tightness, restrictions or weakness. Active range is challenging to measure in infants due to behavior and movement variability, difficulty with isolating cervical movements, and a paucity of practical measurement tools that capture infant movements in the clinical setting in a timely manner. Studies may list “active movement” as an outcome but do not describe how it is measured and most PTs rely on visual estimation.

PTs should measure active cervical movement by using one of the following techniques, looking for active and full range in all planes, including diagonals, while the baby is enticed to follow toys, sounds or other forms of stimulation to elicit full range.

• For the infant who is <3 months old, head rotation is tested in supine.

• For the infant who is ≥3 months old, test neck rotation while the infant sits in the clinician’s lap who is on a rotating stool. The parent entices the infant to maintain eye contact while the PT rotates the baby away from the parent. The PT observes neck rotation from above using the baby’s nose as a midline indicator as it approaches the shoulder. Additionally, neck flexion and extension can be screened in this sitting position.
• For infants 2 months and older, the Muscle Function Scale provides an objective categorization of active lateral flexion in developmentally appropriate positions. By holding the infant vertically in front of a mirror and tipping the baby horizontally, the PT classifies the head righting position according to a 6-point scale. Typically developing infants rarely have a difference between sides, and infants with CMT frequently have a difference of 2-3 points. Clinicians should refer to Öhman, Nilsson, Beckung for specific reference values and procedures.

R. Research recommendations:
• Determine the sensitivity and specificity of the Muscle Function Scale to differentiate infants with clinically significant limitations from typically developing infants.
• Establish a clinically practical, objective method of measuring cervical rotation AROM in infants 0-3 months and infants ≥3 months to assess baselines and change over time.
• Determine what, if any, correlation between active and passive ROM should be used for discontinuation and/or discharge criteria.

• Extremity ROM: Document the infant’s passive and active ROM of the spine, upper and lower extremities, and screen for developmental dysplasia of the hip (DDH). (Evidence quality: II; Recommendation strength: Moderate)

The PT should examine passive and active ROM of the spine, shoulder and hip girdle, and arms and legs by observing the natural movements of the infant and by passively moving the arms and legs through all available range at each joint to rule out brachial plexus injuries, clavicle fractures, neurological impairments, hypermobility or CNS lesions.

To rule out DDH, PTs should observe for symmetry and stability of the hip, and symmetry of the leg lengths and gluteal skin folds. The incidence of DDH with CMT ranges from 2.5% - 17% depending on inclusion criteria, and it increases with the severity of neck rotation restriction. While routine screening of all infants for DDH is controversial, infants at risk for or those diagnosed with CMT may have a slightly higher incidence. Factors such as a history of breech position (OR 4.68 [1.66,13.03]) or cesarean delivery (OR 5.19 [2.06,12.04]), family history, maternal age < 20 years, Apgar scores < 8 at 1 minute, and being female have been associated with greater risk of DDH. No single test or
observation is sufficient to diagnose the presence of DDH, nor does the presence of DDH in young infants necessitate immediate treatment, as >90% of newborns with DDH confirmed by ultrasound may resolve on their own. Conversely, a missed diagnosis of DDH may cause the infant more suffering if treated later with bracing or surgery, thus the Ortolani and Barlow maneuvers and skin fold assessment are traditionally included in the evaluation of the infant under 3 months of age with CMT. Though the sensitivity of the tests vary among studies, the specificity for ruling out DDH is stronger. After 3 months of age, the Ortolani and Barlow maneuvers may not be sensitive enough to pick up DDH as the joint capsules tighten. For infants >3 months old, the Galeazzi sign (asymmetrical shortening of the affected leg), asymmetrical posture of the legs and skin folds, and restrictions of hip adductors may be stronger indicators for DDH, especially since it would be expected to resolve by that time.

- **Pain**: Document the infant’s pain or discomfort (Evidence Quality: IV, Recommendation Strength: Weak)

The PT should observe for behaviors reflective of discomfort or pain reactions in the infant and child during the examination process. Pain is not typically associated with the initial presentation of CMT but may be associated with passive stretching. The infant may cry in response to stretching, or in response to handling from the therapist, and children >2 years old may be able to provide self-reports of pain. The PT should differentiate actual pain responses from discomfort or behavioral reactions to stretching, anxiety, or the stress of an unusual environment. Despite acknowledging the possibility of pain, no assessment tools for identifying or rating pain are reported in the CMT literature.

There are 3 clinician-rated pediatric pain scales that quantify infant pain related behaviors and that do not rely on physiological monitoring (e.g. heart rate, blood pressure, oxygen saturation, body temperature). The Children’s and Infants’ Postoperative Pain Scale (CHIPPS) has been validated for newborns through 5 years of age for post-surgical pain, and is available in English and Portuguese. The Face, Legs, Activity, Crying and Consolability (FLACC) is valid for children from 2 months to 7 years of age and in children < 3 years old before and after anesthesia. The revised rFLACC is valid for children 4-19 years old including those with
cognitive impairments. Parent descriptions of their children’s specific pain reactions are part of the rFLACC, so the clinician can observe for those specifically.

Since the FLACC is valid for the typical age range of infants and children treated for CMT, the GDG is recommending its use over the CHIPS or rFLACC. The FLACC is administered by having the clinician rate facial expressions, movement and behavior state with a 3 point scale of “0”= no expression or a quiet state, “1”= occasional expression or movements and “2”= inconsolable and large, frequent movements for a maximum of 10 points; lower scores indicate fewer pain related behaviors and higher scores indicate more behaviors. Training in the use of the FLACC is required to achieve adequate reliability. Care must be taken to interpret the infant’s behavioral reactions when the PT is handling the infant to differentiate crying and behavioral distress due to pain versus discomfort, separation anxiety or other infant fears. One method to differentiate pain from behavioral distress is to hand the inconsolable baby back to its parent/caregiver, observing how quickly the infant quiets. Another option is to have the caregiver do the handling with PT instruction and observe the infant’s reactions to differentiate true pain from discomfort or behavioral reactions.

**R. Research Recommendation:** Studies are needed to

- Describe and differentiate signs of discomfort from the types of pain reactions typically observed in infants with CMT during specific testing or interventions
- Determine the validity of the FLACC in rating true pain reactions during CMT examinations or interventions.
- **Skin:** Document the condition of the infant’s cervical skin and hip folds (Evidence Quality: V, Recommendation Strength: Theoretical/Foundational)

PTs should observe the symmetry and condition of the skin folds around the neck and hips. Typically, the neck skin folds on the anterior affected side are deeper and reddened. Infants with brachycephaly and limited cervical ROM in all directions may have deeper posterior folds. Observe for symmetry of the hip skin folds in the inguinal and upper thigh area as an indicator of DDH.
• **Muscle**: Document the condition of the infant’s musculature, and particularly the SCMs and secondary cervical muscles (Evidence Quality: II, Recommendation Strength: Moderate)

PTs should visually inspect and palpate both SCM muscles and document the side of tightness, the presence or absence of a fibrous band and/or mass, and if a mass is present, note its size and location along the SCM muscle (inferior, middle, superior or entire length). The presence of a fibrous band and/or mass, particularly a mass that involves more than the distal 1/3 of the muscle, is correlated with greater severity of the condition. These qualities are useful for determining the CMT severity and estimating the episode of care.

PTs should document the presence of secondary asymmetries or compensations in the shoulders, trunk, hips and distal extremities while the infant moves through positions during the examination. Typical compensations include tightness of the upper trapezius muscle, imbalance of neck muscle strength, hiking of the shoulder on the same side of the involved muscle, asymmetrical preference for limb use, asymmetrical and delayed protective and righting reactions of the head, neck, and trunk, Trendelenburg’s sign in children who are walking, and scoliosis. Secondary compensations and asymmetries of movement need to be continually monitored across the episode of care as they can develop and/or worsen over time.

• **Craniofacial**: Document the condition of the infant’s craniofacial characteristics to include head shape and facial features (Evidence Quality: II, Recommendation Strength: moderate)

Facial asymmetries involve the relative alignment of each side of the jaw, the cheekbones, eye orbits and ear positions. Cranial asymmetries or cranial deformation (CD) refers to asymmetries of the skull, including the frontal, temporal, parietal, and occipital bones, presenting with posterior unilateral flatness (plagiocephaly), bilateral posterior flattening (brachycephaly), asymmetrical brachycephaly, or flattening on both sides of the skull (scaphocephaly).
Peitsch et al. reported the incidence of localized cranial flattening as 13% in typical singleton infants,\textsuperscript{137} and 55.6% in twins.\textsuperscript{137} Cheng et al reported the prevalence of craniofacial asymmetry as 90.1% in children with CMT at initial evaluation.\textsuperscript{24} Untreated CMT can cause craniofacial asymmetries on the side of the torticollis, including: reduced jaw or ramal height, a smaller and elevated eye with changes in the orbit, (recession of the ipsilateral zygoma), recession of the ear on the affected side, a flat appearance of the jaw, malocclusion and possible gum line asymmetry.\textsuperscript{17, 18, 53}

Cranial deformation can either cause or be a result of CMT. Limited AROM from CMT may cause CD as asymmetrical muscle tensions lead to an asymmetrical postural head preference and subsequent skull deformation.\textsuperscript{57, 73, 114, 138 17, 25, 137} Conversely, for infants with CD and no initial CMT, an asymmetrical resting position of the skull may cause persistent neck rotation that can lead to SCM tightness.\textsuperscript{57, 73, 139 25, 114, 138}

PTs should document asymmetries of the skull and face. One of the most clinically feasible tools are the classification scales by Argenta.\textsuperscript{136} The method is clinically practical, does not require equipment other than a copy of the scale, includes pictures to assist with rating, and has established inter-rater (.51-.66) and intra-rater reliability (.6-.85).\textsuperscript{140} Other methods to quantify head shape asymmetries exist, and when more reliable or accurate methods for quantifying head shape are available and feasible, PTs should use them. Examples include: plagiocephalometry,\textsuperscript{141, 142} the modified Severity Scale for Assessment of Plagiocephaly,\textsuperscript{143} a craniometer with a headband,\textsuperscript{144} molding a flexible ruler to the infant’s head shape and tracing the shape,\textsuperscript{145} 3- Dimensional computerized scanning,\textsuperscript{146} plaster of Paris molds of the infant’s head,\textsuperscript{147} and the Children’s Healthcare of Atlanta Plagiocephaly Severity Scale.\textsuperscript{148} These alternative methods are sometimes not tolerated well by the infant, are not clinically practical, or are less intuitive than the Argenta classification scales.

PTs should document when cranial deformation or facial asymmetry are inconsistent with deformational plagiocephaly or brachycephaly and refer back to the infant’s physician to assess for craniosynostosis.\textsuperscript{149}

B. Action Statement 9: Upgraded with new evidence. CLASSIFY THE LEVEL OF SEVERITY. Physical therapists and other health care providers should classify and document the level of CMT severity, choosing one of eight proposed grades (Figure 2), based on infant’s
age at examination, the presence of a SCM mass, and the difference in cervical rotation PROM between the left and right sides. (Evidence Quality: II, Recommendation Strength: Moderate)

**Action Statement Profile**

**Aggregate Evidence Quality:** A level II cohort reliability study.

**Benefits:**
- Classifying levels of severity may assist with prognosis and parent education.
- The 8 grades integrate two of the strongest factors related to outcome: the infant’s age at which treatment is initiated and the type of CMT the infant presents with.
- More precise classification grades are needed to compare outcomes across research samples.

**Risk, Harm, Cost:**
- Minimal costs to update electronic health records to add Grade 8 and to retrain staff on its use.

**Benefit-Harm Assessment:** Preponderance of Benefit

**Value Judgments:** The GDG recommends the use of its updated CMT Classification System. Clinician feedback and its uptake into practice suggest that the grades assist with educating families about the estimated episode of care.

**Intentional Vagueness:** None

**Role Of Patient/Parent Preferences:** None

**Exclusions:** None

**Quality Improvement:**
- Documentation of a severity grade provides a common taxonomy for clinical and research communication, and for uniform data entry in patient registries.
- The severity grades are a tool for communicating with parents about the estimated episode of care.

**Implementation and Audit:**
- Documentation forms or electronic records may need revision to reflect the CMT Severity Classification grades, including the addition of Grade 8.
- Clinicians may require training to enhance consistency and reliability of the CMT Severity Classification System.
• Audit the frequency of documentation of the CMT Classification Severity grades and the accuracy of prognoses with respect to episode of care and functional outcomes.

**Supporting Evidence and Clinical Interpretation:** Multiple taxonomies of CMT classification recur in the literature: age of treatment initiation, type of CMT (postural, muscular or SCM mass), severity of ROM limitations, presence of plagiocephaly, and muscle fiber appearance by ultrasound. In most studies, these taxonomies are detailed enough to answer the research questions about incidence of various types, incidence of surgical outcomes, and usefulness of ultrasound as a diagnostic tool or classification process. The use of ultrasound to determine a CMT classification is beyond the scope of typical pediatric PT practice.

When looking for guidance on intervention effectiveness for CMT, study samples typically analyze outcomes according to the type of CMT (postural, muscular or SCM mass), the age of presentation, or cervical rotation PROM. These 3 factors are considered strongly correlated with outcomes, such that the earlier one is treated and the milder the form of CMT, the shorter the episode of care and the higher the probability of complete resolution; however, the 3 factors had not been combined to account for different presentations. No studies were found using passive lateral flexion as a factor for categorizing CMT outcomes.

The 2013 CMT CPG proposed a 7-grade CMT Severity Classification System that combined the 3 factors (i.e., age, PROM, mass) to add clarity to research and aid communication among clinicians. The original 7 grades have a good inter-rater reliability (ICC (2,1) = 0.83 [95% CI 0.74-0.91]) and good intra-rater reliability (ICC (3,1) = 0.81 [95% CI 0.66-0.91]). In a survey of 282 PTs who treat children with CMT, only 3% classified severity with any scale prior to the 2013 CMT CPG; following its publication, the 7-grade CMT Severity Classification System was implemented by 57%. This 2018 CMT CPG updates the original 7 grades to 8, based on clinician confusion as to how to grade toddlers >12 months old, and because the majority of the evidence estimating episodes of care is based on infants younger than 12 months of age.

Figure 2 presents the updated diagram to include Grade 8 for children who are referred for PT at age 12 months or older, regardless of the type of CMT (postural, muscle tightness or SCM mass). The diagram is best viewed in the color version available at (URL.TBA), however to aid clarity with non-color copies, the lines from conditions to grades are patterned. An additional line was added to classify 4-6 month olds with only postural preferences as Grade 1. The vertically aligned ovals, at the left most edge of the diagram, list the factors that are most
relevant to the classification process (age asymmetry noted, age of referral and PT evaluation, type of CMT), followed by diamonds that describe the cycle of PT examination, intervention and reassessment. To the right are the range of conditions and actions that link the classification with PT management.

The eight grades of severity are defined as follows:

Grade 1 – Early Mild: Infants between 0-6 months of age with only postural preference or a difference between sides in passive cervical rotation of <15 degrees.

Grade 2 – Early Moderate: Infants between 0-6 months of age, with a difference between sides in passive cervical rotation of 15-30 degrees.

Grade 3 – Early Severe: Infants between 0-6 months of age, with a difference between sides in passive cervical rotation of >30 degrees or a SCM mass.

Grade 4 – Late Mild: Infants between 7-9 months of age with only postural preference or a difference between sides in passive cervical rotation of <15 degrees.

Grade 5 – Late Moderate: Infants between 10-12 months of age with only postural preference or a difference between sides in passive cervical rotation of <15 degrees.

Grade 6 – Late Severe: Infants between 7-9 months of age with a difference between sides in passive cervical rotation of >15 degrees, or between 10-12 months with a difference of 15-30 degrees.

Grade 7 – Late Extreme: Infants between 7-12 months with a SCM mass, or 10-12 months of age with a difference between sides in passive cervical rotation of >30 degrees.

Grade 8 - Very Late: Infants older than 12 months of age with any asymmetry, including postural preference, any difference between sides in passive cervical rotation, or a SCM mass.

