

# Diagnostic Criteria for Temporomandibular Disorders (DC/TMD) Clinical Examination Protocol

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NOTE: This document is maintained and accessible at [www.rdc-tmdinternational.org](http://www.rdc-tmdinternational.org).

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# 1 Introduction

This document is a component of the Diagnostic Criteria for Temporomandibular Disorders (DC/TMD); the diagnostic criteria are published elsewhere (Schiffman et al, 2013). Schiffman et al, 2013 should be cited when disorders and diagnostic criteria are referenced. See Section 1.6.

Whenever the specific methods for the DC/TMD are utilized, this Protocol document should be cited; see Section 1.4 for details.

This document is derived from research, clinical usage, and field trials. While the intent for each diagnostic test is clearly established and while the procedures have evolved based on the research as well experience across the world, the manner of describing those procedures improves over time. We expect that as more empirical data are produced, our understanding of these procedures will continue to evolve. Consequently, this is a living document and updates are anticipated to emerge following the initial release of this document; most updates are anticipated to reflect clarifications, and errors will also be identified and corrected. Please contact the lead author, Richard Ohrbach (ohrbach@buffalo.edu), with respect to questions or comments regarding this document or with respect to intent to translate.

## 1.1 **If you do not read anything else, start here....**

Read 1.2 Overview so you know what is in this document, and why it is in this document. Then, if you wish to use the DC/TMD for clinical purposes and do not wish to work with structured commands or calibrated procedures, read Section 4 (Concise Specifications), Section 6 (Examination-related Pain Interview), and Section 7 (Illustrations). If you wish to use the DC/TMD for research or highly structured clinical evaluations but are impatient with reading a lot of explanation, read Section 5 (Complete Specifications), Section 6 (Examination-related Pain Interview), and Section 7 (Illustrations). After either approach, apply the DC/TMD to real patients and construct diagnoses; come back to the rest of the Protocol when questions emerge. For everyone else, dive in, learn everything, be critical, and contribute to the project.

## 1.2 **Overview**

Section 2 describes general principles for the examination and Section 3 provides detailed explanation of the DC/TMD examination procedures.

Section 4 describes the concise examination protocol for routine clinical use. It does not attempt to capture the procedural nuances required to maximize the reliability of the examination (see Section 5 for that type of examination). A concise examination protocol is provided for two types of users: (1) clinicians who wish to use the empirically supported diagnostic criteria in a simple clinical manner, and (2) clinicians and researchers who wish to use this brief section as a review or an overview for the more detailed operational examination procedures described in Section 5.

Section 5 provides completely operationalized procedures required for clinical research applications. Clinicians may want to base their examination on these operationalized procedures in the interest of substantially enhanced reliability. The International RDC/TMD Consortium Network (hereafter, "Consortium") conducts examiner training and calibration based on these specifications. Operationalized

procedures improve the examiner's clinical method and resultant decision making. Our experience is that training and on-going monitoring of skills is facilitated by placing only the verbal commands and specific operations into a table format. Refer to Section 3 for general description and clarifications.

Section 6 describes the structured pain interview that is used following any procedure-evoked pain during the examination.

Section 7 provides illustrations for these procedures. A videotape of the examination procedures will be available in the near future on the Consortium website.

Section 8 lists only the mandatory examination commands, as extracted from Sections 5 and 6, in order to facilitate learning. When these commands are committed to memory, the operationalized examination flows quickly.

Section 9 contains examination forms that list the procedures and data reporting options consistent with this protocol. The examination form is inclusive of the tests specifically linked to the DC/TMD diagnostic criteria. The form also includes reporting fields for supplemental tests (described in Sections 3-5) that are sometimes necessary for clarification of the mandatory clinical findings. Clinicians may identify other procedures that are needed for assessment of orofacial pain broadly and which are not included on this form. Supplemental examination forms may be required depending on the setting. See Section 2.2(b), Scope of examination for what the DC/TMD claims to accomplish vs what is outside the scope of the DC/TMD.

Section 10 describes research-relevant aspects of the protocol which an investigator may consider for implementation to further enhance the reliability of the examination. Information relevant for examiner reliability studies is also included. The Consortium web site contains additional information regarding reliability study design.

Section 11 (forthcoming) will list changes included in each new release as we update this protocol.

### 1.3 What has changed from RDC/TMD to DC/TMD?

An overview of the changes in the diagnostic criteria from RDC/TMD to DC/TMD is presented in Tables 1 and 2 in Schiffman et al (2013). The table below summarizes the changes in clinical examination procedures from RDC/TMD to DC/TMD. Procedures carried over from RDC/TMD to DC/TMD may have changed; see Sections 2, 3, and 5 for detailed descriptions.

<b>Comparison of clinical examination procedures: RDC/TMD vs DC/TMD</b>		
<b>Clinical Procedure</b>	<b>RDC/TMD (1992)</b>	<b>DC/TMD (2013)</b>
<b>Pain location</b>		
Identification of pain location according to complaint	✓	✓
Confirmation of pain location according to complaint and examination findings of familiar pain		✓
Identification of headache location		✓

<b>Comparison of clinical examination procedures: RDC/TMD vs DC/TMD</b>		
<b>Clinical Procedure</b>	<b>RDC/TMD (1992)</b>	<b>DC/TMD (2013)</b>
<b>Static Landmarks</b>		
Measurement of vertical incisal overlap and midline deviation	✓	✓
Measurement of horizontal incisal overlap		✓
<b>Mobility</b>		
Jaw-opening pattern	✓	Supplemental; Options reduced
Assessment of familiar pain with jaw mobility testing		✓
Assessment of familiar headache in temporalis with jaw mobility testing		✓
<b>TMJ Assessment</b>		
Assessment of TMJ clicking	✓	✓
Assessment of fine and coarse crepitus	✓	
Assessment of crepitus		✓
Measurement (mm) of opening and closing clicks	✓	
Assessment of reciprocal click elimination on protrusive opening	✓	
Patient report of TMJ noise during movement		✓
Pain and familiar pain associated with click		✓
Documentation of any TMJ locking during examination		✓
<b>Muscle and TMJ Palpation</b>		
Palpation at 2 lbs or 1 lb	✓	
Palpation at 1 kg or 0.5 kg for defined time period		✓
Calibrate fingers to specified forces prior to palpation		✓
Palpation of temporalis and masseter muscles	✓	✓
Palpation of posterior and submandibular muscles, lateral pterygoid area, and temporalis tendon	✓	Supplemental
Palpation of lateral pole of TMJ	✓	✓
Palpation of TMJ via external acoustic meatus	✓	
Palpation around the lateral pole of the TMJ		✓
Assessment of familiar pain with palpation		✓
Assessment of familiar headache in temporalis with palpation		✓

## 1.4 How to cite this document

### Citation of English language source

Cite this document as follows (with *<italic text>* denoting new text to be inserted):

Ohrbach R, Gonzalez Y, List T, Michelotti A, Schiffman E. Diagnostic Criteria for Temporomandibular Disorders (DC/TMD) Clinical Examination Protocol: Version 02June2013. [www.rdc-tmdinternational.org](http://www.rdc-tmdinternational.org) Accessed on *<date>*.

For example:

Ohrbach R, Gonzalez Y, List T, Michelotti A, Schiffman E. Diagnostic Criteria for Temporomandibular Disorders (DC/TMD) Clinical Examination Protocol: Version 02June2013. [www.rdc-tmdinternational.org](http://www.rdc-tmdinternational.org) Accessed on July 1, 2013.

### Citation of translation of full document

Translated versions of this document should be cited as follows if the title is also translated:

Ohrbach R, Gonzalez Y, List T, Michelotti A, Schiffman E. Diagnostic Criteria for Temporomandibular Disorders (DC/TMD) Clinical Examination Protocol: Version 02June2013. [*<Title in target language: <target language> Version 02June2013>*] *<Developer name or names>*, Trans. [www.rdc-tmdinternational.org](http://www.rdc-tmdinternational.org) Accessed on *<date>*.

For example, if the instrument title was translated, the citation would look read as follows:

Ohrbach R, Gonzalez Y, List T, Michelotti A, Schiffman E. Diagnostic Criteria for Temporomandibular Disorders (DC/TMD) Clinical Examination Protocol: Version 02June2013 [Diagnostiska Kriterier för Temporomandibulär Dysfunktion (DC/TMD) Kliniskt Undersöknings Protokoll: Swedish Version 02June2013]. List T, Trans. [www.rdc-tmdinternational.org](http://www.rdc-tmdinternational.org) Accessed on July 1, 2013.

### Citation of translation of partial document

Translated versions of this document should be cited as follows if the title is not translated:

Ohrbach R, Gonzalez Y, List T, Michelotti A, Schiffman E. Diagnostic Criteria for Temporomandibular Disorders (DC/TMD) Clinical Examination Protocol: Version 02June2013 [in *<target language>*]. *<Developer name or names>*, Trans. [www.rdc-tmdinternational.org](http://www.rdc-tmdinternational.org) Accessed on *<date>*.

For example, if only the complete specifications were translated into Swedish while retaining the title in English, the citation for the actual examination as performed would read as follows:

Ohrbach R, Gonzalez Y, List T, Michelotti A, Schiffman E. DC/TMD Complete Specifications for Examination: Version 02June2013 [in Swedish]. List T, Trans. [www.rdc-tmdinternational.org](http://www.rdc-tmdinternational.org) Accessed on July 1, 2013.

...and the user would likely cite the full Protocol as well since it specifies all other aspects of the examination.

## 1.5 Acknowledgments

The authors gratefully acknowledge the following publications, sources, and projects that have contributed substantially to the development of these materials:

- The general directions and description of procedures originate in S. F. Dworkin and L. LeResche. Research Diagnostic Criteria for Temporomandibular Disorders: Review, Criteria, Examinations and Specifications, Critique. *Journal of Craniomandibular Disorders, Facial & Oral Pain* 6:301-355, 1992.
- The specifications in Dworkin and LeResche (1992) were improved and tested by the RDC/TMD Validation Project (Schiffman, PI), available in a text revision (TR): Research Diagnostic Criteria for TMD: Expanded Specifications for TMD Examinations with Clarifications, Prepared for the International RDC/TMD Consortium, 7/10/05, accessible at [www.rdc-tmdinternational.org](http://www.rdc-tmdinternational.org).
- The core verbal commands in the TR were further revised in order to create a clearer language base for translations from English to other languages. This revision is presented in Ohrbach R, John MT, Lobbezoo F, Gonzalez Y, Dworkin SF: Translation and Adaptation of the RDC/TMD, which was developed for the Committee for Translations and Protocols, International RDC-TMD Consortium, October 27, 2005, also accessible at the same URL as above. This set of verbal commands is completely consistent with the intent of the published specifications but improves on English-language ambiguities that were subsequently identified by various international sources.
- RDC/TMD Validation Project (NIDCR U01-DE013331; Schiffman, PI)
- The specifications were further field tested and refined by the OPPERA (Orofacial Pain: Prospective Evaluation and Risk Assessment) study group (NIDCR U01-DE017018; Maixner, PI and Battelle Memorial Institute) in response to feedback received by new examiners trained for that study.
- International Consensus Workshops 2009 (Miami) and 2011 (San Diego), funded and supported by the Canadian Institute for Health Research, International Association for Dental Research, International RDC/TMD Consortium Network of the IADR, Medotech, National Center for Biomedical Ontology, and the Orofacial Pain Special Interest Group of the IASP.
- TMJ Intra-articular Disorders: Impact on Pain, Functioning, and Disability (NIDCR U01-DE-019784; Schiffman, PI).
- In relation to the DC/TMD in particular, further text revision in English usage was implemented by the University at Buffalo and the Malmö University groups in conjunction with conducting additional examiner field studies.
- The research group at ACTA, Amsterdam, The Netherlands for editorial assistance with this document.
- Research colleagues at UNC-CH for editorial assistance with this document.
- The International RDC/TMD Consortium, which has fostered much of the collaboration among such great colleagues.