The classification process begins at the top of the diagram. Document the age that asymmetry is first noted by a parent or health professional; this may be informed by early infant photos. This age provides history of the condition and may impact the prognosis for the episode of care; however, it does not directly factor into the choice of severity grades. The age of referral for PT evaluation is documented to understand the timeliness between referral and the initial PT evaluation. The age of initial PT evaluation is documented and used in combination with the difference in cervical rotation PROM and/or presence of a SCM mass to determine a severity grade. Classifications are first grouped as “early”, “later” or “very late.” “Early” and “later” have a range of severity within the categories. For example, CMT Classification Grade 2, Early
Moderate, is assigned to an infant evaluated by PT either between 0-3 months, or between 4-6 months, with a difference between sides in cervical rotation PROM of 15-30 degrees. A CMT Classification Grade 7, Late Extreme, is assigned to an infant evaluated by PT between 7-9 months of age with a SCM mass or between 10-12 months of age with difference between sides in cervical rotation PROM of >30 degrees or a SCM mass. van Vlimmeren, Engelbert, Pelsma, Groenewoud, Boere-Boonekamp, Nijhuis-van der Sanden 152 illustrate how the grades can describe study samples more accurately.

Decisions regarding intervention intensity, frequency and duration take into consideration each of the factors within the large, center oval: Severity Classification Grade, Access to Services & Clinician Knowledge and Skill, Patient/Caregiver CMT Knowledge and Program Adherence, Muscle Tissue Characteristics, Infant’s Developmental Stage, and Comorbidities. Action Statement 12 regarding prognosis supports the idea that the earlier and more intense the intervention, the shorter the episode of care and the more complete the resolution of symptoms. No specific recommendation of intensity of intervention is appropriate for all cases. Regardless of severity, when a PT intervention is initiated, the first-choice interventions should be frequently performed throughout each day with responses to intervention regularly reassessed for effectiveness. While a minimum of 1.5 months 37 and a maximum of 36 months 61 of conservative intervention is reported, the majority of studies cite a range of 4-6 months duration for intervention.

**R. Research Recommendation:** Studies are needed to determine a reliable, valid and clinically practical method of measuring lateral flexion, and then to determine how the severity of lateral flexion may impact the CMT Severity Classification grades.

**B. Action Statement 10: Revised and updated. EXAMINE ACTIVITY AND DEVELOPMENTAL STATUS.** During the initial and subsequent examinations of infants with suspected or diagnosed CMT, physical therapists should examine and document the types of and tolerance to position changes, and motor development for movement symmetry and milestones, using an age appropriate, valid and reliable standardized test. (Evidence quality: II; Recommendation strength: Moderate)

**Action Statement Profile**

**Aggregate Evidence Quality:** Level II from cohort and outcome studies.
Benefits:

- Early detection of developmental delays, neurological impairments, movement capabilities, muscle function in developmental positions, and infant preferences help to direct the plan of care.
- Provides opportunities for parent education on typical development, importance of prone playtime, alternative positioning, and reinforcement of parent adherence to home programs.
- Standardizes measurement and documentation of motor activity to evaluate group outcomes across clinical settings for infants with CMT.

Risk, Harm, Cost:

- No risks or harms
- Norm-referenced developmental standardized tests are proprietary and thus have associated costs for the forms, test manuals and test items. Proficiency in administering the tests may require training.

Benefit-Harm Assessment: Preponderance of Benefit

Value Judgments: Measures of the infant’s activity, symmetry of movements, and developmental progression must be documented as part of any PT exam. These are consistent with professional standards of practice, and clinical practice specific to CMT.

Intentional Vagueness: None

Role of Patient/Parent Preferences: Parents may perceive that the baby experiences discomfort from the testing positions or that the prone position is harmful, and may request that testing not continue if the baby is crying. The clinician should fully explain the importance of varying the infant’s positions, including use of prone positioning, which may be avoided by parents due to misinterpretation of Back to Sleep instructions.

Exclusions: None

Quality Improvement:

- Routine assessment of development ensures that infants with CMT are achieving age appropriate milestones, and if not, that delays are addressed as they are identified.

Implementation and Audit:

- Documentation forms and electronic records may need revision to include a standardized developmental test (e.g. Test of Infant Motor Performance (TIMP), Alberta Infant Motor
Scale (AIMS) or Peabody Developmental Motor Scales, 2nd edition (PDMS-2) and documentation of asymmetries during developmental activities.

• Clinicians may require training to enhance consistency and reliability to administer standardized developmental tests.

• Audit the incidences in which the standardized developmental tests are completed and inform intervention.

Supporting Evidence and Clinical Interpretation

Infants with CMT have a higher prevalence of gross motor delay at 2 and 6 months of age.\(^{50,51}\)

The motor delay of most infants undergoing PT for CMT resolves by 8-15 months\(^{50,51}\) but, similar to the general population, some will continue to demonstrate a gross motor delay.\(^{50}\) PTs should use a standardized test with established predictive validity to monitor infants with CMT for potential developmental delays, and if identified, should address remediation of those delays in their plans of care. The GDG recommends using age appropriate, reliable and valid standardized tests, such as the TIMP through 4 months of corrected age (http://thetimp.com/), the AIMS from 1-18 months of corrected age or until walking,\(^{153}\) or the gross motor subtests of the PDMS-2 from 1-72 months of age,\(^{154}\) during the initial evaluation and reassessments. While certification is not required to administer these tests, the validity of the scores and test-retest reliability may be improved following formal training. Additionally, the PT should observe and document asymmetries of age appropriate developmental activity, movement and upper and lower limb use throughout all exam positions.\(^{69}\)

R. Research Recommendation: Studies are needed to identify the best developmental tests to use for infants with suspected or diagnosed CMT, from birth through 12 months, so that the same measures can be documented on all infants, enabling comparison of outcomes across studies.

B. Action Statement 11. Revised and updated. EXAMINE PARTICIPATION STATUS.

The physical therapist should obtain and document the parent/caregiver responses regarding:

• Whether the parent is alternating sides when breast or bottle feeding the infant. (Evidence quality: II; Recommendation strength: Moderate)

• Sleep positions. (Evidence quality: II; Recommendation strength: Moderate)

• Infant time spent in prone. (Evidence quality: II; Recommendation strength: Moderate)
• Infant time spent in equipment/positioning devices, such as strollers, car seats or swings.
  (Evidence quality: II; Recommendation strength: Moderate)

**Action Statement Profile**

**Aggregate Evidence Quality:** A predominance of level II prospective cohort follow-up studies with small sample sizes.

**Benefits:**
- Identifies routine passive positioning that facilitates asymmetrical positions of the head, neck and trunk.
- Provides information about the general developmental activities and position preferences of the infant.
- Provides opportunities for parent/caregiver education and counseling about positioning and activities that facilitate symmetrical development, including successful breastfeeding.

**Risk, Harm, Cost:** None

**Benefit-Harm Assessment:** Preponderance of Benefit

**Value Judgments:** None

**Intentional Vagueness:** None

**Role of Parent or Patient Preferences:** Parents and caregivers must accurately describe the infant’s daily care routines so positioning and home exercise programs can be tailored to maximize implementation opportunities and enhance the success of early parent roles. Fear of blame for the infant’s condition may lead parents/caregivers to provide inaccurate descriptions. Clinicians should be sensitive to this and may need to build a level of trust with the parents/caregivers before an accurate description can be obtained.

**Exclusions:** None

**Quality Improvement:**

Routine examination of participation ensures that parent–infant dyads are appropriately and successfully interacting during daily routines in ways that optimize symmetrical development.

**Implementation and Audit:**
- Documentation forms and electronic records may need revision to reflect the 4 participation elements.
Clinicians may require training to enhance consistency and reliability for assessing participation.

Audit the incidences in which the participation elements are documented and inform intervention.

Supporting Evidence and Clinical Interpretation:

There is consensus about the need to assess across all the domains of the ICF, including infant participation in daily routines, to develop a comprehensive plan of care. Moderately strong evidence suggests that specific activities are either preludes for possible asymmetrical development or are the consequences of existing asymmetries.

Positioning: Documentation should address positioning when awake and asleep, while feeding, and while using positioning devices (e.g. car seats, changing tables, cribs). The purpose of asking parents/caregivers about positioning is to prevent deformational plagiocephaly that may be associated with CMT, to correct postural preference that can lead to CMT and plagiocephaly, and to treat CMT if present. Three aspects of positioning support an interaction effect with CMT resolution: use of prone positioning, asymmetrical handling to activate weak neck musculature and AROM toward the limited side, and feeding from alternate sides.

Prone positioning while awake for greater than 1 cumulative hour per day, with no minimum amounts of time per opportunity, appears to offset the transient effects of supine sleep positions on motor skill acquisition. Supine positioning is associated with postural preference and consequently may facilitate asymmetrical neck ROM and secondary development of plagiocephaly. Infants who spend more time in prone and side lying positions reduce the impact of preferred positioning and achieve motor milestones sooner. Though prone sleeping is counter to the “Back to Sleep” recommendations and is not recommended by the GDG, it has been associated with faster achievement of developmental milestones.

The conscientious use of positioning during wakeful activities, (e.g. play, feeding, and dressing) facilitates symmetrical development of head shape, active and passive neck motion, tolerance of prone positioning, and achievement of motor milestones. Conscientious positioning means that the parent actively places the infant in positions during play, on changing tables, in cribs or carries the infant in ways that require head righting, rotation toward the restricted side, neck and upper body extension, or visual attraction toward the
affected side. Active movement toward the affected side\textsuperscript{32} and alternation of trunk and limb movements\textsuperscript{163} help to counteract asymmetries and prevent potential ones. For the infant with postural preference, these activities may reduce the preference and avoid consequential tightness.

Parents are reported to avoid prone positioning with typically developing infants because the infant doesn’t tolerate the position or because the infant has already achieved independent sitting.\textsuperscript{157} Education about the importance of prone playtime is critical for infants with suspected or diagnosed CMT, as they have multiple risks of asymmetrical development and delayed motor milestones. PTs should assess each parent’s ability to carry out exercises and home program positioning.

**Feeding:** PTs should document the infant’s feeding positions and difficulties as reported by the parent/caregiver during the initial and periodic evaluations. Feeding problems have been identified in infants with CMT and/or plagiocephaly as asymmetrical jaw positioning,\textsuperscript{164} preference for side of nursing,\textsuperscript{73,139} and/or side of bottle feeding.\textsuperscript{60,139} As many as 44% of infants with CMT may demonstrate a feeding preference to one side,\textsuperscript{60} and as many as 2.4% are described as having additional feeding problems.\textsuperscript{48} In conjunction with infant preference, the parent’s preferred side or hand dominance may also bias positioning to bottle feed from the same side.\textsuperscript{25} Conversely, infants who breastfeed from both sides have a lower incidence of CD and CMT, possibly due to the frequency of position changes as compared to infants who are bottle fed on the same side of the caregiver at each feeding.\textsuperscript{165} Intervention that addresses alternating sides and alternative positions\textsuperscript{166} for feeding can effectively increase symmetrical positioning, reduce preferred positioning by the infant and improve parent self-efficacy with feeding. Interviewing parents/caregivers about their comfort with alternating feeding positions is common practice,\textsuperscript{33,70} is consistent with family centered care,\textsuperscript{80} and provides an opportunity to suggest positioning strategies.

**Equipment/Positioning Devices:** PTs should document the amount of time the infant spends in positioning equipment as reported by the parents (e.g. positioning/seating devices, strollers, car seats, cribs, or swings).\textsuperscript{114} Persistent use of supportive equipment, in lieu of time spent playing in prone or side lying, may facilitate the deformation of the developing skull due to gravitational forces, which increases the risk of CMT and other asymmetrical developmental movement patterns. The PT should discuss practical strategies with the parents/caregivers regarding positioning and movement facilitation, including alternating positioning of toys and
placement in cribs, and ensuring frequent opportunities to play in prone from an early age. Avoidance of prone placement by parents can occur if the infant does not tolerate it well; the discussion offers an opportunity to assess parent/caregiver comfort and provide graded strategies for prone positioning that build on the infant’s tolerance.

**R. Research Recommendations:** Studies are needed to quantify changes in participation and clarify how the participation elements inform the plan of care.

**B. Action Statement 12: Reaffirmed and updated. DETERMINE PROGNOSIS.** Physical therapists should determine and document the prognosis for resolution of CMT and the episode of care after completion of the evaluation, and communicate it to the parents/caregivers. Prognoses for the extent of symptom resolution, the episode of care, and/or the need to refer for more invasive interventions are related to: the age of initiation of treatment, classification of severity (Figure 2), intensity of intervention, presence of comorbidities, rate of change and adherence with home programming. (Evidence Quality: II, Recommendation Strength: Moderate)

**Action Statement Profile**

**Aggregate Evidence Quality:** Level II-IV cohort studies and case reports with long term follow-up.

**Benefits:**
- Links the exam results and CMT Classification Severity grade to interventions and/or referrals.
- Provides guidance on the frequency and dosage of intervention(s) across episodes of care.
- Allows parents/caregivers to psychologically prepare for what to expect from PT and the range of possible outcomes for their infant.
- Assists parents with understanding and implementing the plan of care.
- Articulates the relationship of exam results to expected outcomes for documentation, including letters of medical necessity.

**Risk, Harm, Cost:**
Lack of a prognosis by either the referring physician or the PT may lead to under-estimation of the CMT severity, resulting in inadequate or untimely delivery of care and/or parent/caregiver confusion about what to expect.
Benefit-Harm Assessment: Preponderance of Benefit

Value Judgments: The GDG supports the need to document the potential for improvement of CMT prior to initiating intervention. The PT prognosis is the bridge between the evaluation of initial examination results and classification of severity with the associated interventions within an expected timeframe; thus it should include both objective outcomes to achieve, and time frames in which to achieve them. Articulating the prognosis for PT management ensures clear communication of expectations for the parents/caregivers, and sets objective milestones as a basis for referral back to the primary health care provider if outcomes are not met.

Intentional Vagueness: None

Role of Patient/Parent Preferences: The prognosis for improvement, or the time to achieve change, may need to be adjusted based on the parent/caregiver ability to comply with a home program designed by the PT. Parents should participate in shared decision making with the PT to design a home program that addresses both the infant’s limitations and other parental responsibilities.

Exclusions: None

Quality Improvement:

• Determining a prognosis provides the family and caregivers, healthcare providers, and payors an estimate of the episode of care.

Implementation and Audit:

• Educate parents and caregivers about the estimated episode of care and the importance of consistently implementing the home program to maximize outcomes.
• Update documentation forms or electronic records to include prognosis based on uniform collection of age of initiation of treatment, CMT Classification Severity grade, intensity of interventions, presence of comorbidities, rate of change, and adherence to home program.
• Include the prognosis and estimate of the episode of care on the initial evaluation document and in all professional communications.
• Audit the frequency of documentation of prognoses and the accuracy of prognoses with respect to episode of care and functional outcomes.

Supporting Evidence and Clinical Interpretation:
A PT is responsible for determining a prognosis following the patient evaluation. A prognostic statement should include the expected outcome in objective measurable terms, the time frame for intervention to achieve the outcomes, and a description of the potential courses of the condition if treated or not. For CMT, the earlier and more intense the intervention, the shorter the episode of care and the more complete the resolution of symptoms.

Demirbilek, Atayurt found the prognosis for full resolution of CMT that is treated conservatively prior to 3 months is 100% and lower (75%) when treated after 3 months of age. Five factors have been associated with full or more complete symptom resolution including the infant’s: (1) participation in PT intervention, (2) younger age at initiation of treatment, (3) decreased difference in cervical rotation PROM between sides, (4) decreased difference in SCM muscle thickness between sides, and (5) the caregiver’s ability to frequently implement a home program of active positioning and passive stretching.

The episode of care has been associated with the severity of the CMT, with mildest forms requiring an average of 2-3 months of treatment, and more severe forms requiring up to 5-6 months of treatment. Infants who receive surgical interventions may require an additional 4 to 11 months of treatment. Six factors have been associated with a longer episode of care including: (1) older age at initiation of treatment, (2) increased restriction of neck rotation PROM, (3) increased severity of head tilt, (4) motor asymmetry, (5) increased thickness or stiffness of the involved SCM or higher thickness ratio between the involved and uninvolved SCM, (6) the presence of a SCM mass or lesion, and (7) delivery history including infants with lower birth weight and breech, compared to cephalic, presentation.

There is no consensus on the intensity, frequency or delivery of intervention that is appropriate for all cases, except that more frequent stretching and strengthening throughout the day is more effective than less. Öhman, Nilsson, Beckung provide preliminary evidence of better outcomes when infants are treated by a PT versus parents, but the combination of PT and home program is the more frequent intervention plan. Individual intervention is the most commonly provided delivery model, but a single observational study of group CMT intervention (each group consisted of 6 infant-parent dyads and 2 PTs) suggests that this model may be an alternative to individual intervention. Additional research is needed to determine
the equivalency of outcomes and the cost-effectiveness of group compared to individual intervention.