## 1.6 DC/TMD Reference

Whenever diagnostic criteria and diagnoses are reported in scientific publications, the following should be cited as the source document:

Schiffman E, Ohrbach R, Truelove E, Look J, Anderson G, Goulet J-P, List T, Svensson P, Gonzalez Y, Lobbezoo F, Michelotti A, Brooks S.L, Ceusters W, Drangsholt M, Ettlin D, Gaul C, Goldberg L, Haythornthwaite J, Hollender L, Jensen R, John M.T, deLaat A, deLeeuw R, Maixner W, van der Meulen M, Murray G.M, Nixdorf D.R, Palla S, Petersson A, Pionchon P, Smith B, Visscher C.M, Zakrzewska J, Dworkin SF (2014). Diagnostic Criteria for Temporomandibular Disorders (DC/TMD) for Clinical and Research Applications: Recommendations of the International RDC/TMD Consortium Network and Orofacial Pain Special Interest Group. *Journal of Oral & Facial Pain and Headache* 28:6-27.

## 2 General Instructions

### 2.1 Direct sources for this protocol

This protocol has evolved from publications, Manuals of Operations and Procedures from various research studies, translations to other languages, examiner training and calibration, and formal reliability studies. It is not possible to credit specific sources for given procedures due to the highly collaborative contributions from the various sources as identified in 1.5 Acknowledgments.

### 2.2 Overview of examination

- (a) Patients and examiners. The individual to be examined is always termed “patient” throughout this document; for research contexts, substitute the term “subject” or “participant”. “Examiner” refers to the individual performing the examination.
- (b) Scope and context of examination. The DC/TMD examination is comprised of a core set of reliable and valid procedures, and for use in a clinical setting, these procedures may need to be augmented by additional procedures as indicated by the differential diagnosis. Consequently, a clinical evaluation does not necessarily end with the procedures defined in this protocol. Clinical procedures for musculoskeletal evaluation pertaining to temporomandibular disorders can be divided into three groups:
  - procedures considered reliable, valid, and essential for the core TMD examination, and these procedures are presented in detail in Section 3;
  - procedures considered reliable and valid but not essential for the core examination, and these procedures may be found in other sources; and
  - procedures that are necessary for purposes of the differential diagnosis, even though they may lack supporting evidence for reliability and validity; these procedures may be found in other sources.
- (c) Restrictions imposed by diagnostic criteria. The criteria for diagnosis, such as requiring pain to be present in the last 30 days, are linked to the broader goal of pain evaluation and diagnosis. These specifications assume, for consistency, a 30-day period. However, limiting a diagnosis to pain that was present during the last 30 days may not be sensible for a given complaint (e.g., cluster headache, when the patient seeks consultation during the period between bouts; or painful jaw locking that was last present 6 months previously but the patient has not consulted with someone until now) or a given setting (e.g., specialty practice with extremely long wait times to get an appointment). A formal frame for diagnosis is intended to provide efficient evaluation for the majority of patients, as demonstrated by the DC/TMD validity data; going outside that frame is expected when the signs or symptoms so dictate. Whether the evaluation is inside or outside a given differential diagnostic frame, formal tools provide consistently better clinical data.
- (d) Clinical vs research applications. The core procedures described in these specifications are sufficient for a comprehensive clinical examination for the large majority of individuals with a TMD. The selection of core tests attempted to balance reliability of the procedure (and the related diagnostic validity), efficiency,



and inclusiveness. For clinical purposes, the examiner must make the decision regarding which additional tests to perform. For research purposes, this protocol is sufficient to address the diagnostic criteria described in Schiffman et al, 2013. Particular aspects of the examination specifically relevant for research purposes are addressed in Section 10.

## 2.3 Patient Management

- (a) Patient positioning. These specifications are written from the perspective that the patient is sitting comfortably upright in a chair that can be adjusted for height. In a given setting, however, other positions are acceptable, and the patient position in the chair should be adjusted for greatest comfort for both patient and examiner.
- (b) Examiner positioning. These specifications are written from the perspective that the examiner is standing to the patient's right and facing the patient. This position allows the examiner to perform the full examination using each hand as required while the other hand is used to stabilize the patient's head or mandible. For procedures that occur on one side of the jaw or head at a time (i.e., lateral jaw movements, palpation), the intent is for the examiner to use the right and left hands symmetrically; for example, the examiner uses his/her left hand to palpate the patient's right side, and the right hand to palpate the patient's left side. If alterations in this basic setup of patient sitting upright and examiner standing to the patient's right are needed (e.g., a patient has a medical condition and needs to sit in a reclined chair; examiner preference), the examiner will likely need to modify his/her position relative to the patient, perhaps to sit behind the patient. All sided-instructions should be modified accordingly.
- (c) Jaw posture. There are three static jaw postures used in this examination: comfort position, where the mouth is closed (i.e., lips touching, for most individuals) and teeth are not touching; maximal intercuspal position (MICP), where the jaw is closed and teeth are fully touching; and where the jaw is held at the end of a movement (e.g., opening). Unless instructions indicate otherwise, the jaw should be in the comfort position. Procedures requesting that the patient bring the teeth together refer to the MICP; MICP is obtained by asking the patient to "put your back teeth completely together", and the additional phrase "where your back teeth fit together best" can be used as needed in order to help the patient accomplish that goal. MICP in patients with dual bite should be obtained by asking the patient to close teeth together with the mandible in the more posterior position.
- (d) Replacement prostheses. Patients with replacement prostheses will be examined with the prostheses in their mouth if the prosthesis is stable. If the replacement prosthesis is loose, the examiner will stabilize it if possible by compressing it against the ridge for measurements that use the teeth as a landmark. If the prosthesis cannot be stabilized, then it should be removed; Section 11 of the examination form should indicate that the prosthesis was removed, and the measurements are taken using soft-tissue reference points which are also noted in Section 11.
- (e) Bite plates and other removable appliances that do not replace teeth. These are removed at the beginning of the examination.
- (f) Instructions to the patient. Examiner pacing, with respect to pauses and inflection of voice, are generally sufficient to manage the back-and-forth flow of instructions

by examiner and action by patient. If necessary, the patient should be reminded to listen to the complete instruction before performing the requested function.

## 2.4 Completing the Examination

- (a) Sequencing of examination procedures. The examination data collection follows the sequence of tests as specified in Section 5, Complete Specifications for DC/TMD Examination.
- (b) Completing all items. All interview and examination items need to be completed unless the patient refuses or is unable to cooperate. In this case, write "RF" (Refusal) on the examination form adjacent to the relevant examination item. When the procedure is incomplete due to refusal, no information is entered other than indicating that the patient refused.
- (c) Repeating examination items. The examiner can repeat a procedure if the finding is inconsistent, if the patient was unable to provide a clear response, or if the patient requests that the procedure be repeated.
- (d) Physical barriers to examination. Patients may present with a beard, a neck brace, hair weavings, or any other potential physical barriers which may interfere with the examination.

## 2.5 Measurements and Movements

- (a) Ruler preparation. If necessary, a mm ruler is prepared by cutting off the end at the zero mark in order to make the end even with the '0' mark. The width of the ruler at the cut end should be sufficient to allow the ruler to be placed on an incisal edge without slipping. The non-measurement edge of the ruler may need to be trimmed back for a few cm at the '0' end in order to create space for the lip when placing the '0' end of the ruler against the maxillary incisors.
- (b) Millimeter measurements. All millimeter measurements will be recorded as double digits; for example, a measurement of 41.7mm is rounded to 41mm and recorded only as an integer number. For values less than 10, the observed value is preceded by a leading zero. Measurements are rounded down to the nearest integer and recorded only as integer numbers. Each of overbite, overjet, and protrusive mandibular movement can take on a negative sign, indicated by checking the appropriate box on the examination form.
- (c) Measurements of range of motion. Millimeter measurements of opening, protrusive, and lateral excursive movements are recorded as described in the specifications. Measurement of incisal relations is included in the examination in order for measured extent of movement to accurately reflect the full extent of movement for opening and protrusive excursions of the mandible. The examiner does not do these corrections during the examination; rather, the examiner records the observed values, and any adjustments are made after the examination is completed in order to compute actual mobility.
  - 1. Vertical movements of the mandible are corrected by adding the vertical overlap; if the vertical incisal overlap is negative due to an anterior open bite, then the negative overlap is added to the observed extent of vertical movement.

2. Lateral excursions are corrected by adding or subtracting the midline discrepancy, as determined by the direction of any discrepancy between the maxillary and mandibular midlines. If any midline discrepancy has been negated via creation of an arbitrary reference midline, the principle remains the same but the value that is added or subtracted is '0'.
  3. Protrusive movements are corrected by adding the measurement of protrusive movements to the horizontal overjet. When an anterior crossbite or prognathic relationship occurs, the negative overjet is added to the protrusive movement. And when a severe overjet (recorded as a positive number) is accompanied by mandibular protrusion that remains posterior to the maxillary teeth (recorded as a negative number), the sum of the two values correctly indicates the extent of mandibular movement in the protrusive direction.
- (d) Movement even with pain. With one exception [**Pain-free opening**], every time the patient moves his/her mouth vertically or excursively, he or she is instructed to move it as far as possible in that direction, even if it is painful.
- (e) Movement without guidance. Movements for range of motion and for joint sounds are made without any assistance by the examiner. Only for **Maximum Assisted Opening** is the jaw actively pushed on by the examiner. The examiner can touch the patient to provide non-verbal cues for the direction of intended movement.

## 2.6 Classification of Anatomic Structures

- (a) Description of problem. When the patient points to the location where he or she feels pain (e.g., by history or from the examination), it may be obvious as to which structure is associated with the complaint or, if the patient points to either the preauricular area or to the boundary of a structure – e.g., anterior area of the masseter muscle – it may not be obvious. When pointing to the preauricular area, the structures associated with a pain complaint may be joint, muscle, or both; when pointing to the marginal area of a muscle, the structures associated with a pain complaint may not be within the muscle tissue at all. The following procedures, when consistently followed, will provide reliable identification of which structure (muscle, joint, or other structure) is associated with the reported pain.
- (b) Identify involved areas of pain. The first time that a participant points to a location that is uncertain in terms of anatomical identity, the examiner will investigate the possible underlying structures. Subsequent pointing by the participant to that same location should allow the examiner to code the structure(s), based on the initial inquiry.
1. Patient points to pain locations. When a patient indicates that a mobility test is painful, the examiner determines the location(s) of the pain induced during the procedure by asking the patient to *point* to each area of pain with one fingertip or to show the area of involvement by “painting” the boundary with a fingertip. The examiner then determines what area(s) the patient has indicated and then records all of the selected locations (as available, depending on the item): temporalis, masseter, sub-mandibular, posterior mandibular, lateral pterygoid, temporalis tendon, and TMJ. These pain-site locations are independent. If the patient reports the location of the pain as, for example, “my joint”, the examiner will ask the patient to point to or show the location.

2. Examiner touches area. It is essential that the examiner correctly identifies the area(s) that the patient is indicating. To insure accuracy, the examiner can place his/her finger on the area(s), and/or the patient can place the examiner's finger on the area(s) that the patient indicates as the location(s) of his/her pain.
  3. Examiner touches uncertain areas. If the locations of pain indicated by the patient are unclear to the examiner, the examiner can touch areas *outside* of the area the patient indicated in order to confirm that that touched area is not part of the pain.
- (c) Classify structures. The next step is for the examiner to classify the indicated area(s).
1. Preauricular area. If it is unclear to the examiner whether the patient is indicating a joint, masticatory muscle, or both when the patient points to the pre-auricular area, the identification of the underlying structure(s) requires two steps to determine the location of anatomic landmarks for the boundaries of the condyle and of the masseter muscle.
    - i. Step 1: Identify the location of the condyle. If the condyle can be readily palpated, application of light pressure to the skin overlying the presumed location of the condyle while the mandible is held in a comfortable position of closure may be sufficient to identify the condylar landmarks and relate to the area of pain as identified by the patient. If the condyle landmark cannot be readily identified via light pressure palpation, then the condyle should be translated (either via opening or protrusion) in order to accurately localize the structure. While the examiner places his/her finger on the area indicated by the patient as the pain site, the examiner asks the patient: "Move your jaw forward (straight out in front of you) until I ask you to stop and then slide your jaw back to a comfortable position". The examiner notes the location of the condyle landmark in relation to the area of pain identified by the patient and localized by the examiner's finger, and determines if the area of pain complaint is associated with the condyle or not.
    - ii. Step 2: Identify the posterior (dorsal) boundary of the masseter muscle. The examiner asks; "Now, gently clench your teeth together, and relax".
  2. Muscle margin. If the examiner needs to localize specific masticatory muscle area(s), s/he can ask the patient, for example in the masseter or temporalis region: "I would like you to clench your teeth together gently and then relax your jaw with your teeth slightly apart from each other." Other maneuvers could be requested as well, depending on the specific muscle group that needs to be identified. If the pain complaint is located near a muscle margin and it is not clear whether the pain is localized in association with the muscle by the patient or not, then the examiner asks the patient to clench (or move the mandible against light resistance) and palpate in order to localize the muscle boundaries.
  3. The problem of dynamic movement. During maximal opening movements in particular and sometimes with lateral or protrusive excursive movements, the condyle will move anteriorly such that it is deep to overlying masseter muscle. When asking the patient where the pain was during the preceding procedure, the patient may point to the area anterior to the condyle in its closed position.

The patient may be pointing to the masseter muscle (for example) but the patient may instead (or also) be pointing to the location of where the condyle was. When the pain during the maneuver is caused in part or in whole by the condyle in an anteriorly translated position, light pressure to the reported pain area (while the patient's mandible is in the closed position) by the examiner and inquiring into if that was the pain just experienced may lead to an unsure patient response. If so, repeat the opening or excursive procedure and then identify the location (and underlying structure) of any pain while the mandible is in the open or excursive position. The patient may also be asked if the "pain was coming from the part that was moving".

4. Intra-oral. If the pain complaint is located inside the mouth, it can be more difficult to accurately classify the structure. An efficient method is the following: (1) ask patient to point to the area that was painful in response to the procedure; (2) the examiner then uses his/her finger, and if necessary asks the patient to hold the examiner's finger and to touch the area again; and (3) the examiner then classifies the area that was touched.
  5. Referred pain. When pain is referred to a deep structure, it is very difficult for the patient to show the location. Nevertheless, ask the patient to point to the surface of where the deep pain is, and then classify accordingly.
- (d) Examiner makes the decision. The examiner's decision regarding localization is made based on the examiner's determination of structure(s).
- (e) Record the pain-relevant structure as follows, based on the area of pain as localized by the patient and as touched by the examiner during the movements:
1. "Joint": If the lateral pole is felt by the examiner's finger when placed in the area of pain complaint and while the mandible is in the "comfortable position" – i.e., *after* (compare to *during*) the patient protrudes/returns to his/her "comfortable position".
  2. "Masseter muscle": If muscle contraction during clenching can be felt by the finger when placed in the area of pain complaint;
  3. The examiner's decision is made based on subject feedback as well as examiner findings. For example, if the patient indicates pain "in the joint" but the examiner identifies the location as muscle based on accurate localization, the examiner would record only "muscle" as the location of the pain.
  4. Both "joint" and "muscle" can be identified as location of pain complaint in the preauricular region.

## 2.7 Verification that reported history of pain is in TMD structures

- (a) Examiner verifies pain location by history. Diagnosis according to the DC/TMD requires that self-report of complainant pain be verified by the examiner as pain that is located within the masticatory system. The examiner verifies pain by history by touching the areas of interest and asking if pain has been present in those areas. The time frame for a DC/TMD diagnosis is the prior 30 days, but this may require modification depending on circumstances. The examiner should note in Section 11 if a different time period was used.
- (b) Patient inquiry. A pain history questionnaire, such as the DC/TMD Symptom Questionnaire, will typically inquire into the presence of pain. However, any such

positive responses are verified by the examiner who will directly inquire, as the first question in the examination (Examiner Confirmation of Pain and Headache Location), regarding the presence and location of facial pain. The examiner may need to explain to the patient that temple “pain” may be different from “headache” or they may be the same or different – all depending on the patient’s pain experience. Neutral probes are used for exploring any report of “headache” vs “pain”.

- (c) Iterative evaluation of pain location by history. As the examination proceeds and the patient reports familiar pain in response to each procedure, the patient may report additional area(s) of pain not previously reported in response to the first examination question (E1); the first question of the examination form (E1) should be updated as necessary so that all areas of pain in the prior 30 days are reported in E1.

## 2.8 Palpation

- (a) Selection of palpation sites. Research data indicate that palpation procedures to the masseter and temporalis muscles are the most reliable, and, more importantly, data from the Validation Project demonstrate that these two muscles bilaterally are sufficient for diagnostic yield 99% of the time. Although the false negative rate by only using these two muscles bilaterally is therefore about 1%, in clinical settings it may still be useful to include the less reliable masticatory muscles for palpation in order to provide a comprehensive examination (see Section 3) relative to the patient’s complaint. That is, if the masseter temporalis muscles are negative for pain from the examination, examination of any of the other supplemental muscles (lateral pterygoid area, posterior mandibular area, submandibular area, temporalis tendon) may be positive and allow for a myofascial pain diagnosis in the masticatory muscles. Only using the masseter and temporalis for palpation yields an examination that is targeted and more efficient, with only slightly less diagnostic sensitivity.
- (b) Basic screening palpation. Palpation for pain is performed by applying pressure, which is either 0.5 kg or 1.0 kg, depending on the procedure or structure, in order to test for a pain response. This procedure should be distinguished from lighter pressure used in touching the skin in order to identify location of reported pain and identification of the structures beneath the skin. Palpation for pain consists of two phases: initial contact with the skin and ramping the pressure to the desired target (ramp phase), and maintaining that pressure for a sufficient duration (steady-force phase). Patients report that they do not regard “touch and go” palpation (i.e., very brief application of pressure at an area) as satisfactory for their feeling confident about whether they experienced pain in response to the palpation pressure. Consequently, after ramping the pressure up to the desired magnitude, a steady level of palpation pressure needs to be maintained for at least one full second, recognizing that part of a 2-second palpation procedure will include time for ramping up to the target pressure and ramping down from the target pressure.
- (c) How many fingers? One finger is recommended in order to best standardize the examination. Two fingers are often used in clinical settings but require more complex calibration procedures to achieve reliable assessment.
- (d) Simultaneous bilateral palpation? Examining both sides at the same time is more efficient than doing one side at a time. However, obtaining maximal reliability in the necessary patient report of pain, whether the pain is familiar and whether the

pain refers to another structure, is facilitated by examining one side at a time. This protocol is designed toward examining only one side at a time.

- (e) Palpation duration. The application of suitable pressure for assessing pain from palpation requires that each screening palpation procedure have a duration of at least 2 seconds, if a myalgia diagnosis is to be provided and for at least 5 seconds if a diagnosis of any one of the myalgia types (local myalgia, myofascial pain with spreading, or myofascial referred pain) is to be provided. The following method, using a timing phrase of “one-thousand 1, one-thousand 2”, will lead to palpation duration of about two seconds, with the steady-force phase lasting about 1 second. The onset of finger contact with the underlying surface occurs with the first “**one-**” (of “**one-**thousand 1”), full target force is developed by the end of that phrase at “**1**” (of “one-thousand **1**”), and pressure offset occurs with “**2**” (of “one-thousand **2**”). The short phrase “press, hold, release” might be useful as a mental reminder during each procedure. This procedure is modified appropriately if a 5 second palpation is used; even better, however, for a 5 second palpation is to time pressure application according to a wall clock.
- (f) Palpation calibration. A critical skill for reliable palpation is producing the proper force in a steady manner which requires on-going skill development and maintenance. The examiner should train him/herself using an appropriate force-measuring device such as a digital postage scale or a suitable handheld algometer. Each instrument has specific benefits. The digital postage scale is very accurate and responsive to ongoing pressure application but does not have a form-factor that is useful in the clinic setting. See Section 10 for further information regarding the calibration process. Calibration by the examiner of his or her fingers for each type of pressure just before doing that part of the examination is recommended.
- (g) Procedure. After instructing the patient (see Section 5 or 8 for detailed verbal instructions), the examiner then palpates each targeted spot by ramping up to the target pressure (e.g., 1.0 kg) and holding the pressure for the specified time. The recommended time periods are either for 2 seconds (if only a diagnosis of myalgia is of interest or concern) or for 5 seconds (if a diagnosis of referred pain is also of interest). Then, the Familiar Pain Inquiry is done, and if positive, the Referred Pain Inquiry. All of the accessible muscle should be palpated. The examiner may additionally focus on specific sites within a muscle, as indicated by the circumstances (e.g., patient complaint that suggests referred pain and a possible anatomic source for that referred pain).
- (h) Confirmation of pain absence. During the palpation procedures, the patient is instructed to report pain following application of pressure. Some examiners prefer to have a patient say “yes” or “no” after each procedure, whereas others prefer to only hear “yes”, if applicable. A hybrid procedure is to inquire at the end of each temporalis or masseter zone or after each muscle, as appropriate, with the question, “any pain?” or “there was no pain?” in order to confirm that the absence of pain reports is due to the absence of pain.