**R. Research Recommendations:** Studies are needed to:

- Clarify the interaction between the factors associated with full symptom resolution and episode of care.
- Clarify the accuracy of prognosis with respect to full symptom resolution and episode of care.
- Describe and clarify the efficacy of different delivery models, e.g. individual versus group or clinic versus home.

**PHYSICAL THERAPY INTERVENTION FOR INFANTS WITH CMT**

The literature continues to support the following five components as the first choice intervention for CMT: neck PROM; neck and trunk AROM; development of symmetrical movement; environmental adaptations; and parent/caregiver education. The provision of interventions allows for continuous evaluation of progress along all ICF domains, including body structure, activities and participation. Moreover, repeated objective measurement of progress can focus intervention choices to achieve goals more quickly. It is incumbent on the PT to educate the parents on the importance of the home program and to partner with them to incorporate a reasonable and effective program into the home and family schedule. Care should be taken to balance the full scope of the family demands and resources on a case-by-case basis.

It is important to look beyond the infant’s body structure limitations to include perceptual–motor experiences within the context of the infant’s social environment, and gross and fine motor exploration as contributing to the development of cognition. Infants with limited or asymmetrical exploration, as seen in CMT and CD, have demonstrated delays in early motor development that may affect the development of early perceptual-motor skills and, therefore, cognition. Thus, pediatric PTs should treat beyond the body structure level to design and provide interventions that incorporate the infant’s available functional range into activities that promote age appropriate participation, and that promote current and future development and learning across domains.
B. Action Statement 13: Revised and updated. PROVIDE THESE FIVE COMPONENTS AS THE FIRST CHOICE INTERVENTION. Physical therapists should provide and document these five components as the first choice intervention for infants with CMT:

- Neck PROM. (Evidence quality: II; Recommendation strength: Moderate)
- Neck and trunk AROM. (Evidence quality: II; Recommendation strength: Moderate)
- Development of symmetrical movement. (Evidence quality: II; Recommendation strength: Moderate)
- Environmental adaptations. (Evidence quality: II; Recommendation strength: Moderate)
- Parent/caregiver education. (Evidence quality: II; Recommendation strength: Moderate)

Action Statement Profile

Aggregate Evidence Quality: Level II randomized controlled trials, cohort and outcome studies.

Benefits to the Infant

- Increases infant’s active and passive ROM.
- Facilitates normal and prevents, reduces or eliminates asymmetrical postural, gross motor, skeletal, cognitive, sensory and visual development.
- Reduces use of environmental supports/equipment that may increase asymmetry.
- Avoids or minimizes need for future, more invasive procedures.

Benefits to the Parent

- Enables parents to be active and effective caregivers
- Education and early intervention provides assurances that they did not cause the CMT.
- Education empowers parents to implement interventions between PT appointments.
- Education provides parents with information about typical developmental milestones and the factors that contribute to asymmetry.
- Balances use of supine as a frequent infant position with activities in prone, side-lying, and sitting during supervised, wakeful activities.
- Reduces potential overall cost of care for CMT with early intense, treatment.

Risk, Harm, Cost:

- Stretching of the SCM can result in muscle snapping, which may or may not cause momentary infant discomfort, however the documented long term outcomes are positive. 31
• Cost of care may be a burden for families.
• Parents/caregivers may apply interventions incorrectly.
• Parents may decrease the intensity of home exercises if they perceive that the PT is implementing the treatment.\(^{68}\)

**Value Judgments:** None

**Intentional Vagueness:** The GDG supports that stretching should be frequent through the day, every day; however there is no dosage standard linking technique and duration of stretches, repetitions within each treatment session, frequency of treatment sessions per day, overall duration of care, and frequency of clinic visits, including tapering schedules, to specific CMT severity classifications.

**Role of Parent/Caregiver or Patient Preferences:** Parental perceptions of the impact of CMT on their infant’s function and the importance of the intervention program on their infant’s future function are strong factors related to adherence to appointments and home exercises.\(^{176}\)

Parent/caregiver adherence to the plan of care under a PT’s guidance\(^{62,174}\) is optimal for achieving early intense treatment dosages.

**Exclusions:** None

**Quality Improvement:**

• This recommendation may reduce unwarranted variation in practice and provides consumers with guidance for evidence-based interventions.

**Implementation and Audit:**

• Develop home exercise program materials, including online demonstrations of the 5 components of the first choice intervention.
• Update documentation forms and electronic records to include the education provided to parents, their understanding and adherence to the exercises.
• Audit PT adherence to providing the 5 components of the first choice intervention or reasons for deviating from the recommendation.

**Supporting Evidence and Clinical Interpretation:**

**Neck PROM:** Manual stretching remains the most commonly reported form of intervention for CMT,\(^{32,54,100,102}\) with one new randomized controlled study comparing 2 stretching frequencies with < 3 months old infants with CMT and PROM limitations.\(^{174}\) One
group received 10 sessions per day of 10 stretches each (100 stretches) and the other received 5 sessions per day of 10 stretches each (50 stretches) with all other stretching parameters held constant. Both groups had significant improvements in head tilt and cervical rotation at 4 and 8 weeks, but the group receiving 100 stretches/day resulted in greater improvement than 50 stretches/day group. While this one study provides support for an increased stretching frequency; there is no consensus on the techniques to perform the stretches, the number of repetitions, the duration of stretches and rest periods, and the number of individuals required for the stretches.

Stretching as an intervention should not be painful; stretches should be stopped if the infant resists, or the parent perceives changes in breathing or circulation. Low intensity, sustained, pain free stretches are recommended to avoid micro trauma of the muscle tissue.

The two-person technique for stretching has one person stabilizing the infant in supine with the head held beyond the support surface and the second person holding the head to guide it through the available range of cervical rotation and side bending. Alternatively, the single person technique has the infant positioned in supine on the caregiver’s lap with one hand stabilizing the chest and shoulders and the other guiding the head through the range. Hand placement is important when using either the one or two person stretch to properly stabilize the infant, to minimize compensatory movements and to guide the infant’s head through the available range. The choice of technique may depend on the size and age of the infant when stretching is initiated, with younger, smaller infants more easily managed by a single person technique, while larger or more active infants may require two people to provide adequate positioning support.

Neck PROM can also be achieved through positioning and handling, including carrying or placing the infant in side lying to gently stretch the shortened SCM and while lying prone with the face turned to the shortened SCM. Passive cervical stretching can also be achieved during feeding by encouraging turning toward the shortened side to pursue a bottle or breast, through the use of alternative feeding positions and when necessary, through positioning in car seats and infant carriers.

Neck and Trunk AROM: Active ROM continues to be the standard of care in combination with other interventions. Strengthening cervical and trunk muscles can be achieved through AROM during positioning, handling, carrying the infant, while feeding,
and through exercises isolating the weaker muscles.\textsuperscript{61, 68, 69, 101} Incorporating righting reactions in upright postures, rolling, side lying or sitting has been used effectively during treatment and daily care routines to strengthen muscles opposite of the affected muscles.\textsuperscript{27, 67, 101} The affected side of CMT is placed downward, elongating the tighter muscles and encouraging activity of the weaker, non-affected side.\textsuperscript{68, 69, 101} Positioning the infant in prone encourages bilateral neck flexor elongation and strengthens neck and spine extensors.\textsuperscript{61, 79} Using visual\textsuperscript{67} and auditory tracking to elicit head turning in supported sitting towards the affected muscle\textsuperscript{32, 69} can strengthen cervical rotation.

**Development of Symmetrical Movement.** Observational data (n=173) suggest that up to 25\% (n=44) of infants with postural CMT may have transient motor asymmetry; 2/3 of the 33 infants with follow-up data had no asymmetries by age 2 years.\textsuperscript{104} Developmental exercises should be incorporated into PT interventions and home programs to promote symmetrical movement in weight bearing postures and to prevent the development of impaired movement patterns in prone, sitting, crawling, and walking.\textsuperscript{84, 69, 104, 139}

**Environmental Adaptations.** Adaptations to the infant’s environment can be incorporated into the home exercise program. Alternating the infant’s position in the crib and changing table encourages head turning in the desired direction.\textsuperscript{23, 137, 139} Adapting the car seat position to promote desired AROM,\textsuperscript{101, 158, 165} minimizing the amount of time in a car seat and infant carrier,\textsuperscript{114, 138} and placing toys on affected side for the infant to turn the head towards the tighter side\textsuperscript{101} have been recommended as part of home programming, but not studied.

**Parent/Caregiver Education.** Parents and caregivers should be educated about the importance of ‘tummy time’ or prone play,\textsuperscript{57, 157, 160, 51, 64, 162} positioning and handling to encourage symmetry,\textsuperscript{57, 139, 23, 68, 79} minimizing the time spent in car seats and carriers to avoid CD as a precursor to CMT,\textsuperscript{23, 25, 114} and alternating readings to each side.\textsuperscript{165, 166} These strategies should be integrated into the daily routines and home programs to enhance adherence.

Parents and caregivers may be inclined to seek advice from Internet sites and support groups. These sources can provide an array of information, but the veracity of information can vary, and the sites cannot tailor interventions to an individual child’s body structures and activity...
limitations. Information on the use of prone positioning for play varies widely on when to start, how often and for how long a session. Parents should be encouraged to review information with their infant’s physician and/or PT regarding exercises or interventions they are considering. Identification of evidence-based, reputable Internet resources would assist both clinicians and families in keeping up with current and valid management approaches.

**R. Research Recommendation:** Studies are needed to:

- Identify intervention techniques and dosages, including accurate descriptions of active exercises, with links to the CMT Classification Severity grades.
- Identify the components of optimal home programs.
- Evaluate the benefits of individual versus group therapy conditions.

**C. Action Statement 14. Revised and updated. PROVIDE SUPPLEMENTAL INTERVENTION(S), AFTER APPRAISING APPROPRIATENESS FOR THE INFANT, TO AUGMENT THE FIRST CHOICE INTERVENTION.** Physical therapists may provide and document supplemental interventions, after evaluating their appropriateness for treating CMT or postural asymmetries, as adjuncts to the first choice intervention when the first choice intervention has not adequately improved range or postural alignment, and/or when access to services is limited, and/or when the infant is unable to tolerate the intensity of the first choice intervention, and if the physical therapist has the appropriate training to administer the intervention. (Evidence Quality: I-IV, Recommendation Strength: Weak)

**Action Statement Profile**

**Aggregate Evidence Quality:** Level I-IV studies; 2 new level I studies on Microcurrent (MC) and kinesiotape (KT). Benefits: On an individual basis, combining supplemental interventions supported by limited evidence with the first choice intervention:

- May be effective in improving outcomes or shortening treatment duration.
- May accommodate an infant's temperament or tolerance to treatment.
- May avoid or minimize the need for future, more invasive procedures.
- May increase parent/caregiver ability to implement home program.

**Risk, Harm, Cost:**
• Selected supplemental interventions should only be applied by clinicians skilled in that specific technique or modality, and who understand potential risks or side effects.
• There may be an added burden to the parent(s)/caregivers to learn additional intervention techniques.
• Some interventions may not be covered by insurance.
• Some approaches may increase the cost of care.

**Benefit-Harm Assessment:** Preponderance of Benefit for microcurrent (MC) and equal for other supplemental interventions.

**Value Judgments:** Clinicians who are seeking to augment their first choice interventions should choose those supplemental interventions with the strongest evidence first. Thus, if trained, clinicians should choose to use MC before choosing among the others of lesser strength.

**Intentional Vagueness:** While evidence supporting the use of MC is increasing, it is not known when it is best to add it to a plan of care.

**Role of Parent/Caregiver or Patient Preferences:** Parents may inquire about different interventions for the treatment of CMT.

**Exclusions:** None

**Quality Improvement:**
• Providing secondary interventions may accelerate the resolution of CMT in infants whose progress has slowed.

**Implementation and Audit:**
• Document the application and dosage of supplemental interventions in order to accurately measure their impact on infants with CMT.
• Audit the types and documentation of supplemental interventions to determine their overall benefit to patients.

**Supporting Evidence and Clinical Interpretation:**
The following interventions are recommended as supplements to the first choice intervention described in Action Statement 13, and are presented in descending order of evidence strength. In addition to experimental intervention studies, several studies have used a combination of the first choice intervention with soft tissue mobilization, massage, and therapeutic US. While these studies are designed to look at prediction of
outcomes or efficacy of other interventions, they provide preliminary evidence that a multimodal approach is effective; additional research is needed to study their individual effects. Finally, there are some interventions described in the common press for which there are no studies to support their effectiveness. Departures from the guideline should be documented in the patient’s record at the time the relevant clinical decisions are made; clinicians are strongly encouraged to publish the clinical reasoning and results of these alternative approaches.

**Interventions with New Evidence**

**Level I Evidence.**

**Microcurrent (MC)** is a low intensity single channel alternating current applied superficially at a level that is not perceived by the patient. Two studies demonstrate reduced treatment duration and improved ROM with the addition of MC to PT intervention. In a 2013 level 1 RCT, all 20 infants received a home program, 20 minutes of exercises, 5 minutes of ultrasound, and 30 minutes with the MC unit set up, but only 10 infants received active MC. Treatment sessions were 3 times per week until the complete PROM resolved or there were no improvements after 6 months of ongoing care. Those receiving the active MC had significantly shorter treatment durations (2.6 months) than those who did not (6.3 months). The results are consistent with a prior RCT when 30 minutes of MC was applied to the involved SCM of infants with CMT, 3 times per week for 2 weeks, resulting in improved head tilt angle, neck rotation toward the affected side, and less crying during therapy when compared to a control group of infants with CMT who received traditional stretching and exercises. The sample groups were small (n = 7 experimental vs. 8 control) and there was no long-term follow-up, but the average infant age was 7 months, and many had already been treated with stretching programs.

**Kinesiological taping (KT)** refers to the use of stretchable tape to support muscles and to provide sensory feedback. Despite the recommendation in the 2013 CMT CPG that KT could be a supplemental treatment, a 2016 level 1 study suggests that there is no added value to KT when provided for 3 weeks in conjunction with other conservative methods. It was a small prospective single blinded RCT with 3 infant groups who had KT applied 6 days/week for 3 weeks; all groups also received an exercise program and PT intervention. Group 1 had exercise only, group 2 had KT applied to the involved SCM for inhibition and the uninvolved SCM for facilitation, and group 3 had KT applied only to the involved SCM for inhibition. While there
were within group changes in neck PROM, MFS scores and head shape symmetry from their baselines, there were no significant differences between treatment groups immediately after treatment, at 1 month or at 3 months post treatment. This suggests that there is no added value of KT beyond exercise even over a 3-week treatment period. Ohman reported an immediate effect of KT on MFS scores while the tape is on; however, it is not clear if the change lasts beyond the immediate effect when KT is removed.\textsuperscript{181} Additional studies of alternative methods of applying KT may further clarify when and if this approach is supported for use with CMT.

**Soft Tissue Mobilization** (STM) as described by Keklicek, Uygur\textsuperscript{11} was applied in three phases: a passive mobilization phase, mobilization with stretching, and mobilization with active cervical rotation. For infants with CMT, a home program with STM 3 days a week for 12 weeks, compared to only a home program, resulted in improved cervical rotation PROM and head tilt after 6 weeks of intervention, but not after 12 weeks of intervention or 18 weeks after the start of the study. Between groups, there was no difference in lateral flexion PROM or AROM throughout the study. It is not clear if the improvements at 6 weeks are due to the treatment technique or intensity of treatment since the intervention for the control group was not dose equivalent and parents performed an unspecified home program of stretching and handling. PTs may choose this approach if an infant is not progressing or is resisting passive stretching.

**Interventions With No New Evidence**

**Level 1 Evidence**

**Myokinetic stretching** as described by Chon, Yoon, You\textsuperscript{100} consists of sustained 2-finger overpressure on the taut SCM muscle; 60 repetitions were delivered over 30 minutes, 5 times per week for an average of 1.7 months. Pre and post treatment measures of the SCM thickness in infants with either the muscular torticollis or SCM mass types were made by ultrasound. Results describe significant reductions in SCM thickness and improved cervical rotation and head symmetry with retention at the 1-year reassessment by parent reports. The study had no control group and the average age of sample was 50 days (range of 30-70). Additionally, the parents performed an unspecified home program of stretching and handling, so it is not clear if the improvements are due to the treatment technique, intensity of treatment, and/or age of the infants. Most studies demonstrate that infants under 2 months will resolve with traditional
stretching approaches delivered at frequencies of less than 5 days/week. PTs may choose this approach if an infant is not progressing or is resisting passive stretching.