## 2.9 Familiar Pain

- (a) “Familiar pain” definition and rationale. If a patient reports “pain” to an examination procedure, the examiner will ask the patient if the pain is familiar and “familiar” is always in relation to the pain complaint outside the clinic setting. For a patient, this pain is most likely the reason why the patient is seeking consultation or treatment.

For the purposes of the DC/TMD, “familiar” pain is defined as pain that is “similar” or “like” the individual’s clinical pain, regardless of its intensity from the clinical procedure vs the typical clinical pain, and experienced by the patient in the reference anatomical region within the prior 30 days. Another way to define the term, in the context of a clinical examination, is reproduction of the pain qualia in response to clinical provocation. The examiner reminds the patient, as needed, that the goal of the examination is to replicate (duplicate) the patient’s pain in order to locate the source. “Familiar” pain is included as a criterion for a pain diagnosis because replication of pain, in terms of differential diagnosis, is essential; the necessary goal in establishing the presence of replication is for the patient to describe the provoked pain in the same way as the pain of complaint, because it is the same type of pain. Moreover, the “familiar” pain probe provides the examiner an opportunity to more fully explore the patient’s pain experience by also inquiring into the context, frequency, and location of any elicited pain symptoms in order to determine their relevance to the chief complaint. The examiner then integrates this information into the history in order to create a coherent set of findings that reduce the discrepancy between reported symptoms vs signs and which supports the diagnoses.

- (b) “Familiar pain” probe. For any procedure that produces pain, the examiner asks as a follow-up probe whether that pain is familiar to the pain that the patient may have experienced in this region in the past 30 days. A “yes” response is followed by the probe, “Familiar to what?” in order to elicit a description of the context in which the pain experience occurred; one type of response points to an event associated with the pain (e.g., chewing gum). Clinical patients who experience pain much or all of the time will more often respond to the “familiar to what?” probe with a response such as “the pain I am seeking care for”.
- (c) Time period for pain. For DC/TMD pain diagnoses, the standard time period for a diagnosis is pain within the prior 30 days. This means that for **Familiar Pain** to be endorsed as [yes], the pain must have occurred within the prior 30 days; pains that occurred previous to the recent 30-day period are not acceptable for **Familiar Pain** at the time of the examination per the DC/TMD 30-day time period and are recorded as [no]. Certain protocols or specific clinical situations may require that this time period be modified, but that should be documented in the clinical record. And, it should be carefully explained in any publication that cites the methods being used. Note that the ICHD-2 criteria require that headache be present within the prior 3 months in order for the disorder to be classifiable. In certain settings, the user may want to modify the time period for headache pain accordingly.
- (d) Complicating factors. There are three issues which affect the patient’s report regarding possible familiar pain: location, temporal characteristics, and intensity. Location and temporal characteristics are readily addressed through appropriate probes, while the intensity characteristic is more complex.
  - 1. Location characteristics. For unilateral pain complaints (that is, a patient is asymptomatic on one side and symptomatic on the other side within the past 30 days), if the patient says that procedure-induced pain on the asymptomatic side is “familiar”, the examiner should probe as follows:
    - i. verify side(s) and specific locations of symptoms in the past 30 days;
    - ii. verify that the familiar pain within a side that had been reported as asymptomatic (E1) occurred within the past 30 days and verify that the pain was familiar;



- iii. return to E1 and update accordingly.
  2. Intensity characteristics. The intent is to capture the qualitative characteristics of the pain that are “like” or “similar to” their pain experience. When intensity is stated by the patient as the qualifying characteristic leading to a “no” response, the best probe is to ask, “Independent of intensity, is the pain you felt like or similar to your usual pain?” The examiner must be careful to adhere to the stated probe and to resist trying to explain the goal of the familiar pain probe to the patient.
- (e) Familiar Headache Pain.
1. Verify headache history. The examiner determines whether the patient has a current history of headache. The presence of headache(s) in the temporal area(s) is assessed by (1) reviewing the appropriate section of the DC-TMD Symptom Questionnaire, (2) asking the patient about headache locations as the first part of the examination, and (3) inquiring into headache during the first instance when the patient reports “familiar pain” in the temporalis muscle from any procedure. If a patient reports more than one type of headache in the temporal area, examination procedures that produce temporalis area pain are followed by inquiry regarding **Familiar Headache** with respect to *any* headache pain located in that area, within the past 30 days; the inquiry is not restricted to any specific headache type. If the patient is positive for history of temporal-area headache, then the examiner determines whether the procedure-induced pain replicates the patient’s temporal area headache by asking the patient, “When you opened your mouth widely and it was painful, was that pain like your headache in this part of your head?” or “When I pressed on the area, was that pain like your headache in this part of your head?” Clarification of this question for the patient is done as with Familiar Pain (above).
  2. “Headache” vs “pain”. Note that the examiner will inquire about **Familiar Headache** even if the patient reports that the procedure-induced pain is not **Familiar Pain**. While this may seem contradictory, individuals do report headaches as different from “pain”. If the patient asks if it is sensible for a pain to not be familiar while the headache is familiar, the examiner will say “yes”.

## 2.10 Referred Pain

- (a) Definition. Pain is considered *referred pain* if the patient reports pain beyond the boundary of the muscle or joint being palpated (i.e., perceived in another structure). It is not referred pain if the patient reports pain extending beyond the area of provocation but only within the boundary of the muscle or joint.
- (b) Localization. If the patient reports pain as a result of muscle or TMJ palpation, the patient is asked if s/he felt pain anywhere else (i.e., in any other structure) beyond the immediate area of the examiner’s palpation, and if so to point to that area. If the site of any referred pain is deep, then the patient should still be asked to point to the skin (or mucosa) overlying the deep area.
- (c) Spreading pain. The DC/TMD includes a placeholder for “spreading pain”, defined as pain that extends beyond the area of nociceptive stimulation but not beyond the boundary of the muscle being palpated.

## 2.11 Examination-related Pain Interview

- (a) Interview structure. There is a standard set of questions related to the examination-based interview of presence of pain, whether it is familiar pain, whether it is familiar headache, and where the pain is perceived. The inquiry into pain starts with an examination-specific question based on the particular procedure. This initial question is prompted after each relevant procedure in the Specifications; the specific questions for each type of clinical procedure are listed at the beginning of Section 5. The pain interview is comprised of a standard hierarchy of questions. Additional questions are needed if the patient responds in other ways, and such questions should follow the intent of the specific questions described here.
- (b) Ambiguous responses from patient. When requested, the patient must clearly indicate “pain” or “no pain”. If the patient provides other descriptors (e.g., achiness, tightness, pressure, uncomfortable, etc), the examiner will clarify this with “Is that pain or not?” If headache is a primary focus of the examination, then this question may need to be modified, such as “Is that headache pain or not?” No other question is provided for addressing this particular ambiguity, as any other question will tend to have leading characteristics. For other forms of ambiguity, the intent is to clarify and not to lead the patient towards making specific responses.
- (c) Repeat questioning. A simple question such as “Did you feel pain [from that procedure]?” may be shortened after the first few uses of it, to “Pain?”. Examiners are encouraged to develop shorthand versions of the repeated items within the Examination-related Pain Interview for use with a given patient *after* the patient understands the intent of the question. Another example is the repeat question of “Show me where you felt pain” followed by the question “Were there any other areas?”; the latter question is repeated until the patient says “no”. The first time that this form of questioning occurs, such as in E1 (Pain location), is an opportunity to review with the patient that inclusive reporting of all pain locations is requested.
- (d) Efficient Completion of the Examination-related Pain Interview. After the first several positive responses from the pain provoking procedures, the examiner can instruct the patient to respond in an abbreviated form. For example, the patient might be instructed to report, in response to positive palpation findings, as follows: “yes, familiar” or “yes, not familiar”.

## 2.12 Examination Form

- (a) Overview. The DC/TMD includes an examination form which standardizes the examination and the recording of findings. This form, Section 9 and available on the website as a stand-alone document, is inclusive of all procedures described in this protocol. The form is available in versions for the US and for international settings.
- (b) Completion of all items. Unless a procedure is indicated as supplementary, the procedure should be completed. Completion of a procedure does not mean that all response bubbles have to be completed (see next section for further explanation). Rather, the form is intended to be a record of what is normal as well as abnormal, hence reporting negative findings (as [N]) is as important as reporting positive findings. Completion of all items relevant to a given complaint also supports reliable decision-making. Procedures noted as “supplementary” are used as indicated by the clinical circumstance. If the examination form is used for a

screening examination, then only items indicated for the type of screening examination would be completed.

- (c) Form structure logic. While all items should be completed, not all response fields need to be completed. Parts 1, 2, and 3 are typical checklists. The remaining sections of the examination utilize a conditional reporting format.
1. If the response from the initial inquiry about presence of pain from the procedure is reported by the patient as “no”, then record [N]. All other response options for that item are left blank since no response is needed.
  2. If initial inquiry response about presence of pain is “yes”, the examiner records [Y] to **Pain**. Then the examiner will ask a series of further questions depending on the type of examination procedure that induced the pain.
  3. **Familiar Pain** and **Familiar Headache** co-exist as parallel forms of inquiry because some individuals will report temporalis area “pain” as different from temporalis “headache” with respect to an examination procedure provoking that particular pain or headache experience. This was addressed in section 2.9.
  4. A response for **Referred Pain** is recorded if **Pain** is “yes” and independent of whether **Familiar Pain** or **Familiar Headache** are “yes”.
  5. Example. In Part 4B, if the patient reports pain only in the right temporalis and right masseter during maximum unassisted opening, [Y] would be marked in the **Pain** column for the right temporalis and the examiner would proceed with the Examination-related Pain Interview, asking if the pain was familiar, if the provoked pain (or noxious experience) was familiar to headache, and if the pain was referred. For the masseter muscle, the Examination-related Pain Interview would address if the pain was familiar and if the pain was referred. For all other muscles and both TMJs, [N] is marked in the **Pain** column and because the remaining columns are not applicable, they are left blank.
- (d) Description of the form structure. The conditional sections of the examination form are as follows.

Parts 4 and 5 use the conditional structure as described above under (c), and illustrated with the example at (c)5.

In Parts 6 and 7, mandatory response fields are listed under *Examiner* and *Patient*. The examiner section and the patient-report section are separated by a vertical line. The patient-report section starts the conditional response fields which are completed only if the patient reports ‘yes’ (recorded as [Y]) to the presence of a clicking sound; the examiner then begins the Examination-Related Pain Interview relevant to joint sounds.

In part 8, *Locking* is reported as an observed event during any part of the examination, and the response fields for *Reduction* are completed. If Locking is reported as “no”, then the remaining fields for that type of locking in that joint are left blank.

In Parts 9 and 10, if *Pain* to palpation is not reported, then [N] is marked and the remainder of the row for that muscle is left blank. If **Pain** to palpation is reported, then a prolonged palpation is performed and the Examination-related Pain

Interview is used for completion of the **Familiar Pain** and, if applicable, **Familiar Headache**, and then **Referred Pain**.

- (e) Temporalis and masseter palpation. The examination form attached to this protocol has 3 report fields for each of temporalis and masseter, each field corresponding to a delineated palpation zone. The purpose of zones within these muscles is to enhance structured training and systematic practice. In a clinical setting, only the diagnosis may be of interest, and if familiar pain, familiar headache, and referred pain are obtained from the first site examined within the temporalis, the examiner could easily conclude examination of that muscle and move on to the next part of the examination (masseter palpation). In this example, no zones would be needed on the exam form. In contrast, if an examiner wishes to be thorough, the present form provides self-evident documentation of what was performed. Other examination forms are available on the Consortium website – for example, one that just lists temporalis and masseter (without zones); the level of detail in terms of recording findings from these two muscles is up to the examiner.
- (f) Examiner Comments. Section 11 of the examination form provides a space to write additional information. This is optional.
- (g) Form modification. An experienced clinician may wish to use additional procedures for a given patient depending on the nature of the complaint. For a given setting, the form may also be modified by eliminating all supplemental procedures (notably, jaw-opening pattern, supplemental muscle palpations); if the supplemental muscle palpations are removed, the user should evaluate the standard response options for E4 and E5, in that perhaps only temporalis and masseter pain, as areas reported by the patient during mobility testing, are of interest for the myalgia and myofascial pain diagnoses. Similarly, if a user is not interested in referred patterns associated with palpation, then the “Referred Pain” field may be removed from E9 and E10; the palpation procedure could be similarly modified, as described in the Protocol.
- (h) Efficient completion of the examination. An assistant for recording examination findings permits the examination to be completed much more quickly. The accompanying video demonstrates a suggested dictation style.

## **3 Description of DC/TMD Examination Procedures**

### **3.1 Overview**

This section provides a rationale and explanation for each examination procedure. Verbal instructions, examiner procedures, and sequencing are described in a detailed manner in Specifications Sections 4 and 5. Redundancy between this section and the two Specifications sections occurs where both general and specific points are needed. This arrangement permits Sections 4 and 5 to serve as a field manual, while this section provides explanation.

The DC/TMD protocol is applicable to both clinical and research settings. For this document, the person being examined is a “patient” while the individual performing the examination is an “examiner.”

### **3.2 Why this protocol**

The instructions in this document are specific to the DC/TMD. These instructions are concisely operationalized in Section 4 and completely operationalized in Section 5. Operationalized procedures accomplish a number of objectives: (1) provide the necessary elements for constructing an efficient and comprehensive set of procedures for the examination of TMD; (2) address reliability and validity issues; and (3) provide a context for what constitutes a “positive finding” as the outcome of a diagnostic test. The stated reliability and validity of the empirically-supported diagnoses comprising the DC/TMD exist only to the extent that a diagnostic test has been performed as defined. Modifying the procedures in this manual, without assessing the new reliability and its effect on diagnostic validity, leads to unknown findings in terms of empirically supported disorders. The authors of this document and the authors of the DC/TMD do not claim that these procedures are the only way to perform a TMD examination; but we do claim that these procedures are the best that have been identified and disseminated to date in terms of maximal reliability and validity.

This protocol should be cited as a supporting reference when publishing scientific communications. Because this protocol is a living document, the specific version should be cited; the Consortium web site will maintain an archive of all released versions. If the goals of the examination lie outside the purpose or scope of the DC/TMD, these instructions may require modification, and users of this protocol should clearly indicate in any communication that modifications were incorporated. Any modifications should be accompanied by rationale and explanation in order to clearly describe the frame within which a modified examination occurs since that can affect the reliability of the diagnostic procedures as well as validity of the diagnosis per the DC/TMD.

### **3.3 Identifying information**

The patient name, examiner name, and date are entered at the top of the examination form (See Section 8). Other identifying information may also be included in this section of the examination form via inclusion of additional fields.

### 3.4 Instructions to the patient

Standard instructions include establishing rapport with the patient, explaining what “pain” means for examination purposes, introducing “familiar pain” and “familiar headache, and noting that the time period of interest is the prior 30 days. These instructions are stated in E1, Section 5.

### 3.5 Description of procedures

Each section of the examination is organized according to the DC/TMD Examination Form, starting with the rationale for the particular procedure followed by the description of the procedure. See Sections 4 and 5 for more detail regarding how the procedure is implemented in the clinic.

## E1 Examiner Confirmation of Pain and Headache Location

**Rationale.** Patients typically describe in the pain history the location of symptoms in anatomical terms (e.g., “TMJ”, “joint”). The examiner, however, must name the symptom areas through identification of anatomical landmarks. Consequently, for the entire examination, the instructions request that the patient point to the area of pain rather than allowing the patient to indicate the involved area by name. This first step in the examination orients the patient to the areas of interest, with regard to pain and any other symptom reporting, followed by the examiner confirming the anatomical structures associated with the areas of pain complaint.

**Scope of Examination.** The examiner identifies areas on the head and face that are being addressed in this examination with respect to pain report. The purpose of this instruction is to reduce reporting symptoms associated with other areas not relevant to this examination when performed for the DC/TMD. The scope of examination, with respect to the patient’s reference frame for pain reporting, can be expanded; for example, the cervical areas could be included by identifying them during the initial instructions.

**Procedure.** The areas of interest for symptom reporting are identified via light touch, with the examiner touching each area in turn. The areas are not named.

**E1\_a Pain.** Ask the patient whether s/he has had pain in any of the identified areas within the prior 30 days. Examiner inquires about specific locations of pain. Follow-up question, for this and any other procedure, regarding whether other areas of pain also occur should always be considered and asked, depending on how the patient responds to the question. The patient is reminded at this point in the examination to always report all areas of pain when asked about pain locations.

**E1\_b Headache.** Ask the patient to show all locations of headache experienced within the prior 30 days. If the patient inquires into whether “headache” is different from “pain” (as in the prior item, E1\_a), inform the patient that each person experiences pain differently, and if a particular pain is experienced as a “headache”, then that should be reported. Headache location options are “temporalis”, “other”, and “none” for each of right and left. For example, a bilateral frontal headache would be indicated as “other” on each side.

**Repeat Assessment.** During the course of the examination, pain location is consistently assessed in response to pain provocation procedures. The patient may subsequently report pain in an area not previously identified during E1. The

examiner then returns to E1 and confirms with the patient that the new area, not previously reported, should be included. The responses in sections E1\_a or E1\_b are correspondingly updated to reflect the revised reporting of anatomical locations involved with pain during the last 30 days. A new area may be added to the set already reported in E1\_a or E1\_b, or an area already reported could also be removed as a result of a subsequent clarification at any time during the examination.

## **E2** Incisal Relationships

**Rationale.** The maxillary and mandibular incisors serve as stable landmarks for reliable measurements of mandibular range of motion in vertical as well as horizontal planes of movement.

**General.** The absence of both maxillary incisors, without prosthetic replacement, makes reliable measurement of mandibular range of motion challenging. Typically, the nasopalatine papilla is used as the maxillary landmark, or a lateral incisor might be used. Reliable landmarks in the edentulous mandible are more difficult to establish; typically, the estimated midline is used.

**Select maxillary and mandibular reference teeth.** Considering the position and shape of the maxillary incisors and their opposing mandibular incisors, select maxillary right central incisor (US #8, FDI #11) as the maxillary reference tooth if the incisal edge is horizontal and the tooth is relatively well-aligned within the arch, and if the opposing mandibular incisor fulfills similar criteria. Otherwise, select the maxillary left central incisor (US #9, FDI #21) if it and the opposing central incisor better fulfill these criteria. Note that the mesial-distal center of the incisal edge of the maxillary reference tooth will be the specific maxillary reference position for all vertical and protrusive mobility measurements. The reference position of the mandibular reference tooth is the part of the tooth that opposes the mesial-distal center of the maxillary reference tooth, and it is also used for all vertical and protrusive mobility measurements. Placing a vertical line on the particular part of the maxillary reference tooth, extended down to the part of the opposing mandibular tooth, may be helpful; see “Method 2” for adjusting midlines.

**Reference line – vertical overlap.** While posterior teeth are in the MICP position, a horizontal pencil mark is placed on the buccal surface of the mandibular reference tooth in relation to the maxillary reference tooth. Reverse these instructions if anterior cross-bite exists. Insure that the examiner’s line of vision is in line with the horizontal occlusal plane to minimize error in placing the line more inferior or more superior than intended on the mandibular reference tooth.

**Reference line – maxillary & mandibular midline.** Inspect the relationship between the midline between the maxillary central incisors and midline between the mandibular central incisors. If one maxillary central incisor is missing, select the mesial incisal edge of the remaining central incisor as the reference. If neither central incisor is present, then select the nasopalatine papilla as the reference. If there is a diastema, measure from the mesial edge of the selected maxillary central incisor. Use prosthetic teeth if available. If the discrepancy between the maxillary and the mandibular midline is less than 1.0mm, then select the mandibular midline as the mandibular reference-midline for lateral excursive movements and consider the midlines to have a deviation of 0mm. Use “N/A” and mark ‘00’ mm on the examination form.

If the discrepancy is 1.0mm or more, then select one of the following three methods for adjusting the midlines.

**Method 1:** The distance between the two midlines will be measured, rounded to the lowest whole mm, and recorded on the examination form. Note the direction that the mandibular midline deviates from the maxillary midline, and mark either “right” or “left”.

**Method 2:** A vertical line is drawn on the labial surface of the maxillary reference tooth, and the line is extended down onto the facial surface of the opposing mandibular reference tooth. Lateral excursion measurements are made between these two lines. Use “N/A” to indicate that the midlines have been adjusted to a difference of 0mm and leave the number of mm blank

**Method 3:** Select the maxillary midline as the maxillary reference point, and mark the labial surface of the opposing mandibular incisor with a vertical line that extends from the maxillary midline. In this case, the pencil line on the mandibular tooth is the mandibular reference midline. Use “N/A” to indicate that the midlines have been adjusted to a difference of 0mm and leave the number of mm blank.

**Incisal Overjet (horizontal overlap).** Measure distance from labial surface of mandibular reference incisor to labial surface of maxillary reference incisor. If anterior cross-bite situation exists, the field “if negative” on the examination form will be marked.

**Incisal Overbite (vertical overlap).** Measure the distance from the mandibular incisal edge to the marked horizontal line and record the measurement by placing the zero end of the ruler next to the line and measure to the mandibular incisal edge. Reverse these instructions if anterior cross-bite exists and measure the distance on the maxillary incisor. If open bite exists, the measurement is made between maxillary and mandibular incisal edges while the mandible is in the MICP position. The measurement of open bite is registered as a negative one, and the field “if negative” on the examination form should be marked.