**Level IV Evidence**
The Tscharntuter Akademie for Motor Organization approach (TAMO) promotes problem solving and movement exploration during treatment, emphasizing light touch and the infant’s responses to gravity and support surfaces. A single case study of TAMO describes the treatment plan for an infant with CMT. The subject is a twin born prematurely, hospitalized in the NICU for 5.5 weeks and for other medical conditions during which he appeared to develop asymmetrical posturing. Despite home programming of position changes, encouragement of AROM, and use of prone positioning, SCM tightness developed and the infant was referred for treatment at 6.5 months of age (4.5 months corrected age). The application of TAMO is mixed with AROM activities, soft tissue mobilization, parent instruction for use of home positioning to facilitate muscle lengthening and carrying techniques that facilitate head righting opposite of the tightness. While the changes across time are well documented, it is not clear what contribution the TAMO approach provides separate from the positioning and handling approaches that others have shown to be effective except for the noticeable absence of passive stretching. This approach may be a useful addition for PTs who have received postgraduate training in the TAMO approach, particularly for infants who are resistant to stretching; however, without any other studies to demonstrate its application, generalizability is limited.

**Level V Evidence**
The Tubular Orthosis for Torticollis (TOT) collar has been described in the literature and online (www.symmetric-designs.com) as a neck orthotic designed to prevent movement toward and stimulate active movement away from the tilted head position. The collars are used as an adjunct to conservative treatment of infants with CMT aged 4 to 4.5 months who demonstrate adequate head control in supported sitting, and who demonstrate > 5-6 degrees of head tilt. Although noted as part of routine intervention in the treatment of infants with CMT who meet criteria for their use, there are no studies that isolate the outcomes of the TOT collar compared to other interventions. Pilot data reported in Karmel-Ross suggest that infants
treated with the TOT collar achieve 89.5/90 degrees vertical head position as compared to 84.8/90 for those who did not.

**Soft foam collars** have been described by Jacques and have been used post surgery, post surgery in conjunction with PT, and post botulinum toxin without specific rationales provided. They may be useful as passive support for the lengthened muscle, to protect incisions from curious hands, or to facilitate active movement away from the previously shortened side. Binder, Eng, Gaiser, Koch describe the use of a soft felt and stockinette collar for infants presenting with < 45 degrees passive cervical rotation and a constant tilt. In all cases, no studies have been found that isolate the impact of foam or soft collars on the outcomes of conservative care.

**Custom fabricated cervical orthoses** have been described for post surgical management of CMT in children or young adults. They reportedly provide greater stabilization of the spine and less mobility than the softer foam collars or semi rigid cervical orthoses; however, their use with infants has not been reported in the literature.

**Interventions Without Published Evidence of Efficacy**

The following approaches have either not been studied systematically or shown not to provide any additional benefit. Additional approaches have been found on the Internet and in the common press for which no peer reviewed literature was found.

Cervical manipulation of the infant in supine has been compared to standard stretching alone in a small double blind randomized trial (n=32). Results indicated no differences between the groups, with many confounding variables. The study was underpowered, both groups received stretching and home programs, the infants were young, (3-6 months of age) when stretching alone is known to be effective, and selected measures are reported as unreliable due to infant cooperation. The actual technique used for cervical manipulation is not well described in the study. Others have concluded that the use of cervical manipulation in infants has no sufficient evidence of benefits, and may be associated with higher risks of apnea and possible death. In weighing the potential risks against the benefits of other approaches, the GDG does not recommend cervical manipulation as an intervention for infants with CMT.

The following interventions appear in print, online, in continuing education brochures and parent support groups for infants with torticollis and deformational plagiocephaly, but no
peer reviewed studies have been found that describe the specific approaches or their
effectiveness for resolving CMT: soft tissue massage as a single modality,\textsuperscript{82} 79, 84, 100 craniosacral
therapy,\textsuperscript{82} Total Motion Release (TMR), and Feldenkrais.\textsuperscript{82} Physicians, therapists, and parents
should be aware that these approaches have not been systematically described or studied for
CMT, and their clinical application, risks and anticipated outcomes may only be anecdotally
reported. Due to a lack of studies, the GDG cannot recommend these approaches for
management of CMT at this time. Clinicians who choose to use these approaches should
document departures from the guideline in patient records at the time the relevant clinical
decisions are made, obtain consent to treat from parents that acknowledges the lack of published
evidence, carefully document objective measures of change, and consider publication of their
outcomes.

**R. Research Recommendation:** Studies are needed to describe and clarify the efficacy of all
supplementary interventions, including determinants for their choice, principles of application,
dosage and outcomes measures.

**B. Action Statement 15. Revised and updated. INITIATE CONSULTATION WHEN THE
INFANT IS NOT PROGRESSING AS ANTICIPATED.** Physical therapists who are treating
infants with CMT or postural asymmetries should initiate consultation with the infant’s physician
and/or specialists about other interventions when the infant is not progressing as anticipated.
These conditions might include: when asymmetries of the head, neck and trunk are not starting to
resolve after 4-6 weeks of initial intense treatment or after 6 months of treatment with only
moderate resolution. (Evidence Quality: II, Recommendation Strength: Moderate)

**Action Statement Profile**

**Aggregate Evidence Quality:** Level II based on cohort follow-up studies.

**Benefits:**

- Other interventions (e.g. botulinum neurotoxin therapy or surgery) can be considered to
  resolve the current asymmetries and prevent further progression of deformities and
  compensations.
- Provides the family/caregivers with alternative management strategies to help resolve
  asymmetries.

**Risk, Harm, Cost:**
• The consultations and possible subsequent interventions may add to the cost of care.

**Benefit-Harm Assessment:** Preponderance of Benefit

**Value Judgments:** Collaborative and coordinated care is in the best interest of the infant and family centered care.

**Intentional Vagueness:** The GDG is intentionally vague about the range of 4-6 weeks as the amount of time that a PT should treat an infant who is not responding to intervention. Since younger infants typically change more quickly than older infants, the GDG recommends that infants younger than 2 months who are not responding to intervention should be referred to their physician sooner than infants older than 2 months, who may require more time to respond to treatment.

**Role of Patient/Parent Preferences:** The age of the infant, severity of the CMT, rate of changes, needs of the family, cooperation and developmental needs of the infant, and available resources of the family/caregivers should help to determine the episode of care before an infant is referred back to the infant’s physician for consideration of alternative interventions.

**Exclusions:** None

**Note:** The 2013 CMT CPG conditions of referral when an infant presents at older ages with ROM limitations and/or facial asymmetry were incorporated into Action Statement 5 on Screening.

**Quality Improvement:**

- Referral back to the physician when the infant is not progressing as anticipated enhances coordinated communication about the infant, enables the infant to receive additional or specialized interventions, and promotes stronger professional relationships.

**Implementation and Audit:**

- Documentation should include information supporting the reason for referral, the PT’s hypotheses about other factors that might need attention, and the treatment types and intensities that were used.
- Survey referral sources for how they would like to receive communication about their patients (e.g. digital versus hard copy reports or letters).
- Audit the number of infants that are fully resolved as compared to those who require referral for interventions other than PT.

**Supporting Evidence and Clinical Interpretation:**
The literature supports a wide range of treatment durations for conservative care, so the question of when to refer an infant who is not progressing as anticipated has no clear answer. The duration of care will vary depending on the age of diagnosis and referral of the infant for services and the severity grade. Infants who are referred within the first 3 months with a severity grade of 1-3 (Figure 2) will most likely NOT require 6 months of conservative intervention, if the interventions appropriately address the impairments and there is adherence with home programming. Infants who present with severity grades of 4-7 will more likely require the full 6 months of care, or more, depending on the number of comorbidities. Factors that might extend treatment duration include the presence of motor asymmetries,\textsuperscript{104} an older age at initiation of treatment,\textsuperscript{36, 37} the presence or absence of a SCM mass,\textsuperscript{61, 72, 99, 173} the amount of head tilt,\textsuperscript{24, 37, 61, 131, 171} the quality of the SCM fibers,\textsuperscript{71, 99, 171, 172} the presence of facial asymmetry or CD,\textsuperscript{37} parental preference for conservative care, inconsistent home program adherence by parents/caregivers, and infant health conditions that may interfere with CMT interventions. Throughout the episode of care, the PT should collaborate with the infant’s physician and the family to make a judgment about when to increase the intensity of direct PT treatment or consider alternative approaches. This decision should be based on the rate of change, the persisting impairments, the age of the infant and the needs and values of the family. The literature supports that if infants have treatment initiated before 3 months of age, 98-100\% will respond to conservative treatment within a 6-month period of time,\textsuperscript{32, 54, 59, 61} though full resolution may require longer durations. The determining factors should be documented measures of progressive improvement, with referral triggered by plateaus at or after 6 months of consistent and intensive intervention.

**Invasive Interventions:** There are two conditions for which a child may be referred for consideration of more invasive interventions. If after 6 months of conservative treatment there is a lack of progress, or if the child first begins intervention after 1 year of age and presents with significant restrictions and/or a SCM mass, the PT should consult with the infant’s physician or referring physician about other approaches; the two most reported are botulinum toxin injections and surgical lengthening of the SCM. The following brief descriptions are provided for information, but are not exhaustive reviews of these approaches. Clinicians and families should discuss these options with their infants’ physicians when conservative care has not been successful.
Botulinum toxin is a neurotoxin that is postulated to act on the tight SCM in 2 ways: as a neuromuscular block that inhibits acetylcholine release, thus reducing stimulation of an already tight muscle, and as a neurotoxin causing muscle atrophy and weakening that allows for easier stretching. While it is not formally approved for use with infants, it is approved for adults with cervical dystonia. Three retrospective studies describe botulinum toxin as varying from 25% to 74% to 93% effective for increasing ROM in infants with CMT. Adverse effects include pain and bruising, temporary dysphagia, and neck weakness, all of which are reported to resolve.

Surgical release of the SCM is the more traditional alternative for treating recalcitrant CMT. It is beyond the scope of this CPG to describe the variety of surgical approaches, which generally fall into 3 categories: tendon lengthening, unipolar release of the distal SCM attachment or bipolar release of both SCM muscle attachments. There is emerging evidence that use of acellular dermal matrix may yield better post-surgical cervical ROM for corrections after age 8. Criteria that have been used to determine the timing for surgery include: persisting limitations in cervical ROM >15 degrees, progressing limitations, having a SCM mass and being >12 months of age combined with late age diagnosis, persistent visual head tilt, not responding to treatment after 6 months, and reaching the age of 1 year without resolution; surgery before 8 years of age appears to yield better outcomes than after age 8. The post op management of CMT is similar to pre-op, and can range from 4-6 weeks up to 11 months to work on scar management, muscle strength and ROM.

R. Research Recommendations: Studies are needed to describe the incidence of infants that require invasive care, their history of interventions, the best time for referral, and any associated physical therapy outcomes.

PHYSICAL THERAPY DISCONTINUATION, REASSESSMENT, AND DISCHARGE OF INFANTS WITH CMT

B. Action Statement 16: Revised and updated. DISCONTINUE DIRECT SERVICES WHEN THESE 5 CRITERIA ARE ACHIEVED. Physical therapists should discontinue direct physical therapy services and document outcomes when these 5 criteria are met: PROM within 5 degrees of the non-affected side; symmetrical active movement patterns; age appropriate motor development; no visible head tilt; and the parents/caregivers understand what
to monitor as the child grows. (Evidence Quality: II-III, Recommendation Strength: Moderate)

**Action Statement Profile**

**Aggregate Evidence Quality:** Level II-III based on long-term follow-up studies.32,202

**Benefits:**

Use of these criteria for discontinuation from direct PT reasonably ensures that:

- The CMT has resolved within accepted ranges of measurement error.
- There are no lingering secondary compensations or developmental delays.
- The parents/caregivers know how to assess for regression as the infant grows and when to contact their infant’s physician and/or the PT for reassessment.
- Discontinuation documentation reflects the expected outcomes for the episode of care, relative to the baseline measures taken at the initial examination.

**Risk, Harm, Cost:** There is an unknown amount of risk that discontinuation from PT services with 5 degrees residual asymmetry will progress to other anatomical areas (cervical scoliosis, craniofacial) or return as the infant grows.

**Benefit-Harm Assessment:** Preponderance of Benefit

**Value Judgments:** The GDG defines cervical rotation and lateral cervical flexion motions as included in PROM. Further, it includes full active cervical rotation and lateral flexion in the phrase symmetrical active movement.

**Intentional Vagueness:** None

**Role of Patient/Parent Preferences:** Parents/caregivers need to be educated about the importance of screening for asymmetries as the child grows and becomes more active against gravity. They should be advised that preferential positioning is often observed during times of fatigue or illness, and that re-evaluation is only warranted if it persists.

**Exclusions:** None

**Quality Improvement:**

- Complete documentation of baseline and discontinuation measures will support more accurate PT outcomes.
- Measurements taken at each treatment session provides feedback to parents about the child’s progress and supports fine tuning of the interventions which can shorten the duration of care.7

**Implementation and Audit:**

This clinical practice guideline is open for public comment prior to submission for formal publication. Comments or concerns may be sent to torticolliscpg@gmail.com by June 15, 2018 for consideration by the authors. Please reference the line numbers for specific issues.
• PTs should follow up with families that discontinue direct PT services prior to achieving resolution of asymmetries or formal discharge, to determine the reason for discontinuation.
• PTs should educate parents/caregivers on signs of recurring CMT when changing from direct PT to monitoring with a reassessment at 3-12 months of age or when infant starts walking.

Supporting Evidence and Clinical Interpretation:
The 2018 CMT CPG uses the phrase *discontinuation of direct services* to mean when the infant has achieved the 5 criteria and regular intervention is no longer warranted. *Discharge* is defined as occurring 3-12 months after the discontinuation of direct services when PT reassessment for potential residual CMT or other developmental concerns are negative.

While the duration of intervention for the individual infant will vary depending on the constellation of factors identified in Figure 2, the criteria for discontinuing direct PT services are based on norms for infant growth and development, known risk of early delays, and the emerging evidence of possible long-term sequelae. Functionally, it is critical that the infant who has achieved full PROM can actively use the available range, so PT criteria for discontinuation should address developmental activity rather than focus solely on biomechanical measures of change. Persistent functional limitations or developmental delays, after achievement of full PROM, are reasons to extend or initiate a new episode of care. Finally, these criteria are common across the literature and thus, are in keeping with current practice norms.

R. Research Recommendation: Longitudinal studies are needed to understand the best criteria and/or timing for discontinuing infants from direct PT intervention.

B. Action Statement 17: Revised and updated. **REASSESS INFANTS 3-12 MONTHS AFTER DISCONTINUATION OF DIRECT SERVICES, THEN DISCHARGE IF APPROPRIATE.** 3-12 months following discontinuation from direct physical therapy intervention OR when the child initiates walking, physical therapists who treat infants with CMT should examine postural preference, the structural and movement symmetry of the neck, face and head, trunk, hips, upper and lower extremities, and developmental milestones to assess for reoccurrence of CMT and evidence of atypical development. (Evidence Quality: II, Recommendation Strength: Moderate)
Action Statement Profile

Aggregate Evidence Quality: Level II based on longitudinal follow-up studies with moderately large samples, reasonable follow-up periods and reliable outcome measures.

Benefits:

- Detection of postures and movement consistent with relapsing CMT, particularly as infants initiate walking and move against gravity.
- Detection of developmental delays.
- Ability to restart home exercise programs if asymmetry is identified.
- Screening identifies other causes of asymmetry, other than CMT, if asymmetries reappear.

Risk, Harm, Cost:

- A single follow-up visit will minimally add to the cost of care.