### **E3 Opening Pattern (Supplemental)**

**Rationale.** Given the difficulty of making a reliable assessment and the rare utility for contributing to a formal DC/TMD diagnosis, this procedure was not included as a core component of the DC/TMD. However, the test has presumed utility for common diagnosis of disk displacement without reduction, with limitation, and for less common diagnoses (for example, muscle contractures or muscle guarding) and for identifying adaptive patterns in response to conditions such as unilateral masseter pain or disk displacement. The primary reason for retaining the test on a routine basis, however, is that it serves as a useful “warm-up” procedure for the patient before asking the patient to perform the opening mobility movements which are measured.

**Vertical guide and starting position.** A vertical reference line to monitor mandibular movement is perhaps the best method. While many approaches exist, the maxillary midline or the vertical mark on the incisors (Method 2 for measuring incisal relations) is simple to use. The teeth should be in MICP before beginning the procedure in order to observe for any lateral deflections in full closure perhaps dictated by the occlusion and to insure that any displaced disks are not already reduced prior to the opening phase. The patient’s head should not be turned to the side for the convenience of the examiner as that will potentially alter



movement dynamics of the mandible during opening. The examiner may lightly depress the lower lip in order to visualize the dental reference points. The straight edge of a millimeter ruler can be held vertically as a guide by gently aligning the ruler with the reference midline.

**Opening pattern.** The examiner asks the patient to *slowly* open three times, observing from a position *directly in front of the patient* for movements of the mandible in the frontal plane that depart from a line parallel with the mid-sagittal plane. Slow opening is requested in order to fully visualize any non-linear movements. Two-three seconds from closed to fully open is a sufficient pace, while one second may be sufficient for a limited opening. If the patient exhibits more than one opening pattern then score all patterns that occur according to the following criteria. Additional opening sequences are permitted if the examiner needs to verify an observation. Note that only opening patterns are recorded.

- a. *Straight*. This is defined as no or minimally perceptible deviation (< 2mm) upon opening. Choose this option if there is uncertainty regarding presence of a deviation. If any deviation is both minimal and inconsistent from trial to trial, choose this option.
- b. *Corrected Deviation* (includes right, left, or both). The mandible exhibits a perceptible deviation ( $\geq 2$  mm) to the right and/or left but returns to the midline before or upon reaching the maximum unassisted opening. Note that if opening is straight but closing exhibits clear deviation, the opening pattern is recorded as straight.
- c. *Uncorrected deviation* (specify right or left). This is defined as deviation of the mandible of  $\geq 2$  mm to either the right or the left from the midline with maximum unassisted opening.

## **E4** Open Movements

**Rationale.** Mobility testing addresses a core sign of TMD, is one of the most reliable clinical measures, and is a clinically appropriate outcome measure.

**General.** Measurements are taken between the incisal edges of the maxillary and mandibular reference teeth, as described in E2. The specific instructions that operationalize each of these different measures are stated in Sections 4 and 5. Pain-free opening and maximum unassisted opening are patient-based measures, while maximum assisted opening is examiner-based.

- E4\_A Pain Free Opening.** The patient opens for the measurement. In certain settings, repeating the test, if the pain-free opening is less than 30mm, might be appropriate in order to assess for possible low-range outlying values.
- E4\_B Maximum Unassisted Opening.** The patient opens for the measurement. Ask the patient about any pain produced by this procedure.
- E4\_C Maximum Assisted Opening.** The patient opens for the measurement. The sequence of steps, as driven by the verbal commands, is designed to minimize the influence of guarding due to uncertainty on the part of the patient, but guarding occurs and while a standardized procedure assists in the detection of guarding, the identification of guarding is not, at this time, operationalized. The examiner has the option of repeating the procedure if s/he believes the patient prematurely terminated the procedure or responded with resistance. Cooperation and rapport between examiner and patient is critical for the success

of this particular procedure. Ask the patient about any pain produced by this procedure.

- E4\_D Opening Terminated.** If patient indicates to the examiner that the procedure should be stopped, [Yes] is endorsed. If the patient indicates for the procedure to be terminated simultaneous with the examiner's percept that the assisted opening has reached its maximum, [No] should be endorsed. For all other situations, [No] should be endorsed.

## **E5 Lateral and Protrusive Movements**

**Rationale.** Excursive movements complement open movements for full assessment of jaw mobility. These measurements are supplemental and may be omitted. The rationale for assessing lateral movements is to document the extent of the excursive movement(s) and any resultant (induced) in pain. Moreover, in certain settings, measurement of excursive movements serves to document if condylar movement was limited versus normal. The examination form provides fields for recording the extent of movement.

**General.** Lateral excursive measurements are made between the maxillary and mandibular reference midlines, while protrusive excursive measurement is made between the labial surfaces of the maxillary and mandibular reference teeth. If the patient cannot perform a movement, indicate this on the recording form by leaving the section blank. For the lateral excursive movements, if the patient is confused about direction s/he should move his or her jaw, touch the ipsilateral side of the face, lip, or even shoulder, and ask the patient to move towards the indicated side. Lateral pressure to the jaw by the examiner, as an aid to help the patient move in the requested direction, is very difficult to calibrate and consequently is discouraged.

- E5\_A Right Lateral Excursion.** Ask the patient to move mandible to the patient's right. Record any reported pain.
- E5\_B Left Lateral Excursion.** Ask patient to move mandible to the patient's left. Record any reported pain.
- E5\_C Protrusion.** Ask patient to move the mandible forward. Record any reported pain. Note that if the mandibular incisors cannot be protruded beyond the maxillary incisors, the value will be negative; the form should be marked for the negative number. If the incisors exhibit a Class III situation in maximum closure, the horizontal overlap is recorded as a negative value (as explained in E2), but the protrusive movement, still measured as the distance from the labial surfaces of the maxillary to mandibular incisors, will be recorded as a positive number (consistent with the Class I situation where the mandibular incisor is anterior to the maxillary incisor).

## **E6 TMJ Noises During Open & Close Movements**

**Rationale.** TMJ noises are a classic sign associated with TMD. However, because TMJ noises are often not stable over time, clinical diagnosis of intracapsular disorders is at best fair except for displacement without reduction, with limited opening. Because patients are often concerned about joint noises, the assessment of TMJ noise remains part of the clinical examination.

**General.** Since the 1992 publication of the RDC/TMD, much research regarding joint sounds has been published, and the Validation Project attempted to improve upon joint sound characterization and assessment. While the assessment method has been improved with the recognition of assessing pain with the sound, the definition of the joint sounds is nevertheless the same as in the RDC/TMD (1992).

**Instructions and Palpation.** The examiner explains that the jaw joints (TMJ) will be examined for whether they make any noise while the patient moves his or her jaw, and the patient is asked to report any noise that was felt or heard. Palpation is generally performed by placing one finger on the skin overlying the lateral pole of the TMJ condyle, and light palpation pressure is used.

**Examiner Detection of Noises.** Using palpation, the examiner will determine if joint noises are present during opening and closing. The patient will also report whether they heard or felt a joint sound. It is essential that the patient bring the posterior teeth into MICP before each open-close cycle. This maneuver insures that the full range of opening and closing has been assessed. Joint noises can be assessed either unilaterally or bilaterally, depending on circumstance. Bilateral assessment is sometimes essential in order to determine if the noise from a single click is being conducted via bone to both joints. In contrast, if the patient report of noises is clinically important, then patients typically do better by focusing on one joint at a time. Sometimes, tooth contact can be sufficiently “loud” or noticeable such that the sound can be misperceived by the examiner as a joint noise. In order to control for this, ask the patient to intentionally tap the teeth together lightly before starting the open-close procedure in order to establish a reference.

**Definitions of noises.**

- (a) Click. A distinct noise, of brief and very limited duration, with a clear beginning and end, which usually sounds like a “click”. Also referred to as a snap or pop.
- (b) Crepitus. A noise that is continuous, over a longer period of jaw movement than a click or pop and can occur during part or the whole of the opening and/or closing movement. The noise is not muffled, and it may be comprised of multiple overlapping grating sounds such that it becomes “continuous”; distinguish this from the discrete sound characteristics associated with a click. Such joint noise is also often referred to as crunching, grating, or grinding sounds.
- (c) Eminence click. The eminence click has to include at least an opening click and is detected when the condyle-disk complex translates around the eminence accompanied by a bodily shift of the mandible. The examiner observes for noise near the end-range of normal range of movement (i.e., at the end of normal-range opening or beginning of closing from a normal-range maximal opening). Noise detected at the end-range of vertical jaw movement that is limited is not likely representative of an eminence click. An eminence click is not reported on the examination form; it is identified only to distinguish it from the “click” that is reported.

**Recording joint noises.** Only clicking noises that meet the following criteria are scored.

- (a) Opening click. If from MICP to maximum opening, a click is noted on at least one of three opening movements, record **Open Click** as [yes].

- (b) Closing click. If from maximum opening to MICP, a click is present on at least one of three closing mandibular movements, record **Close Click** as [yes].
- (c) Crepitus. Crepitus can be scored in addition to a click.
- (d) None. Indicates that neither click nor crepitus were present during opening, closing, or both; this is scored as a [no] for each of **Click** and **Crepitus** in this examination.

**Patient report of joint noises with movement.** Any sounds that the patient perceives during any part of the joint noise evaluation are recorded separately for each of right and left joints. When the examiner has completed assessment of joint noise, the patient is asked if s/he felt or heard any joint noise. If the patient says “yes”, the examiner follows with identification of type and side of all noises. If the patient reports distinct sounds such as clicking, popping or snapping sounds, these are coded as a [click] on the form. If the patient reports longer duration sounds including crunching, grinding or grating sounds, these are coded as [Crepitus] on the form. Otherwise, [No] is coded for that side. If the patient uses terms other than those listed above under “Definitions”, the examiner then asks for a description rather than assuming that a particular term necessarily refers to a specific sound such as “click” or “grating” and then determines the type of sound. A sound that the patient describes need not necessarily map to [click] or [crepitus] and such noises are most likely recorded as [No].

**Pain inquiry.** The patient is asked about pain that occurs at the same time as the clicking noise. Opening itself may cause pain, so the examiner should not assume that a “yes” response to this inquiry necessarily indicates that the click itself was painful.

## **E7 TMJ Noises During Lateral & Protrusive Movements**

**Rationale.** This test is an extension of the evaluation of TMJ noises during opening and closing movements.

**Procedures.** The examiner asks the subject to move his or her mandible to the right, to the left, and protrude just as previously performed when measuring the extent of these movements. Make sure the subject closes into MICP prior to and at the end of each movement, as with opening/closing noise assessment. A minimum of three movements is required. A noise is scored as positive any time it occurs during the lateral or protrusive movements (out or in). After the movements are completed, then assess for "Pain with click" and "Familiar pain" for any clicks reported by the patient. The definitions of the noises are the same as for **TMJ Noises During Open and Close Movements**.

## **E8 Joint Locking**

**Rationale.** Joint locking in the clinic is uncommon but it does occur. Documenting whether locking occurs or not is a useful function within the examination, given the associated pain, disability, and treatment complexity that can be associated with joint locking.

**Closed lock procedures.** If the patient’s mandible suddenly locks during the process of opening, then a lock “While opening” would be recorded as [yes]. If the lock is

self-reducing or the patient engages in a specific maneuver to unlock the mandible, then the patient effected a reduction (code as [yes]), whereas if the examiner has to reduce the lock, then the examiner should be coded as [yes] and the patient as [no].

**Open lock procedures.** If the patient's mandible becomes locked in the wide open position, then that type of lock is recorded as [yes]. Recording of the reduction of the lock is the same as described for the Closed lock procedures (described just previously).

## **E9 Muscle and TMJ Pain with Palpation**

**Rationale.** Pain induced in muscles via palpation is a classic clinical test. The intent is to determine if the patient reports pain from palpation of a muscle or joint and determine if any induced pain duplicates or replicates the patient's pain complaint. Several approaches are available, depending on the purpose of the examination. See Part 2.12.e for description of the examination form pertinent to temporalis and masseter palpation.

### **General**

- (a) Palpating the muscles and joint capsules for pain requires that the examiner press on a specific site using the spade-like pad of one finger (the second or third digits; or index finger or middle finger) with standardized pressure. The "spade-like" area of the finger is the space between the tip (just adjacent to the edge of finger nail) and the finger-print area. One finger is used and finger placement is as shown in the illustrations, Section 7.
- (b) Within each group of muscle sites as indicated on the examination form, apply pressure to the right side and then to the left side. When applying pressure, support the head or mandible by placing the other hand on the opposite side of the head in order to provide stability. During palpation, the patient's mandible should be in a comfortable position, without the teeth touching.
- (c) Each major muscle (temporalis, masseter) is divided into 3 zones for purposes of insuring that the muscle is examined in a consistent manner. Responses may be recorded for each zone or for the muscle as a whole; alternate examination forms exist for each approach. Within each zone, 3-5 areas should be palpated, depending on the size of the muscle and the intent of the examination.
- (d) Due to the inherent difficulty in an examiner exactly calibrating his/her finger pressure when going from measurement scale to actual palpation, the examiner should target no less than the indicated value. For example, a target of 1 kg should be at least as great as 1.0 kg but not less. Target "pressures" are 1 kg (as measured by a force meter) to the temporalis and masseter muscles and around the lateral pole of the TMJ and 0.5 kg to the lateral condylar pole of the TMJ and any supplemental muscle areas
- (e) If the examiner is unable to palpate at the specified amount of pressure due to the patient's physical withdrawal or the patient's request for the palpation to be more gentle, then such information is recorded in the Examination Comments section, and the palpation should be modified accordingly.
- (f) In a given setting, diagnosis of myalgia may be the sufficient end-point and further investigation for presence of referred pain may not be needed. If so, the

palpation and pain reporting procedures (by the patient) should be accordingly modified.

- (g) Summary of palpation principles
  - i. Locate, then palpate.
  - ii. Press on the site using the correct amount of steady pressure, without moving the fingers sideways or rubbing the area.
  - iii. Be systematic in how each defined region is examined.

### **Approaches**

- (a) In addition to setting stimulus intensity, palpation consists of two additional parameters that can be altered depending on the clinical or research question to be answered: location and stimulus duration.
- (b) Location consists of how much of a structure is examined; the masseter and temporalis are large enough that more than a few palpation sites are required to fully examine the muscle. Such structures may be examined by applying the palpation pressure to every aspect of the muscle in order to insure that no area is missed, or a sampling approach may be used where only selected parts of the muscle are examined on a routine basis. In clinical settings, a sampling approach is often augmented by additional palpation as guided by the patient history and diagnostic hypotheses. Other smaller structures such as the TMJ are readily examined in a complete manner.
- (c) Stimulus duration refers to how long the palpation pressure is held. The minimum duration for the DC/TMD is 2 seconds (which is sufficient for a diagnosis of myalgia but likely insufficient for a referred pain diagnosis), and a duration of (at least) 5 seconds is recommended if identification of referred pain is important. There are two methods associated with stimulus duration, depending on the desired outcome from the examination.
- (d) Method 1. Use 5 seconds duration for every palpation. If false negative diagnoses for myofascial pain with referral must be minimized, then palpation of every muscle and joint site with (at least) 5 full seconds of palpation pressure is necessary, and referred pain and hyperalgesia will be more reliably detected. Watching a clock to insure adequate stimulus duration is recommended.
  - a. To shorten the time required for the palpation procedures, after 2 seconds or so and while continuing to hold the pressure, the examiner may prompt with the question of “pain?”, and other prompts (“familiar?”, “familiar headache?”, and “referred?”) may be possible within the remaining time until (at least) 5 seconds has elapsed. Any unasked pain inquiry questions may then be asked for that palpation site.
  - b. To reduce impact of multiple “pain?” prompts, simply ask about pain just before the end of the 5-second pressure application, and then proceed with the remaining prompts after removing the pressure.
  - c. The intent of the prolonged palpation (holding a pressure for a full 5 seconds) is to identify the possible presence of referred pain. This procedure can be altered depending on patient response; a highly pain-sensitive individual may not readily tolerate 5 seconds of pressure in a given area, and the Comments section of the examination form should be used for recording such observations and that, for example, the

examination for referred pain was not performed. However, in practice 5-seconds of pressure is tolerable.

- (e) **Method 2.** Use 2 seconds duration for every palpation. If identification of referred pain is not important in a given examination or setting, then palpation with only 2 seconds duration will be generally sufficient to identify myalgia and arthralgia. This approach is particularly well-suited if the clinical evaluation serves as a gateway for referral. Instructions include: **Now I am going to apply pressure to different areas of your head and jaw, and I will ask about pain. And: I will hold the pressure for 5 seconds [or 2 seconds], and I will then ask you about pain; please tell me yes or no, and if so I will then ask you if the pain is familiar, and if the pain stays under my finger or if you feel it also in different areas of your head or jaw.**

### Description of Specific Extraoral Muscle Sites

- (a) *Temporalis Anterior – 1.0 kg.* Start just posterior to the bony crest lateral to the eyebrow and superior to the zygomatic process of the temporal bone. Request muscle contraction via patient clenching as necessary in order to insure that muscle tissue is beneath the finger. The area for palpation lies along a curve parallel to the anterior extent of the muscle; lightly palpate for the bony crest defining the anterior boundary of the temporal fossa.
- (b) *Temporalis Middle – 1.0 kg.* Start just anterior of the ear and superior to the zygomatic process of the temporal bone; the area for palpation is directly superior.
- (c) *Temporalis Posterior – 1.0 kg.* Start just above the superior tip of the ear; the area for palpation is directly superior. Ask the patient to clench and then relax to help identify muscle boundaries, as necessary.
- (d) *Origin of Masseter – 1.0 kg.* Request that the patient first clench and then relax in order to confirm (1) the location of the posterior extent of the muscle with respect to the anterior border of the TMJ condyle and (2) the anterior border of the masseter. Start at the posterior extent, just inferior to the zygomatic process of the temporal bone; the area for palpation is directly anterior.
- (e) *Body of the Masseter – 1.0 kg.* Start at the posterior boundary of the muscle, midway between origin and insertion. The area for palpation is directly anterior.
- (f) *Insertion of the Masseter – 1.0 kg.* Start at the posterior boundary of the muscle, just superior to the inferior mandibular border; the area for palpation is directly anterior.

### Description of Specific Joint Palpation Sites.

- (a) *Lateral Pole – 0.5 kg.* Place index finger just anterior to the tragus of the ear and on the skin overlying the patient's TMJ. In order to confirm location, ask the patient to open or protrude slightly until the examiner feels the lateral pole of the condyle translated forward.
- (b) *Around the Lateral Pole – 1.0 kg.* While the mandible is in the comfort position or in a slightly protruded position, place index finger just anterior to the tragus of the ear and dorsal to the TMJ. While the mandible is supported from the other side, the index finger presses while orbiting around the lateral pole in a circular fashion over the superior aspect of the condyle and then anteriorly – i.e., from the 9:00 to the 3:00 position, and then continuing fully around the condyle. Two-

five seconds duration for this procedure yields the appropriate pace of finger movement.

**Examiner calibration.** The examiner calibrates the necessary fingers at the specified palpation “pressure”, just prior to that set of palpations.

**Examination sequence.** A practice trial is optional and may be performed on the deltoid muscle or frontalis muscle. Figures related to palpation are shown in Section 7. In order to maximize examiner consistency, the following sequence is used:

- Temporalis and masseter, right side and then left side (1 kg), following order of zones as listed above.
- Lateral pole of TMJ, right side and then left side (0.5 kg)
- Around the TMJ condyle, right side and then left side (1 kg)
- Supplemental muscles (0.5 kg), as indicated.

**Palpation and pain inquiry.** The examiner inquires about pain from the palpation, whether the pain is familiar, and the anatomical extent of the pain. For the latter, the examiner asks the patient to show (with a fingertip) where the pain was felt. Verbal responses such as “to my ear” or “deep” are accepted as evidence of extension of the palpation-induced pain, while ambiguous responses from the patient are interpreted as [no]. This protocol requires that “referral” denotes pain felt in a different structure than that which is being examined via palpation.

## **E10 Supplemental Muscles**

**Rationale.** Additional sites may be examined as per the protocol in E9.

## **E11 Examiner Comments**

**Rationale.** The examiner records any observations that are deemed pertinent towards understanding any findings. Any barriers that compromised any part of the examination are also recorded here; see Section 2.4(d) for details. Any clinical observations that may affect diagnosis should be recorded here as well.



## 4 Concise Specifications for DC/TMD Examination

### 4.1 Overview

The intended user of the Concise Specifications is the individual (clinician or researcher) who wishes to use empirically validated diagnostic criteria for temporomandibular disorders while retaining a simple examination. The verbal commands and associated procedures used for each component of the clinical examination are listed here in a table format for ready reference. The reader should refer to Section 2 (General Instructions) for the full context of the examination. Full description of the procedures is provided in Section 3, and the fully operationalized version of these procedures is provided in Section 5. Figures, as referenced below, are found in Section 7. The enumeration of the examination procedures in this section corresponds to that in Section 5 as well as on the DC/TMD Examination Form (Section 8).

### 4.2 Examination-related Pain Interview

Inform the patient that s/he might experience pain during the clinical exam, and if so, s/he will be asked additional questions. When this sequence of question and response is used as part of the exam, the specifications (below) indicate “Conduct Examination-related Pain Interview.” The detailed version is in Section 6.

**Familiar pain.** If the patient reports pain as a result of an examination procedure, then ask the patient if it is “familiar pain”, that is, pain “similar” or “like” the pain s/he has experienced in the last 30 days in the same region (i.e., his or her pain complaint). Remind the patient that you are trying to replicate or duplicate his or her pain so that you can locate the source of the pain.