Benefit-Harm Assessment: Preponderance of Benefit

Value Judgments: A single follow-up PT visit for infants with a history of CMT is consistent with the APTA Guide to Physical Therapist Practice that describes the roles of a PT as including prevention of recidivism and preservation of optimal function.78

Intentional Vagueness: The recommended time at which follow-up is scheduled (3-12 months) is wide because the age of the infant at discontinuation from direct PT intervention will vary. Reassessment of younger infants, discontinued from direct intervention between 4-6 months, may need to occur sooner when the infants are initiating standing and walking. It is not known how far out into early childhood that screening should occur. Literature suggests that by 18 months, the infant with delays at 10 months catches up with their peers;50,203 and they continue to demonstrate age appropriate motor development at preschool age202. However, a single follow-up study suggests that some infants are at greater risk for persistent neurodevelopmental conditions, such as developmental coordination disorder and attention deficit hyperactivity, which may not become evident until the early school years.110

Role of Patient/Parent Preferences: Parents/caregivers may choose to forego a PT reassessment if it places undue burden on the family for travel, time or finances. Parents should be advised at discontinuation of direct PT intervention of the small chance that developmental conditions may evidence themselves when the child enters school, and parents should be educated to observe for persistent asymmetry.
Exclusions: None

Quality Improvement:

- Long-term follow-up reassessments will provide data to understand the incidence of residual asymmetries or functional deficits, and parental satisfaction.

Implementation and Audit:

- Provide education to clinicians and families about this recommendation to improve adherence to reassessment.
- Determine a method, based on location and health care coverage processes, to facilitate a cost effective PT reassessment. This may require PTs to educate administrators, service coordinators and non-medical professionals about the importance of a comprehensive reassessment for infants with CMT. PTs should collaborate with their administrative and health care providers to develop pathways for parents to obtain this reassessment, either internally or by referral to other services.
- Provide clear instructions to parents about the signs of unresolved or returning CMT.
- After reassessment, document:
  - That parents were instructed to notify the PT if there is a persistent return of head tilt or asymmetry in active rotation or lateral flexion ROM.
  - The PT recommendation to the physician to check the infant’s cervical ROM and presence of head tilt in well child visits.
  - The PT recommendation for a PT reassessment to check the condition of the infant’s CMT and general development at 12 months or when walking begins.
- Have the parent complete a reminder post card for a PT reassessment that can be mailed to the family at the appropriate time.
- Audit the number of reassessments completed versus the reasons for no reassessment, or premature discontinuation of services.

Supporting Evidence and Clinical Interpretation:

The long-term consequences of CMT are implied from studies of older children and adults who require surgeries for correction of unresolved asymmetry\textsuperscript{39, 44, 196} and from long term follow-up studies\textsuperscript{32, 202}. While the short-term outcomes of conservative management are well documented, there is little direct evidence of the long-term effectiveness of early PT intervention, nor the rate of recidivism following early intervention. Studies report an ‘excellent’ resolution of CMT as
having less than 5 degrees of passive rotation asymmetry with the opposite side,\textsuperscript{24, 28, 43, 173} and a ‘good’ resolution with as much as 10 degrees\textsuperscript{28, 43} residual. It is not known whether the last 5-10 degrees will resolve on its own, in whom it remains as a mild limitation, whether achieving passive rotation ROM equates to full active use of the available ROM, and whether a mild residual asymmetry influences normal development.

Öhman, Beckung\textsuperscript{202} found that although infants with a history of CMT did not exhibit motor delays at preschool age, 7% exhibited a head tilt and 26% had some degree of asymmetry in PROM. The clinical significance of the asymmetric neck PROM is uncertain because only children with CMT were followed. All had $\geq 85^\circ$ of rotation PROM to each side, and 7 children had a lateral flexion PROM difference between sides of only 5-10$^\circ$; it’s not clear if age matched children without CMT would present with similar results. In this study, asymmetric neck PROM at preschool age was associated with the degree of asymmetric neck rotation PROM as an infant.\textsuperscript{202}

The documented potential for increasing muscle fibrosis,\textsuperscript{95} developmental delays,\textsuperscript{110} and hemi-syndrome\textsuperscript{69} support that a single PT reassessment is prudent to determine if the resolution of CMT achieved at an earlier age is maintained as the infant continues to develop, and to assess for potential developmental delays or biased limb use. Physicians should be cognizant of the risk for asymmetries and/or motor delays during routine physical exams as infants with a history of CMT are followed through to their teen years.

The length of time after discontinuation that a PT reassessment should be conducted is supported by level IV evidence. Wei, Schwartz, Weaver, Orvidas\textsuperscript{48} propose following infants until complete resolution, or a minimum of 12 months. Ultrasound images suggest that while clinical indicators of ROM may improve, they are not correlated with SCM fibrous changes, and these fibrous changes can continue until at least age 3.\textsuperscript{95} Finally, the potential for developmental delays may not become evident until early school age,\textsuperscript{110} so a re-examination when the child enters elementary school may be warranted if a parent or teacher reports, or the child presents with, residual asymmetries, developmental delays or preferential positioning. Regional differences as to when a child is seen for their final direct service appointment may differ from the criteria for discharge, when the episode of care for CMT is considered closed.

R. Research Recommendations: Studies are needed to:
• Determine the most reasonable PT reassessment times after discontinuation of direct PT intervention based on initial presentations.

• Establish the level of risk of developing asymmetries following an episode of intervention.

• Describe parent/caregiver experiences and/or satisfaction with PT intervention and infant outcomes. Limited mentions of parent and/or patient satisfaction are available post surgery, and post botulinum toxin use, but none were found specific to PT management.

• Determine the validity and reliability of using telemedicine or virtual meetings as compared to in-person PT reassessment for the 3-12 month reassessment.

SUMMARY

A review of the literature, including a focused systematic review, resulted in 17 graded action statements with varying levels of obligation that address education, referral, screening, examination and evaluation, classification, prognosis, first choice and supplementary physical therapy interventions, inter-professional consultations, discontinuation, reassessment, and discharge, with suggestions for quality improvement, implementation and audits. Flow sheets for referral paths and classification of CMT severity have been updated. Research recommendations are made for 16 practice issues and summarized at the end of the document.

GENERAL GUIDELINE IMPLEMENTATION STRATEGIES

There is a growing body of evidence on implementing research into practice. The following suggestions are provided as possible strategies for clinicians to implement the action statements of this CPG, but are not an exhaustive review. Many variables impact the successful translation of evidence into practice; clinicians will need to assess their own practice structures, cultures and clinical skills to determine how to best implement the action statements as individuals and how to facilitate implementation by others.

The GDG recommends that:

● Education about the CMT-CPG to be included in physical therapy curricula.
• Continuing education programs are provided to PTs on the updates in the 2018 CMT CPG.
• PTs distribute brochures developed by the APPT (URL.TBA) to parents, physicians, midwives, and other health care providers that summarize the applicable key points of the 2018 CMT CPG.

Strategies for Individual Implementation

• Seek training in the use of the recommended standardized measures and/or intervention approaches.204
• Build relationships with referral sources to encourage early referral of infants.
• Measure individual service outcomes of care (e.g. patient impact across the ICF domains, costs, parent/caregiver satisfaction).205, 206

Strategies for Facilitating CPG Implementation in Other Clinicians

• Recognize that adoption of the recommendations by others may require time for learning about the 2018 CMT CPG content, developing a positive attitude toward adopting the action statements, comparing what is already done with the recommended actions, trialing selected changes in practice to determine their efficacy, and finally, routine integration of the tested changes.205, 207
• Identify early adopting clinicians, such as yourself, as opinion leaders to introduce the guideline via journal clubs or staff presentations.205, 207
• Identify gaps in knowledge and skills following presentation of content to determine needs of staff for adopting recommendations.207
• Use documentation templates to facilitate standardized collection and implementation of the recommended measures and actions.4, 208, 209
• Institute quality assurance processes to monitor the routine collection of recommended data and implementation of recommendations, and to identify barriers to complete collection.205, 210
• Measure structural outcomes (e.g. dates of referral, equipment availability), process outcomes (use of tests and measures, breadth of plan of care), and service outcomes (e.g. patient impact across the ICF domains, costs, parent/caregiver satisfaction).205, 206
SUMMARY OF RESEARCH RECOMMENDATIONS BY ACTION STATEMENT NUMBER

Action Statement 1: Educate Expectant Parents and Parents of Newborns on Positioning.
Studies are needed on the impact of education of:
  • Health care providers on their knowledge of pediatric PTs’ roles in managing postural preference.
  • Parents/caregivers about the parental experience of receiving this education.

Action Statement 2: Assess Newborn Infants for Asymmetries/CMT
Studies are needed to determine:
  • Whether routine screening at birth increases the rate of CMT identification or increases false positives.
  • The barriers to early referral of infants with CMT to PT.

Action Statement 3: Refer Infants With Asymmetries To Physician And Physical Therapist.
  • Studies are needed to clarify the predictive baseline measures and characteristics of infants who benefit from immediate follow-up, and to compare the cost benefit of early PT intervention and education as compared to parental instruction and monitoring by physicians.
  • Longitudinal studies of infants with CMT are needed to clarify how the timing of referral and initiation of intervention impact body structure and functional outcomes, and overall costs of care.

Action Statement 4: Document Infant History
  • Studies are needed to clarify how the health history factors influence PT diagnosis, prognosis, and intervention.

Action Statement 5: Screen Infants for Non-Muscular Causes of Asymmetry and Conditions Associated with CMT.
  • Studies are needed to identify the precision of screening procedures specific to CMT.

Action Statement 6: Refer Infants from Physical Therapist to Physician if Indicated by Screen.
  • Studies are needed to clarify the incidence of non-muscular causes of CMT and associated conditions, and how early referral impacts ultimate outcome.

Action Statement 7: Request Images and Reports
• Studies are needed to determine who would benefit from imaging, at what time in the management of CMT images are useful, and how images effect the plan of care.

**Action Statement 8: Examine Body Structures**

• Reliable, valid and time efficient methods of measuring infant cervical PROM need to be developed, including lateral flexion, and large scale normative data of PROM should be established by age in months.
• Determine the sensitivity and specificity of the Muscle Function Scale to differentiate infants with clinically significant limitations from typically developing infants.
• Establish a clinically practical, objective method of measuring cervical rotation AROM in infants 0-3 months and infants >3 months to assess baseline and change over time.
• Determine what, if any, correlation between active and passive ROM should be used for discontinuation and/or discharge criteria.
• Studies are needed to describe and differentiate signs of discomfort from the types of pain reactions typically observed in infants with CMT during specific testing or interventions, as well as to determine the validity of the FLACC in rating true pain reactions during CMT examinations or interventions.

**Action Statement 9: Classify the Level of Severity**

• Studies are needed to determine a reliable, valid and clinically practical method of measuring lateral flexion, and then to determine how the severity of lateral flexion may impact the CMT Severity Classification grades.

**Action Statement 10: Examine Activity and Developmental Status**

• Studies are needed to identify the best developmental tests to use for infants with suspected or diagnosed CMT, from birth through 12 months, so that the same measures can be documented on all infants, enabling comparison of outcomes across studies.

**Action Statement 11: Examine Participation Status**

• Studies are needed to quantify changes in participation and clarify how the participation elements inform the plan of care.

**Action Statement 12: Determine Prognosis.** Studies are needed to:

• Clarify the interaction between the factors associated with full symptom resolution and episode of care.
• Clarify the accuracy of prognosis with respect to full symptom resolution and episode of care.

• Describe and clarify the efficacy of different delivery models, e.g. individual versus group or clinic versus home.

**Action Statement 13:** Provide These Five Components As The First Choice Intervention.

Studies are needed to:

• Identify intervention techniques and dosages, including accurate descriptions of active exercises, with links to the CMT Classification Severity grades.

• Identify the components of optimal home programs.

• Evaluate the benefits of individual versus group therapy conditions.

**Action Statement 14:** Provide Supplemental Intervention(s), After Appraising Appropriateness For The Infant, To Augment The First Choice Intervention

• Studies are needed to describe and clarify the efficacy of all supplementary interventions, including determinants for their choice, principles of application, dosage and outcomes measures.

**Action Statement 15:** Initiate Consultation when the Infant is not Progressing as Anticipated

• Studies are needed to describe the incidence of infants that require invasive care, their history of interventions, the best time for referral, and any associated physical therapy outcomes.

**Action Statement 16:** Discontinue Direct Services when these 5 Criteria are Achieved.

• Longitudinal studies are needed to understand the best criteria or timing for discontinuing infants from direct PT intervention and the final discharge from the episode of care.

**Action Statement 17:** Reassess Infants 3-12 Months after Discontinuation of Direct Services, then Discharge.

• Determine the most reasonable reassessment times after discontinuation of direct PT intervention based on initial presentations.

• Establish the level of risk of developing asymmetries following an episode of intervention.

• Describe parent/caregiver experiences and/or satisfaction with PT intervention and infant outcomes. Limited mentions of parent and/or patient satisfaction are available post
surgery\textsuperscript{43, 197} and post botulinum toxin use,\textsuperscript{187} but none were found specific to PT management.

- Determine the validity and reliability of using telemedicine or virtual meetings as compared to in-person PT reassessment for the 3-12 month reassessment.

**DEVELOPMENT OF THE GUIDELINE**

This clinical practice guideline is the product of many people’s work and support. At each phase of the update, the GDG has benefitted from the work and advice of clinicians, methodologists and the patients with whom we work. The following outlines the phases of this update, and formally acknowledges the contributors along the way.

Phase 1: Organization and manuscript development, including determination of scope.

Colleen P. Coulter PT, DPT, PhD, PCS
Sandra L. Kaplan PT, DPT, PhD
Barbara Sargent PT, PhD, PCS

Phase 2: Literature search and abstract review.

Colleen P. Coulter PT, DPT, PhD, PCS,
Emily Heidenreich PT, DPT
Sandra L. Kaplan PT, PhD
Barbara Sargent PT, PhD, PCS

Phase 3: Literature review, appraiser reliability training and critical appraisal ratings for systematic review.

Emily Heidenreich PT, DPT
Barbara Sargent PT, PhD, PCS

Phase 4: Action Statement generation and literature summarization.

Colleen Coulter PT, DPT, PhD, PCS,
Sandra L. Kaplan PT, PhD
Barbara Sargent PT, PhD, PCS

Phase 5: First round review by content experts

Cynthia Baker MD (AAP representative)
Christine McDonough PT, PhD (Methodologist)
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Scott Parrott PhD (Methodologist)
Melanie Percy RN, PhD, CPNP, FAAN (Pediatric Nurse Practitioner)
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Philip Spandorfer MD (Pediatrician)

APPT Knowledge Translation Committee Project Leaders:
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Ellen Brennan PT, DPT, PCS
Catie Christensen PT, DPT, PCS
Melanie McKinney PT, DPT, PCS (Chair)
Barbara Pizzutillo PT, DPT, MBA
Susan Rabinowicz DPT, MS

All 1st round reviewers declared an absence of conflicts of interest with the topic, process and/or financial relationships.

Phase 6: External review of revised CPG by the public; AGREE II ratings. (To be conducted in May, 2018)

A revised draft of the guideline was posted for public comment on the APTA Academy of Pediatric Physical Therapy web site. Notices were sent through the APPT electronic newsletter, directly to the prior literature appraisers, and to any clinicians who had inquired about the CPG during its update regarding the opportunity for comments. Comments were and may be submitted to torticolliscpg@gmail.com.

AGREE II Review (TBA)

This CPG was evaluated by three reviewers using AGREE II, an established instrument designed to assess the quality of clinical practice guidelines.

Phase 7: Submission for publication to Pediatric Physical Therapy.

Colleen P. Coulter PT, DPT, PhD, PCS
Sandra L. Kaplan PT, PhD
Barbara Sargent PT, PhD, PCS
Linda Fetters PT, PhD, FAPTA, Journal Editor

Phase 8: Dissemination of guideline (e-publication, print publication, application to National Guideline Clearinghouse)

APTA Academy of Pediatric Physical Therapy Web pages.
NGC and PEDro Submissions – Sandra L. Kaplan PT, DPT, PhD

Phase 9: Plan for revision. The GDG recommends that the CPG be updated in five years, as the body of evidence expands. The guideline revision will be organized by Barbara Sargent PT, PhD, PCS. Similar to the 2018 CMT CPG, a systematic review to inform the 2023 CMT CPG will be initiated in 2021 and completed in 2023; the 2023 CMT CPG update will begin in 2022 and be completed in 2023.

Phase 10: Plan for monitoring guideline uptake. The GDG recommends a survey of pediatric PTs in 2021, similar to Kaplan, 2017, to assess the 2018 CMT CPG guideline uptake and cost effectiveness of developing CPGs within the APPT.

Special Acknowledgements

Pam Corley, Reference librarian, USC 2013 CMT CPG
Robert Johnson MLIS, Reference librarian, USC, 2018 CMT Systematic Review
Richard Shiffman MD, BridgeWIZ developer.

Conflict of Interest Statements

Colleen P. Coulter PT, DPT, PhD, PCS - nothing to disclose
Barbara Sargent PT, PhD, PCS – nothing to disclose
Sandra L. Kaplan PT, DPT, PhD – nothing to disclose

All authors are members of the APTA and the Academy of Pediatric Physical Therapy, both of which provided funds for travel to meetings and clerical services in support of this guideline; funding sources did not influence the content or process of updating the guideline.
REFERENCES


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144. Öhman A. A craniometer with a headband can be a reliable tool to measure plagiocephaly and brachycephaly in clinical practice. Health. 2016;08(12):1258-1265.


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Please reference the line numbers for specific issues.


APPENDICES, FIGURES AND TABLES

Appendix 1: ICF and ICD 10 Codes

<table>
<thead>
<tr>
<th>ICF codes</th>
<th>CMT presentation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Impairments of Body Functions and Structures</strong></td>
<td></td>
</tr>
<tr>
<td>B7108 Mobility of joint functions, other specified</td>
<td>Cervical Passive &amp; Active ROM</td>
</tr>
<tr>
<td>B7300 Power of isolated muscles and muscle groups</td>
<td>Strength of lateral neck flexion and cervical rotation; Strength of neck and back extensors in prone; symmetrical strength of SCM in pull to sit.</td>
</tr>
<tr>
<td>B7350 Tone of isolated muscles and muscle groups</td>
<td>Hyper or hypotonia; spasm</td>
</tr>
<tr>
<td>B7600 Control of simple voluntary movements</td>
<td>Active visual pursuit toward the shortened side; symmetrical movements of trunk; UE and LEs in developmental positions</td>
</tr>
<tr>
<td>S7103 Joints of head and neck region</td>
<td>Cervical AROM, PROM</td>
</tr>
<tr>
<td>S7104 Muscles of head and neck region</td>
<td>Presence of a SCM mass</td>
</tr>
<tr>
<td>S7108 Structure of head and neck region, other specified</td>
<td>Facial and skull symmetry</td>
</tr>
<tr>
<td>S7401/ S5001 Hip Joint</td>
<td>Hip Dysplasia</td>
</tr>
<tr>
<td><strong>Activity Limitations</strong></td>
<td></td>
</tr>
<tr>
<td>D110 Watching</td>
<td>TIMP, AIMS, AROM, ocular torticollis</td>
</tr>
<tr>
<td>D440 Fine hand use</td>
<td>Hands to midline; hemi-syndrome</td>
</tr>
<tr>
<td>D445 Hand and arm use</td>
<td>Hands to midline; hemi-syndrome; AIMS, AROM</td>
</tr>
<tr>
<td><strong>Participation Restrictions</strong></td>
<td></td>
</tr>
<tr>
<td>D7600 Parent-child relationships</td>
<td>Parent comfort and knowledge with positioning and home programming</td>
</tr>
<tr>
<td>D7601 Child-parent relationships</td>
<td>Infant engagement with parent during feeding and play</td>
</tr>
<tr>
<td>D920 Recreation and leisure</td>
<td>AIMS, attention to toys,</td>
</tr>
</tbody>
</table>
ICD 10 Codes
The following codes may be used by a variety of health care professionals and are offered for reference; they are not intended to be directional for billing purposes.

Q67.0 Facial asymmetry
Q67.3 Plagiocephaly
Q68.0 Congenital deformity of sternocleidomastoid muscle
Q79.8 Other congenital malformations of musculoskeletal system
P15.2 Sternomastoid injury due to birth injury
M43.6 Torticollis
Appendix 2: Operational Definitions

**Brachycephaly:** Cranial deformation with flattening of the entire posterior surface of the head.\textsuperscript{212}

**Cervical rotation:** Movement in the transverse plane, such that the chin turns toward or past the ipsilateral shoulder.

**Congenital muscular torticollis (CMT):** Congenital muscular torticollis is a common pediatric orthopedic condition, described as a postural deformity of the neck evident at birth or shortly thereafter. It is typically characterized by a head tilt to one side and the neck rotated to the opposite side, due to unilateral shortening or fibrosis of the sternocleidomastoid muscle. It may be accompanied by cranial deformation or DDH, and less frequently, atypically present as a head tilt and neck twisting to the same side.\textsuperscript{29,111,213} CMT has been associated with DDH,\textsuperscript{49} brachial plexus injury,\textsuperscript{20-22} lower extremity deformities,\textsuperscript{23-25} early developmental delay,\textsuperscript{20,50} persistent developmental delays,\textsuperscript{110} facial asymmetry, which may impact function and cosmesis,\textsuperscript{52} and temporomandibular joint dysfunction.\textsuperscript{53}

**Cranial deformation:** a distortion of the shape of the skull resulting from mechanical forces that occur pre or postnatally.\textsuperscript{212} This term includes plagiocephaly and brachycephaly.

**Lateral cervical flexion, side bending, or head tilt:** Movement in the coronal plane, such that the infant’s ear approaches the ipsilateral shoulder.

**Plagiocephaly:** Cranial deformation with flattening of 1 side of the head.\textsuperscript{140}

**Postural preference:** (synonymous with positional preference) refers to the preferred head and neck asymmetry that an infant gravitates to in all positions.
**Sternocleidomastoid mass** (synonymous with fibromotosis colli, tumor, pseudotumor or node): A condition in which the sternocleidomastoid muscle is enlarged due to fibrosing of muscle cells with identifiable histological changes. It is referred to as a ‘mass’ throughout this document.
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Please reference the line numbers for specific issues.
### Table 4. Studies on Measurement Approaches

<table>
<thead>
<tr>
<th>Measurement of interest</th>
<th>Type of measurement tool</th>
<th>Citations</th>
<th>Level of evidence, validity and reliability</th>
<th>Position for measurement (infant and examiners)</th>
<th>Strengths and Limitations</th>
<th>What norms are used</th>
</tr>
</thead>
<tbody>
<tr>
<td>Passive side bending (S)/ lateral flexion (L)</td>
<td>Arthrodial protractor</td>
<td>Cheng et al. 1999, 2000, 2001</td>
<td>n/a for lateral flexion</td>
<td>Supine: 2 examiners; 1 measures and 1 stabilizes the shoulders.</td>
<td>S- Reproducible; used in many studies  L- no established reliability for lateral flexion</td>
<td>Comparison of values to right and left.</td>
</tr>
<tr>
<td></td>
<td>Ohman &amp; Beckung, 2008</td>
<td>Referenced Klackenberg’s intra rater reliability values, .94-.98</td>
<td>Supine: 2 examiners; 1 measures and 1 stabilizes the shoulders.</td>
<td>S- Assigned PROM values.  L- infants did not have torticollis</td>
<td>70° mean PROM</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Klackenberg et al. 2005</td>
<td>Intra rater reliability .94 -.98</td>
<td>Supine with head and body supported. PT measures; 2nd examiner stabilizes the shoulders.</td>
<td>S- Reproducible with high intra rater reliability  L- no ICC for inter-rater reliability</td>
<td>ICC higher when measuring the affected side than unaffected. 60 ° infants ear reached shoulder</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Goniometer with level adaptation</td>
<td>Karmel-Ross, 1997</td>
<td>n/a</td>
<td>Supine and sitting according to infant’s development. In supine the head is supported off the</td>
<td>S- assigning ROM values L- orienting the goniometer accurately</td>
<td>n/a</td>
</tr>
<tr>
<td>Measurement of interest</td>
<td>Type of measurement tool</td>
<td>Citations</td>
<td>Level of evidence, validity and reliability</td>
<td>Position for measurement (infant and examiners)</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>edge of the surface</td>
<td></td>
<td>n/a</td>
</tr>
<tr>
<td></td>
<td>Photography</td>
<td>Klackenberg et al. 2005</td>
<td>ICC (0.74-0.90) fair to good</td>
<td>Supine PT measures and 2&lt;sup&gt;nd&lt;/sup&gt; examiner stabilizes the shoulders. Photo is taken and examiner draws on photo</td>
<td>S- comparison values to measurement with protractor L- Too many variables to control. Extra steps. Author reports unfeasible</td>
<td>n/a</td>
</tr>
<tr>
<td></td>
<td>Photography</td>
<td>Rahlin &amp; Sarmiento, 2010</td>
<td>Intra-rater reliability .80 - .85, ICC (3,1) Inter-rater reliability .72 - .99 ICC (2,1)</td>
<td>Supine. One examiner places child and provides visual stimulus in midline</td>
<td>S- measures the infants resting posture L-time consuming with several steps to measure the photograph</td>
<td>n/a symmetry of movement by feel</td>
</tr>
<tr>
<td></td>
<td>Palpation of extensibility</td>
<td>Emery 1994</td>
<td>n/a</td>
<td>2 examiners PT measures the 2&lt;sup&gt;nd&lt;/sup&gt; stabilizes the shoulders</td>
<td>Subjective data no definition of resistance</td>
<td>n/a symmetry of movement by feel</td>
</tr>
<tr>
<td>Passive cervical rotation</td>
<td>Arthrodial protractor</td>
<td>Cheng et al., 1999, 2000, 2001</td>
<td>Inter-rater reliability ICC .71 unpublished data</td>
<td>Supine with the head supported off the edge of the surface; 2</td>
<td>S- Reproducible and used in many studies</td>
<td>110° cervical rotation</td>
</tr>
<tr>
<td>Measurement of interest</td>
<td>Type of measurement tool</td>
<td>Citations</td>
<td>Level of evidence, validity and reliability</td>
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<tr>
<td></td>
<td></td>
<td>Ohman &amp; Beckung, 2008</td>
<td>Inter-rater reliability ICC .71 per Cheng’s unpublished date</td>
<td>examiners 1 measures and 1 stabilizes the shoulders.</td>
<td>S- Assigned PROM values. L- infants did not have torticollis</td>
<td>110° mean PROM</td>
</tr>
<tr>
<td></td>
<td>Goniometer</td>
<td>Klackenberg et al. 2005</td>
<td>Right CMT ICC.82 - .95 for rotation and side for rotation and lateral flexion. ICC .58 - .65 for rotation and side for rotation and lateral flexion to the non-affected side</td>
<td>Supine with head and body on the surface. PT measures and 2nd examiner stabilizes the shoulders.</td>
<td>S- establishing intra-rater reliability L- cervical rotation is limited by supporting surface</td>
<td>ICC higher when measuring the affected side than unaffected; 70 – 80 ° when infant’s chin touches supporting surface</td>
</tr>
<tr>
<td></td>
<td>Goniometer with level adaptation</td>
<td>Karmel-Ross, 1997</td>
<td>n/a</td>
<td>Supported sitting according to infant’s development. 2nd examiner stabilizes shoulders</td>
<td>S- values can be assigned L- accounting for compensations of trunk and shoulders</td>
<td>100 – 120° cervical rotation per Emery values 1994</td>
</tr>
<tr>
<td></td>
<td>Visual inspection</td>
<td>Boere-Boonkamp &amp;</td>
<td>n/a</td>
<td>Supine</td>
<td>S- Easy to administer</td>
<td>n/a</td>
</tr>
</tbody>
</table>

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<td>Level of evidence, validity and reliability</td>
<td>Position for measurement (infant and examiners)</td>
<td>Strengths and Limitations</td>
<td>What norms are used</td>
</tr>
<tr>
<td>Palpation of extensibility</td>
<td>Cameron</td>
<td>n/a</td>
<td>Supine 2 examiners one measures the 2nd stabilizes the shoulders</td>
<td>S- Easy to administer; Subjective</td>
<td>symmetry of movement by feel Grades assigned by mild, moderate, severe</td>
<td></td>
</tr>
<tr>
<td>Active lateral flexion /side bending</td>
<td>Muscle Function Scale</td>
<td>Ohman et al., 2009</td>
<td>Inter and Intra rater reliability Kappa&gt;0.9; ICC 0.9</td>
<td>Infant is held in a vertical position and lowered to horizontal</td>
<td>S- valid and reliable measure of lateral flexion strength L- lateral flexion only</td>
<td>0 – 5 score Validated on infants &gt; 4 months of age 5/5 is normal strength of lateral flexion</td>
</tr>
<tr>
<td></td>
<td>CROM Inclinometers mounted on glasses head and magnet yolk on trunk</td>
<td>Karmel-Ross, 1997</td>
<td>n/a</td>
<td>Supported sitting in adapted car seat mounted on hinge</td>
<td>S- measures for lateral flexion L- Stabilizing of the body. Child needs head and trunk control</td>
<td>n/a</td>
</tr>
<tr>
<td>Active cervical rotation</td>
<td>Visual tracking</td>
<td>Persing 2003 Laughlin 2011</td>
<td>n/a</td>
<td>Supine infants &lt; 4 months and supported</td>
<td>Easy to administer but no values</td>
<td>-0-Comparison between right</td>
</tr>
<tr>
<td>Measurement of interest</td>
<td>Type of measurement tool</td>
<td>Citations</td>
<td>Level of evidence, validity and reliability</td>
<td>Position for measurement (infant and examiners)</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>Boere-Boonkamp 2001</td>
<td>n/a</td>
<td>Supine, 1 examiner to encourage the infant to track</td>
<td>S- Easy to administer but no values</td>
<td>-0-Comparison between right and left ranges</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CROM- Inclinometers mounted on glasses head and magnet yolk on trunk</td>
<td>Fletcher 2008</td>
<td>Intra rater reliability ICC .92 for lateral flexion ICC .94 for rotation</td>
<td>1 examiner with subject independent sitting</td>
<td>S- reproducible if child is older and cooperative L- Adults only head array needs to be worn</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Youdas 1992</td>
<td>Inter rater: ICC.80; Intra rater: ICC.67 to.90 (median=.86) for left lateral flexion, ICC.60 to .94 (median=.85) for right lateral flexion, .81 to .95 (median=.84) for left rotation, and .58</td>
<td>1 examiner with subject independent sitting</td>
<td>S- reproducible if child is older and cooperative L- Adults only head array needs to be worn</td>
<td>No values for infants</td>
</tr>
<tr>
<td>Measurement of interest</td>
<td>Type of measurement tool</td>
<td>Citations</td>
<td>Level of evidence, validity and reliability</td>
<td>Position for measurement (infant and examiners)</td>
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</tr>
<tr>
<td>Classification reliability</td>
<td>CMT Severity Classification System (7-grades)</td>
<td>Oledzka et al. 2018 (in press)</td>
<td>Inter rater reliability is good: ICC (2,1) = 0.83 [95% CI 0.74-0.91]). Intra rater reliability is good; (ICC (3,1) = 0.81 [95% CI 0.66-0.91]).</td>
<td>Not applicable</td>
<td>S-Large sample with some attrition L- classification grades were assigned using paper cases versus independent assessment in a clinical setting.</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

Abbreviations: CMT, congenital muscular torticollis; CROM, cervical range of motion; ICC, intraclass correlation coefficient; L, limitation; N/A, not applicable; PROM, passive range of motion; S = strength.
### Table 5: Studies on the First Choice Intervention

<table>
<thead>
<tr>
<th>Author &amp; Year</th>
<th>Study Design/ Level of Evidence</th>
<th>Participants</th>
<th>Experimental vs. Comparison Groups</th>
<th>Intervention</th>
<th>Results (Between group differences)</th>
<th>Clinical Implications</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ohman et al 2010</strong></td>
<td>RCT, Level II</td>
<td>20 infants with CMT &lt; 5 mo with head tilt and limited ROM</td>
<td>(1) PT (n=10)</td>
<td>(1) PT: PT stretches into LAT FLEX and ROT, 15 min, 3 day/wk, 10-30 sec hold; no stretching at home</td>
<td>Treatment duration to achieve good ROM (ROT ≥90° and no side difference in LAT FLEX): shorter in PT vs Parent group</td>
<td>Shorter treatment duration to achieve good ROM and symmetric head posture when stretching performed by experienced PT versus parents</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(2) Parent (n=10)</td>
<td>(2) Parent: Parent stretches 3-5 sessions, 2x/day, 15 min total, 7 day/wk, 10-30 sec hold</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Both groups: HP of prone positioning, carry infant with affected side down.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>He et al 2016</strong></td>
<td>RCT, Level II</td>
<td>50 infants with CMT&lt; 3 mo, limited cervical ROM</td>
<td>(1) 50x Stretching (n=24), (2) 100x Stretching (n=26)</td>
<td>Both groups: 5-10 day training then parents implemented at home: 10 ROT and LAT FLEX stretches, 10-15 sec hold, 5 or 10x/day as per group assignment, weekly phone follow-up</td>
<td>ROT &amp; LAT FLEX ROM (AP): 100x group greater improvement at 1 and 2 mo post-tx</td>
<td>Increased frequency of daily stretching resulted in decreased head tilt and increased ROT &amp; LAT FLEX PROM</td>
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<td>HEAD TILT (AP): 100x group greater improvement at 1 and 2</td>
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<td>Author &amp; Year</td>
<td>Study Design/Level of Evidence</td>
<td>Participants</td>
<td>Experimental vs. Comparison Groups</td>
<td>Intervention</td>
<td>Results (Between group differences)</td>
<td>Clinical Implications</td>
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<tr>
<td>Ohman et al 2011</td>
<td>RCT, Level II</td>
<td>37 infants with CMT &lt; 11 mo</td>
<td>(1) Handling strategies only (n=9); (2) Handling strategies + strength EX (n=13); (3) Handling strategies + strength EX + PT (n=11)</td>
<td>(1) Handling strategies: prone when awake and supervised, carry and hold infant with affected side down, encourage ROT to affected side; (2) Handling strategies and strength EX: handling activities as in Group 1, slowly transitioning infant from sitting or standing to horizontal with 5-15 sec hold for 15-min. (3) Handling strategies + strength EX + PT: handling and strength EX as in Group 2 but PT helps 2-3 days/wk. All groups: strategies to prevent and reduce CD, stretching for infants with limited ROM (&lt;90°in ROT and/or side difference in LAT FLEX).</td>
<td>Treatment duration to achieve symmetric head posture (1 item on the SSAP): NS</td>
<td>No differences in treatment duration with stretching and different types of AROM: handling, handling + strengthening, handling + strengthening + PT.</td>
</tr>
<tr>
<td>Author &amp; Year</td>
<td>Study Design/ Level of Evidence</td>
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<td>Cheng, Wong et al., 2001; Cheng &amp; Au, 1994</td>
<td>II Pro cohort</td>
<td>821 subjects over a 12 year period</td>
<td>n/a</td>
<td>Passive stretching 3x/week, 3 reps, x 15 stretches, 1 sec hold, 10 sec rest in between stretches. PT performs the EX Parents were instructed in home program of positioning. No stretching</td>
<td>The duration of treatment was significantly associated with the clinical group (3.7 mo with SCM mass, 2.5 mo for muscular, 1.4 mo for postural CMT), age of presentation, passive ROT deficit, and involvement of the right side (p &lt; 0.0001); difficult birth (p &lt; 0.009) Surgery- 7.5% for SCM mass, 3.1 for muscular, and 0% for postural</td>
<td>Controlled manual stretching is safe and effective treatment if initiated before 12 mo of age. The infant’s clinical subtype of CMT, age of presentation, and ROT deficits are factors that influence outcomes.</td>
</tr>
<tr>
<td>Author &amp; Year</td>
<td>Study Design/ Level of Evidence</td>
<td>Participants</td>
<td>Experimental vs. Comparison Groups</td>
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<tr>
<td>Demirbilek &amp; Atayurt, 1999</td>
<td>III Retro cohort</td>
<td>57 patients &lt; 18 mo of age</td>
<td>n/a</td>
<td>Passive stretching 4 to 5 x/day, 40 reps/set Duration of holds and rest- n/a 2 person stretches Methods unclear for who instructs the parents and performs the exercises Intensive therapy is reposted for infants s/p SCM release with unclear methods</td>
<td>Surgery: 0% &lt; 3 months of age required surgery; 25% between 3 and 6 months of age; 71% between 6 and 18 months; 100% &gt; 2 to 7 years of age. Overall 26% subjects (15/57) required surgery</td>
<td>Earlier treatment is initiated is better outcome. Greater resolution of CMT if treatment is initiated &lt; 3 months of age. Retrospective study with no control group. Passive stretching methodology is not clear on the duration of holds and rest between sets and who performs the exercises</td>
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</tbody>
</table>
| Cameron et al., 1994 | III Retro cohort 30 year period | 126 patients 88 = early < 3 mo of age 38 = late > 3 mo of age | n/a | Passive stretching 2x/day, 10 reps each session Caregivers perform the stretching, 4 infants were admitted to the hospital for stretching due to no progress, and 1 required nurse coming to the home No information on who instructs parents | 100% of infants who initiated treatment < 3mo resolved with no surgery. 45% of who initiated treatment > 3 months of age required surgery, (P<0.005) 65% of infants had full | Early initiation of treatment before 3 months of age showed full resolve of the CMT. Parental education and frequent follow up were related to successful outcomes.

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<table>
<thead>
<tr>
<th>Author &amp; Year</th>
<th>Study Design/ Level of Evidence</th>
<th>Participants</th>
<th>Experimental vs. Comparison Groups</th>
<th>Intervention</th>
<th>Results (Between group differences)</th>
<th>Clinical Implications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Celayir, 2000</td>
<td>II Pro Cohort study</td>
<td>45 infants &lt; 4 mo of age</td>
<td>n/a</td>
<td>(P)ROM 8x/day (Q 3 hours), 10 reps each session, hold 10 seconds. (P)ROM: flexion, extension, rotation, and LAT FLEX Re-assess every 4 months until resolve with 1 month check after full resolution physician, surgeon, instructs the parents. No PT in the center. Home program of handling and</td>
<td>Study stresses importance of an intensive concise (P)ROM program for all infants. Patients who received early treatment did not receive surgical intervention. Parent involvement in (P)ROM and home</td>
<td>This is a retrospective study with no control group or specific methodology for the intervention. Intervention was altered in 5 subjects who were not making improvement. Unclear the age at initiation of treatment of these 5 subjects</td>
</tr>
<tr>
<td>Author &amp; Year</td>
<td>Study Design/ Level of Evidence</td>
<td>Participants</td>
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<td>positioning</td>
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<td>rotation limitation and no asymmetry</td>
<td>program was important for successful outcomes.</td>
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<td>Mean duration of treatment was 3.2 months</td>
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### Table 6. Studies on Supplemental Interventions

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<tr>
<th>Author &amp; Year</th>
<th>Study Design/Level of Evidence</th>
<th>Participants</th>
<th>Experimental vs. Comparison Groups</th>
<th>Intervention</th>
<th>Results (Between group differences)</th>
<th>Clinical Implications</th>
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</thead>
<tbody>
<tr>
<td>Kwon and Park 2014</td>
<td>RCT, Level II</td>
<td>20 infants with CMT &lt; 3 mo with entire SCM involvement, palpable SCM mass</td>
<td>(1) EX + US + Microcurrent on (n=10), (2) EX + US + Microcurrent off (n=10)</td>
<td>Both groups: Intervention 3x/wk; US 5 min + EX (ROM, postural training, manual SCM stretching [3 x 15 reps, 1 sec hold, 5-10 sec rest]) 20 min + Microcurrent 30min (on/off) as per group assignment</td>
<td>ROT PROM (AP): 1,2,3 mo post-tx was significantly greater in microcurrent group vs. control; NS at 6 mo</td>
<td>The addition of microcurrent resulted in shorter tx duration</td>
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<td>Both groups: HP of ROT &amp; LAT FLEX stretches, 10x/session, 6x/day; Positioning and handling to promote ROT towards affected SCM</td>
<td>SCM Thickness, CSA, red pixel intensity (SE): 3 mo post-tx significant differences in microcurrent group vs. control</td>
<td></td>
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<tr>
<td>Kim et al, 2009</td>
<td>Control trial, Level II</td>
<td>15 infants with CMT</td>
<td>(1) Microcurrent (n=7), (2) PT (n=8)</td>
<td>Both groups: Intervention 3x/wk for 2 wks as per group assignment: (1) 30 min Microcurrent + 2 min stretching, (2) 30 min ROM exercises + postural training + stretching (control)</td>
<td>ROT PROM (AP): improvement greater in microcurrent group Head Tilt in supine (AP): improvement greater in microcurrent group</td>
<td>Greater improvement in head tilt and ROT PROM after 2 wks microcurrent and stretching intervention versus PT.</td>
</tr>
<tr>
<td>Author &amp; Year</td>
<td>Study Design/ Level of Evidence</td>
<td>Participants</td>
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<tr>
<td>Giray et al 2016&lt;sup&gt;27&lt;/sup&gt;</td>
<td>RCT, Level II</td>
<td>33 infants with CMT, 3-12 mo</td>
<td>(1) EX+ inhibitory KT on involved SCM (n=12), (2) EX+ inhibitory KT on involved SCM + facilitory KT on uninvolved SCM (n=10), (3) EX only (n=11)</td>
<td>All groups: 30 min EX 2x/wk for 3 wks consisting of ROM, stretching, strengthening, head and trunk strengthening; KT applied after EX as per group assignment</td>
<td>ROT &amp; LAT FLEX PROM (AP): NS; STRENGTH (MFS): NS; CD (SSAP): NS</td>
<td>KT for 3 wks provided no added benefit to PT intervention</td>
</tr>
<tr>
<td>Ohman</td>
<td>RCT, 29 infants</td>
<td>(1) Inhibitory</td>
<td>(1) KT muscle relaxation technique to</td>
<td>STRENGTH (MFS): Significant</td>
<td>When KT applied</td>
<td></td>
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<tr>
<td>Author &amp; Year</td>
<td>Study Design/ Level of Evidence</td>
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<tr>
<td>et al 2015</td>
<td>Level II</td>
<td>with CMT ≤12 mo with LAT FLEX muscle imbalance</td>
<td>KT on involved SCM (n=16) (2) No KT (n=13)</td>
<td>involved SCM</td>
<td>difference between groups with KT applied: significantly lower scores on the involved side with KT &amp; significantly higher scores on the uninvolved side with KT.</td>
<td>to the involved SCM, immediate improvement in scores on the MFS.</td>
</tr>
<tr>
<td>Ohman et al 2012</td>
<td>Retrospective cohort</td>
<td>28 infants with CMT &lt;12 mo with LAT FLEX imbalance</td>
<td>(1) Muscle-relaxing KT on involved SCM (n=13), (2) Facilitory KT on involved SCM (n=8), (3) Muscle-relaxing KT on involved SCM + facilitatory KT on uninvolved SCM (n=7),</td>
<td>(1) Muscle-relaxing KT on involved SCM, (8) Facilitatory KT on involved SCM, (3) Muscle-relaxing KT on involved SCM + facilitatory KT on uninvolved SCM</td>
<td>STRENGTH (MFS): Significant decrease in the difference between MFS scores after KT applied with either technique. MFS score on the unaffected side and the muscle-relaxing technique were significantly associated with a decrease in the difference between the MFS scores on the unaffected and affected sides.</td>
<td>When KT applied, there is an immediate decrease in the difference between MFS scores on the unaffected and affected side.</td>
</tr>
</tbody>
</table>

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<table>
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<th>Experimental vs. Comparison Groups</th>
<th>Intervention</th>
<th>Results (Between group differences)</th>
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<tbody>
<tr>
<td>Lee et al, 2017</td>
<td>Prospective cohort</td>
<td>102 infants with CMT &lt;6 mo</td>
<td>(1) Intervention initiated before 6 wks (n=55)</td>
<td>Both groups: 30 min, 3x/wk consisting of US (3 min), massage (5-7 min), manual passive stretching (ipsilateral neck ROT and contralateral LAT FLEX for 10-30 sec, 10x), no HP</td>
<td>SCM thickness (US): change in SCM thickness greater when treatment started before 6 wks compared to after 6 wks Head tilt in supine (photo): NS between groups</td>
<td>Greater improvement in SCM thickness when intervention started before 6 wks compared to after 6 wks</td>
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<td>(2) Intervention initiated after 6 wks (n=47)</td>
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<tr>
<td>Lee et al, 2017</td>
<td>Prospective cohort</td>
<td>70 infants with CMT &lt;6 mo</td>
<td>(1) Grade I (&lt;15° difference in cervical ROT; n=22)</td>
<td>All groups: 30 min, 3x/wk for 6 mo consisting of US (3 min), massage (5-7 min), manual passive stretching (ipsilateral neck ROT and contralateral LAT FLEX for 10-30 sec, 10x).</td>
<td>Head tilt in supine (photo): Significant difference between groups before intervention, but not after 3 or 6 mo of intervention</td>
<td>Infants with CMT with different severity levels exhibit differences in TOA scores at the initiation of PT intervention and within the first 6 months of intervention.</td>
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<td>(2) Grade II (15-30° difference in cervical ROT; n=32)</td>
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<tbody>
<tr>
<td>Chon et al, 2010</td>
<td>Retrospective cohort</td>
<td>32 infants with CMT &lt;3 mo</td>
<td>(3) Grade III (&gt;30° difference in cervical ROT; n=16)</td>
<td>30 min, 5x/wk consisting of 4 sets of 15 stretches with 3 min rest. MST protocol: (1) SCM stretching and (2) myofasical release with sustained finger pressure for 5-10 sec. HP consisting of gentle stretching, massage, education (adequate head positioning and handling skills)</td>
<td>SCM thickness (US): in both groups, significant difference between sides pre-intervention, but not post-intervention. ROT PROM (AP): in both groups, significant improvement from pretest to post test. CD (radiological exam): in both groups, significant improvement from pretest to post test</td>
<td>Infants with CMT with or without SCM tumor demonstrated improvements in SCM thickness, ROT PROM and CD after MST.</td>
</tr>
<tr>
<td>Haugen et al, 2011</td>
<td>RCT, Level II</td>
<td>32 infants with CMT 3 – 6 mo with cervical</td>
<td>(1) Manual therapy and PT (2) PT only</td>
<td>Both groups: PT in the home consisting of 8 wks of encouragement of symmetrical motor performance through a variety of</td>
<td>Changes in CMT symptoms (worse, unchanged, better, much better based on video analysis): NS</td>
<td>Manual therapy for 3 wks provided no added benefit to PT intervention</td>
</tr>
<tr>
<td>Author &amp; Year</td>
<td>Study Design/ Level of Evidence</td>
<td>Participants</td>
<td>Experimental vs. Comparison Groups</td>
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<tr>
<td>Emery, 1994</td>
<td>II Pro cohort</td>
<td>100 mean age 4 mo</td>
<td>n/a</td>
<td>(P)ROM 2x/day, 5 repetitions, 10 sec hold. Active EX home program- Positioning and handling EX, prone positioning, and righting reactions in infants &gt; 64 months. TOT collar was provided in infants &gt; 4.5 months of age with &gt; 6 degree of head tilt PT instructs parents 2 person stretch</td>
<td>LAT FLEX PROM (worse, unchanged, better based on video analysis): NS LAT FLEX AROM (worse, unchanged, better based on video analysis): NS</td>
<td>The longer duration of care was correlated with the greater limitation in ROT (r= .42) Although earlier the intervention was initiated the quicker the resolve of the CMT. However, the restriction in passive ROT was found to be a better indicator of length</td>
</tr>
<tr>
<td>Author &amp; Year</td>
<td>Study Design/ Level of Evidence</td>
<td>Participants</td>
<td>Experimental vs. Comparison Groups</td>
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<tr>
<td>Keklicek &amp; Uygur 2018</td>
<td>RCT, Level II</td>
<td>29 infants with CMT 0–6 mo with head tilt of 5–20°</td>
<td>(1) STMo and HP (n=14) (2) HP only (n=15)</td>
<td>Both groups: Instruction in HP consisting of positioning, handling strategies, environmental adaptations, strengthening exercises, and stretching (5x for each set with 30 sec stretch, 10 sec rest) performed after each diaper change. Caregivers encouraged to connect with PT 2-3x/wk via phone application. STM group only: STM 3x/wk for 12 wks.</td>
<td>ROT PROM (AP): Improvement greater in STMo group after 6 wk of intervention, but NS at 12 wks and 18 wks. LAT FLEX PROM (AP): NS LAT FLEX AROM (MFS): NS Head Tilt (photo): Improvement greater in STMo group after 6 wks of intervention, but NS at 12 wks and 18wks.</td>
<td>STM may speed the improvement in cervical ROM and head tilt when combined with a</td>
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Abbreviations: AP, arthrodial protractor; AROM, active range of motion; CMT, congenital muscular torticollis; CD, cranial deformation; CSA, cross sectional area; DTSM, difference in thickness of the sternocleidomastoid muscles; EX, exercise; goni=goniometer; HP, home program; KT, kinesiotaping; LAT FLEX, cervical lateral flexion; MFS, Muscle Function Scale; min, minute; mo, month; mod, moderate; MST, myokinetic stretching; NS, not significant (p>.05); obs, observation; photo, photography; PROM, passive range of motion PT, physical therapy; RCT, randomized control trial; reps, repetitions; ROM, range of motion; ROT, cervical rotation; SCM, sternocleidomastoid muscle; SE, sonoelastography; sec, seconds; SSAP, severity scale for assessment of plagiocephaly; STM, soft tissue massage; STMo, soft tissue mobilization; TOA, Torticollis Overall Assessment; TOT collar, Tubular Orthosis for Torticollis; tx , treatment; US, ultrasound; wk, week; x, times; +, plus; /, per.
Table 7. Studies of Long Term Follow-Up

<table>
<thead>
<tr>
<th>Author, Year, Journal</th>
<th>Study Design / Level of Evidence</th>
<th>Participants</th>
<th>Residual CMT</th>
<th>Developmental Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cabrera-Martos. 2015.</td>
<td>prospective cohort</td>
<td>175 infants with DP with or without torticollis followed from initiation of tx for DP and/or torticollis until standing without support (Spain)</td>
<td>NA</td>
<td>Infants with DP without torticollis acquired creeping and unsupported standing later than infants with DP and torticollis when adjusting for the severity of DP and age at referral to treatment. There was no difference in the age of acquisition of rolling and sitting. Mean age of acquisition of skills in all infants was 7.5 mo for rolling, 8.7 mo for sitting without support, 11.3 mo for creeping, and 12.3 mo for standing without support.</td>
</tr>
<tr>
<td>Ohman. 2013</td>
<td>cohort</td>
<td>58 children with history of CMT followed up at 3.5-5 yrs (Sweden)</td>
<td>7% had a head tilt</td>
<td>At 3.5-5 yrs, 7% (3/58) had a head tilt considered to be distinct (2) or extensive (1, received surgery). At 3.3-5 yrs, 26% (15/58) had some degree of asymmetry in PROM. The clinical significance is uncertain because only children with CMT were followed. All had ≥ 85° of rotation PROM to each side, and 7 children had a lateral flexion PROM difference between sides of only 5-10°; it’s not clear if age matched children without CMT would present with similar results.</td>
</tr>
<tr>
<td>Ohman, 2009</td>
<td>Case control</td>
<td>122 infants with and without CMT at 2-18 mo of age (Sweden)</td>
<td>At 10 mo, 47% (n=27/57) had evidence of</td>
<td>At 2 mos, gross motor function of 38% (n=11/25) of infants with CMT, compared to without CMT (11%, n=4/35), was ≤ 10th percentile (assessed using AIMS). – significantly different between groups</td>
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</tbody>
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<table>
<thead>
<tr>
<th>Study</th>
<th>Design</th>
<th>Sample Size</th>
<th>Follow-up</th>
<th>Results</th>
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<tbody>
<tr>
<td>Ohman. 2013</td>
<td>Case control</td>
<td>81 children with and without history of CMT followed up at 3.5-5 yrs (Sweden)</td>
<td>NA</td>
<td>At 3.5-5 yrs, infants with a history of CMT, as compared to without a history of CMT, are at no greater risk for motor delay (assessed using MABC-2).</td>
</tr>
<tr>
<td>Schertz et al., 2008</td>
<td>Prospective cohort</td>
<td>83 infants with history of CMT followed at 8-15 mos (Israel)</td>
<td>NA</td>
<td>At initiation of tx for CMT (performed at 2.9 [SD 1.5] mo), gross motor function of 34% (n=35/101) of infants with CMT was ≤ 10th percentile (assessed using AIMS). - lower than the general population</td>
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CMT. At 18 mo, 6 infants still had evidence of CMT. Without CMT (3%, n=1/39), was ≤ 10th percentile (assessed using AIMS). At 6 mos, infants with CMT, compared to without CMT, spent less time in prone. - both gross motor function and time spent in prone significantly different between groups. At 10 mos, gross motor function of 23% (n=13/57) of infants with CMT, compared to without CMT (10%, n=4/39), was ≤ 10th percentile (assessed using AIMS). – not significantly different between groups. At 18 mo, all infants with and without CMT achieved the total score on the AIMS. Both CMT and prone time had an impact on motor development at 2 and 6 months of age. Prone time had a higher impact and also had an impact at 10 mo of age.
| Schertz, et al, 2013 | prospective cohort | 68 children with history of CMT followed up at 7-9 yrs (Israel) | NA | Presence of NDD assessed via clinical assessments (n=38; DSM-IV-TR for ADHD and ASD; BOT-2 or MABC for DCD, MAASE for LI) or telephone interview (n=30; DCD-hebrew for DCD; parent report for ADHD, ASD, DCD, LI)

At 7-9 yrs, 32% (n=22/68) of children with a history of CMT were diagnosed with a NDD (8.8% [n=6/68] ADHD only, 8.8% [n=6/68] ADHD + DCD, 10.3% [n=7/68] DCD only, 1.5% [n=1/68] LI, and 2.9% [n=2/68] LI + ADHD + DCD). Prevalence of DCD and ADHD in this sample of children with a history of CMT in Israel is higher than reported in other samples, which is 4% for DCD in the general population of children in the United Kingdom and 7% for ADHD in the general population of children in the United States).

| Watemberg, 2016 | retrospective cohort | 173 infants with postural CMT followed from initiation of Rx for CMT to 2 years (Israel) | At 2 yrs, 21.7% (n=26/120) had evidence of CMT. | At initiation of tx for CMT, motor delay and DP were more common in infants with CMT and functional motor asymmetry versus CMT and no functional motor asymmetry (n=173). At 1-2 yrs, 27.2% (n=11/33) of infants with motor asymmetry at initiation of tx for CMT, continued to have motor asymmetry. |

Abbreviations: ADHD, Attention deficit hyperactivity disorder; ASD, autism spectrum disorder; AIMS, Alberta Infant Motor Scale; BOT-2, Bruininks-Oseretsky Test of Motor Proficiency, 2nd edition-Short Form; CAT-CLAMS, Clinical Adaptive Test/Clinical Linguistic Auditory Milestone Scale; CMT, congenital muscular torticollis; DCD, developmental coordination disorder; DSM-IV, Diagnostic and Statistical Manual of Mental Disorders, 4th edition; DP, deformational plagiocephaly; LI = language impairment, MABC = Movement Assessment Battery for Children 1st/2nd editions; MAASE, A test for spoken language processing (in Hebrew); mo, month; NDD, neurodevelopmental disorder; tx, treatment; wk, week; yrs, years; /, per.

This clinical practice guideline is open for public comment prior to submission for formal publication. Comments or concerns may be sent to torticolliscpg@gmail.com by June 15, 2018 for consideration by the authors. Please reference the line numbers for specific issues.
Table 8. The 2018 CMT CPG Summary of Action Statements

EDUCATION, IDENTIFICATION AND REFERRAL OF INFANTS WITH CONGENITAL MUSCULAR TORTICOLLIS (CMT)

P. Action Statement 1: EDUCATE EXPECTANT PARENTS AND PARENTS OF NEWBORNS ON POSITIONING. Physicians, nurse midwives, prenatal educators, obstetrical nurses, lactation specialists, nurse practitioners or physical therapists should educate and document instruction to all expectant parents and parents of newborns, within the first 2 days of birth, on the importance of symmetrical positioning, supervised prone/tummy play when awake 3 or more times daily, full active movement throughout the body, and the role of pediatric physical therapists in the comprehensive management of postural preference and optimizing motor development. (Evidence quality: V; Recommendation strength: Best Practice; 2018-New)

A. Action Statement 2: ASSESS NEWBORN INFANTS FOR ASYMMETRIES/CMT. Physicians, nurse midwives, obstetrical nurses, nurse practitioners, lactation specialists, physical therapists or any clinician or family member must assess and document the presence of neck and/or facial or cranial asymmetry within the first 2 days of birth, using passive cervical rotation and/or visual observation as their respective training supports, when in the newborn nursery or at site of delivery. (Evidence Quality: I, Recommendation Strength: Strong; 2018-Updated)

B. Action Statement 3: REFER INFANTS WITH ASYMMETRIES/CMT TO PHYSICIAN AND PHYSICAL THERAPIST. Physicians, nurse midwives, obstetrical nurses, nurse practitioners, lactation specialists, physical therapists or any clinician or family member should refer infants identified as having postural preference, reduced cervical range of motion, sternocleidomastoid masses, and/or craniofacial asymmetry to their primary physician and a physical therapist with expertise in infants as soon as the asymmetry is noted. (Evidence Quality: II, Recommendation Strength: Moderate; 2018-Updated)

PHYSICAL THERAPY EXAMINATION AND EVALUATION OF INFANTS WITH ASYMMETRIES/CMT

B. Action Statement 4: DOCUMENT INFANT HISTORY. Physical therapists should obtain and document a general medical and developmental history of the infant, including 9 specific health history factors, prior to an initial screening. (Evidence Quality: II, Recommendation Strength: Moderate; 2018-Updated)

B. Action Statement 5: SCREEN INFANTS FOR NON-MUSCULAR CAUSES OF ASYMMETRY AND CONDITIONS ASSOCIATED WITH CMT. When infants present with or without physician referral, and a professional, or the parent or caretaker indicates concern about head or neck posture and/or developmental progression, physical therapists with infant experience should perform and document screens of the neurological, musculoskeletal, integumentary and cardiopulmonary systems, including screens of vision, gastrointestinal history, postural preference and the structural and movement symmetry of the neck, face and head, trunk, hips, upper and lower extremities, consistent with state practice acts. (Evidence Quality: II-IV, Recommendation Strength: Moderate; 2018 - Revised)
**B. Action Statement 6: REFER INFANTS FROM PHYSICAL THERAPIST TO PHYSICIAN IF INDICATED BY SCREEN.** Physical therapists should document referral of infants to their physicians for additional diagnostic testing when a screen identifies: non-muscular causes of asymmetry (e.g. poor visual tracking, abnormal muscle tone, extra-muscular masses); associated conditions (e.g. cranial deformation); asymmetries inconsistent with CMT; or if the infant is older than 12 months and either facial asymmetry and/or 10-15 degrees of difference exists in passive or active cervical rotation or lateral flexion; or the infant is 7 months or older with a sternocleidomastoid mass; or if the side of torticollis changes. (Evidence Quality: II, Recommendation Strength: Moderate; 2018 - Revised)

**B. Action Statement 7. REQUEST IMAGES AND REPORTS.** Physical therapists should request and include in the medical record all images and interpretive reports, completed for the diagnostic workup of an infant with suspected or diagnosed CMT, to inform prognosis. (Evidence Quality: II, Recommendation Strength: Moderate; 2018-Updated).

**B. Action Statement 8: EXAMINE BODY STRUCTURES.** Physical therapists should perform and document the initial examination and evaluation of infants with suspected or diagnosed CMT for the following 7 body structures:

- Infant posture and tolerance to positioning in supine, prone, sitting and standing for body symmetry, with or without support, as appropriate for age. (Evidence quality: II; Recommendation strength: Moderate)
- Bilateral passive range of motion (PROM) into cervical rotation and lateral flexion. (Evidence quality: II; Recommendation strength: Moderate)
- Bilateral active range of motion (AROM) into cervical rotation and lateral flexion. (Evidence quality: II; Recommendation strength: Moderate)
- PROM and AROM of the upper and lower extremities, inclusive of screening for possible developmental dysplasia of the hip (DDH). (Evidence quality: II; Recommendation strength: Moderate)
- Pain or discomfort at rest, and during passive and active movement. (Evidence quality: IV; Recommendation strength: Weak)
- Skin integrity, symmetry of neck and hip skin folds, presence and location of a SCM mass, and size, shape & elasticity of the SCM muscle and secondary muscles. (Evidence quality: II; Recommendation strength: Moderate)
- Craniofacial asymmetries and head/skull shape. (Evidence quality: II; Recommendation strength: Moderate)

(2018-Revised)

**B. Action Statement 9: CLASSIFY THE LEVEL OF SEVERITY.** Physical therapists and other health care providers should classify and document the level of CMT severity, choosing one of eight proposed grades (Figure 2), based on infant’s age at examination, the presence of a SCM mass, and the difference in cervical rotation PROM between the left and right sides. (Evidence Quality: II, Recommendation Strength: Moderate; 2018-Upgraded)
**B. Action Statement 10: EXAMINE ACTIVITY AND DEVELOPMENTAL STATUS.**
During the initial and subsequent examinations of infants with suspected or diagnosed CMT, physical therapists should examine and document the types of and tolerance to position changes, and motor development for movement symmetry and milestones, using an age appropriate, valid and reliable standardized test. (Evidence quality: II; Recommendation strength: Moderate; 2018-Revised)

**B. Action Statement 11. EXAMINE PARTICIPATION STATUS.** The physical therapist should obtain and document the parent/caregiver responses regarding:
- Whether the parent is alternating sides when breast or bottle feeding the infant. (Evidence quality: II; Recommendation strength: Moderate)
- Sleep positions. (Evidence quality: II; Recommendation strength: Moderate)
- Infant time spent in prone. (Evidence quality: II; Recommendation strength: Moderate)
- Infant time spent in equipment/positioning devices, such as strollers, car seats or swings. (Evidence quality: II; Recommendation strength: Moderate)

(2018-Revised)

**PHYSICAL THERAPY INTERVENTION FOR INFANTS WITH CMT**

**B. Action Statement 13: PROVIDE THESE FIVE COMPONENTS AS THE FIRST CHOICE INTERVENTION.** Physical therapists should provide and document these five components as the first choice intervention for infants with CMT:
- Neck PROM. (Evidence quality: II; Recommendation strength: Moderate)
- Neck and trunk AROM. (Evidence quality: II; Recommendation strength: Moderate)
- Development of symmetrical movement. (Evidence quality: II; Recommendation strength: Moderate)
- Environmental adaptations. (Evidence quality: II; Recommendation strength: Moderate)
- Parent/caregiver education. (Evidence quality: II; Recommendation strength: Moderate)

**C. Action Statement 14. PROVIDE SUPPLEMENTAL INTERVENTION(S), AFTER APPRAISING APPROPRIATENESS FOR THE INFANT, TO AUGMENT THE FIRST CHOICE INTERVENTION.** Physical therapists may provide and document supplemental interventions, after evaluating their appropriateness for treating CMT or postural asymmetries, as adjuncts to the first choice intervention when the first choice intervention has not adequately improved range or postural alignment, and/or when access to services is limited, and/or when the infant is unable to tolerate the intensity of the first choice intervention, and if the physical therapist has the appropriate training to administer the intervention. (Evidence Quality: I-IV, Recommendation Strength: Weak; 2018-Updated)
**B. Action Statement 15. INITIATE CONSULTATION WHEN THE INFANT IS NOT PROGRESSING AS ANTICIPATED.** Physical therapists who are treating infants with CMT or postural asymmetries should initiate consultation with the infant’s physician and/or specialists about other interventions when the infant is not progressing as anticipated. These conditions might include: when asymmetries of the head, neck and trunk are not starting to resolve after 4-6 weeks of initial intense treatment or after 6 months of treatment with only moderate resolution. (Evidence Quality: II, Recommendation Strength: Moderate; 2018 - Revised)

**PHYSICAL THERAPY DISCONTINUATION, REASSESSMENT, AND DISCHARGE OF INFANTS WITH CMT**

**B. Action Statement 16: DISCONTINUE DIRECT SERVICES WHEN THESE 5 CRITERIA ARE ACHIEVED.** Physical therapists should discontinue direct physical therapy services and document outcomes when these 5 criteria are met: PROM within 5 degrees of the non-affected side; symmetrical active movement patterns; age appropriate motor development; no visible head tilt; and the parents/caregivers understand what to monitor as the child grows. (Evidence Quality: II-III, Recommendation Strength: Moderate; 2018 - Updated)

**B. Action Statement 17: REASSESS INFANTS 3-12 MONTHS AFTER DISCONTINUATION OF DIRECT SERVICES, THEN DISCHARGE IF APPROPRIATE.** 3-12 months following discontinuation from direct physical therapy intervention OR when the child initiates walking, physical therapists who treat infants with CMT should examine postural preference, the structural and movement symmetry of the neck, face and head, trunk, hips, upper and lower extremities, and developmental milestones to assess for reoccurrence of CMT and evidence of atypical development. (Evidence Quality: II, Recommendation Strength: Moderate; 2018-Updated)