**Familiar headache.** If the patient reports pain in the temples as a result of an examination procedure, then ask the patient if it is “familiar headache”, that is, pain similar or like the headache s/he has experienced in the temple area (s) in the last 30 days.

**Referred pain.** If the patient reports familiar pain as a result of muscle or TMJ palpation or familiar headache as a result of temporalis muscle palpation, then the palpation is repeated and the patient is asked if s/he felt pain anywhere else beyond the immediate area of the examiner’s palpation. It is considered *referred pain* if s/he reports pain beyond the boundary of the muscle or joint being palpated (i.e., perceived in another structure). It is not referred pain if s/he reports pain extending beyond the area of provocation but only within the boundary of the muscle or joint.

**Efficient Completion of the Examination-related Pain Interview.** After several positive responses from the pain provoking procedures, the examiner can instruct the patient to respond in an abbreviated form. For example, the patient might be instructed to report, in response to positive palpation findings, as follows: “yes, familiar” or “yes, not familiar” in order to eliminate the repetitive asking of whether positive pain findings are familiar or not.

### 4.3 Measurements

Measurements are rounded down to the nearest whole mm and recorded only as integer numbers.

## 4.4 Completion of examination form

The examination form is organized so that a 'no' response in any multi-response field (e.g., pain from maximum unassisted opening in the temporalis muscle) will complete that set of response options; in contrast, a 'yes' response requires that the remainder of the response options (e.g., familiar pain, familiar headache, and referred pain) be completed.

## 4.5 Specifications

EXAM ITEM	COMMUNICATION TO PATIENT	EXAMINER PROCEDURE
<b>E1. Examiner Confirmation of Pain and Headache Locations</b>		
<p><i>Scope of examination: anatomic areas of interest</i></p> <p><i>Figure 1</i></p>	<p>Inform the patient that his or her head and face will be examined with respect to the areas as indicated.</p>	<ul style="list-style-type: none"> <li>● The examiner touches bilaterally the overall areas of the temporalis, masseter, TMJ, and posterior mandibular and submandibular muscle areas.</li> <li>● The examiner informs the patient that pain from the inside of the mouth should also be reported.</li> </ul>
<p><i>E1a</i></p> <p><i>Location of pain in the last 30 days.</i></p> <p><i>Figures 2 &amp; 3</i></p>	<p>Ask the patient if s/he has experienced any pain in areas just identified via touch in <i>the last 30 days</i>.</p> <p>If s/he answers "YES", ask him or her to point with one fingertip to each of the areas where s/he has felt pain <i>in the last 30 days</i>.</p> <p>IF "YES", tell him or her that you want to confirm where s/he is reporting pain.</p>	<ul style="list-style-type: none"> <li>● Examiner touches the reported area(s) of pain to confirm that the pain is located in a masticatory structure(s).</li> </ul>
<p><i>E1b</i></p> <p><i>Location of headache in the last 30 days.</i></p>	<p>Ask the patient if s/he has experienced any headache in <i>the last 30 days</i>.</p> <p>If s/he answers "YES", ask him or her to point with one fingertip to each of the areas where s/he has felt headache <i>in the last 30 days</i>.</p> <p>IF "YES", tell him or her that you want to confirm where s/he is reporting headache.</p>	<ul style="list-style-type: none"> <li>● Examiner touches the reported area(s) of pain to confirm the headache location(s).</li> </ul>
<b>E2. Incisal Relationships</b>		
<p><i>Select maxillary and mandibular reference teeth</i></p>	<p>&lt;none&gt;</p>	<ul style="list-style-type: none"> <li>● Typically the measurements done in this section use either the right or left pair of maxillary and mandibular central incisors.</li> <li>● Use the same two reference teeth for all subsequent measurements.</li> </ul>

EXAM ITEM	COMMUNICATION TO PATIENT	EXAMINER PROCEDURE
<p><i>Reference line – vertical overlap</i></p> <p><i>Figure 4</i></p>	<p>Ask patient to gently place his or her back teeth completely together (where they fit together the best).</p>	<ul style="list-style-type: none"> <li>● With a pencil, mark the horizontal reference line where the incisal edge of the mesial-distal center of the maxillary reference tooth overlaps the opposing mandibular incisor.</li> <li>● If anterior cross-bite, reverse the instructions.</li> </ul>
<p><i>Reference line – mandibular reference midline</i></p> <p><i>Figures 5 &amp; 6</i></p>	<p>If needed, then ask patient to open slightly so that the mandibular embrasures can be observed.</p>	<ul style="list-style-type: none"> <li>● Assess maxillary and mandibular dental midlines; coincidental (&lt; 1mm) maxillary and mandibular dental midline is considered 0 mm discrepancy and requires no further attention.</li> <li>● If midline <math>\geq</math> 1 mm, then mark vertical line on face of maxillary reference tooth and extend down to the mandibular reference tooth. Record “N/A” on exam form.</li> <li>● Two other options are described in Section 5.</li> </ul>
<p><i>Horizontal incisal overjet</i></p> <p><i>Figure 7</i></p>	<p>Ask patient to gently place his or her back teeth completely together (where they fit together the best).</p>	<ul style="list-style-type: none"> <li>● Verify teeth are in maximum intercuspation but without clenching.</li> <li>● Measure the distance from the midpoint of the labial surface of the selected maxillary central incisor to the labial surface of the opposing mandibular incisor on a horizontal plane.</li> <li>● If anterior cross-bite is present, then mark “negative”.</li> </ul>
<p><i>Vertical incisal overlap</i></p> <p><i>Figure 8</i></p>	<p>Ask patient to open sufficiently to measure the vertical overlap.</p>	<ul style="list-style-type: none"> <li>● Measure the distance that the maxillary tooth overlaps the mandibular tooth.</li> <li>● If an anterior open-bite is present, measure the distance between the edges of the maxillary and mandibular incisors and mark “negative.”</li> <li>● If anterior cross-bite is present, reverse the above instructions.</li> </ul>

EXAM ITEM	COMMUNICATION TO PATIENT	EXAMINER PROCEDURE
<b>E3. Opening Pattern (Supplemental)</b>		
<i>Opening Pattern</i> <i>Figures 9 &amp; 10</i>	Ask patient to open as wide as s/he can, even if it is painful.	<ul style="list-style-type: none"> <li>● Observe if the opening movement is: straight (no observed deviation: &lt; 2mm to either side), corrected (i.e., S- or C-curve deviation <math>\geq 2</math> mm), or uncorrected (i.e., lateral deviation <math>\geq 2</math> mm). For uncorrected deviation, observe with full opening if the deviation is to the right or left side.</li> </ul>
<b>E4. Open Movements</b>		
<i>E4A. Pain-free opening</i> <i>Figure 11</i>	Ask patient to open his or her mouth as wide as he can without feeling any pain or, if s/he is already experiencing pain, to open as wide as s/he can without increasing his or her current pain.	<ul style="list-style-type: none"> <li>● Measure the interincisal distance between the maxillary and mandibular reference teeth.</li> </ul>
<i>E4B. Maximum unassisted opening</i> <i>Figure 12</i>	Ask patient to open as wide as s/he can, even if it is painful.	<ul style="list-style-type: none"> <li>● Measure the interincisal distance between the maxillary and mandibular reference teeth.</li> </ul>
<i>E4B. Post-MUO pain</i> <i>Figure 13</i>	Ask patient to identify with his or her finger(s) all of the areas where pain was experienced. Conduct Pain Interview.	<ul style="list-style-type: none"> <li>● Confirm the anatomical structure(s) that the patient identified as the site(s) of his or her pain.</li> </ul>
<i>E4C. Maximum assisted opening</i> <i>Figure 14</i>	Obtain permission from the patient to “stretch” his or her mouth open further. Inform the patient that if s/he wants you to stop, to raise his or her hand.	<ul style="list-style-type: none"> <li>● After the patient opens, place thumb on the patient’s maxillary central incisors, and cross index finger over to the mandibular central incisors.</li> <li>● Using moderate pressure, push the mouth open further.</li> <li>● Measure the interincisal distance between the maxillary and mandibular teeth.</li> <li>● It is critical that this measurement is at least the same as was measured for Maximum Unassisted Opening.</li> </ul>
<i>E4C Post-MAO pain</i> <i>Figures 15 &amp; 16</i>	Ask patient to identify with his or her finger(s) all of the areas where pain was experienced as a result of the examiner’s manipulation. Conduct Pain Interview.	<ul style="list-style-type: none"> <li>● Confirm the anatomical structures that the patient identified as the sites of his or her pain.</li> </ul>
<i>E4D. Opening terminated</i>	<none>	<ul style="list-style-type: none"> <li>● Record whether or not the patient raised his or her hand to terminate.</li> </ul>

EXAM ITEM	COMMUNICATION TO PATIENT	EXAMINER PROCEDURE
<i>E4E. Adjusting vertical measurements; see Section 2 for further detail</i>	<none>	<ul style="list-style-type: none"> <li>● The measurements of pain-free, maximum unassisted, and maximum assisted opening represent the gap between the incisal edges.</li> <li>● Total opening is the sum incisal overbite + the measured opening between incisal edges.</li> </ul>
<b>E5. Lateral &amp; Protrusive Movements</b>		
<i>E5A Right lateral excursion Figure 17 Also: Figure 21</i>	Ask patient to open slightly, and to move his or her jaw as far as s/he can to the right, even if it is painful.	<ul style="list-style-type: none"> <li>● Measure from the maxillary reference midline to the mandibular reference midline.</li> </ul>
<i>E5A Post excursion pain Figure 18</i>	Ask patient to identify with his or her finger(s) all of the areas where pain was experienced with the movement. Conduct Pain Interview.	<ul style="list-style-type: none"> <li>● Confirm the anatomical structure(s) that the patient identified as the site(s) of his or her pain.</li> </ul>
<i>E5B Left lateral excursion Figure 19 Also: Figure 21</i>	Ask patient to open slightly, and to move his or her jaw as far as s/he can to the left, even if it is painful.	<ul style="list-style-type: none"> <li>● Measure from the maxillary reference midline to the mandibular reference midline.</li> </ul>
<i>E5B Post excursion pain Figure 18</i>	Ask patient to identify with his or her finger(s) all of the areas where pain was experienced with the movement. Conduct Pain Interview.	<ul style="list-style-type: none"> <li>● Confirm the anatomical structure(s) that the patient identified as the site(s) of his or her pain.</li> </ul>
<i>E5C Protrusive excursion Figure 20</i>	Ask patient to open slightly, and to move his or her jaw as far as s/he can forward, even if it is painful.	<ul style="list-style-type: none"> <li>● Measure the distance from the buccal surface of the mandibular tooth to the buccal surface of the maxillary tooth .</li> </ul>
<i>E5C Post protrusion pain Figure 18</i>	Ask patient to identify with his or her finger(s) all of the areas where pain was experienced with the movement. Conduct Pain Interview.	<ul style="list-style-type: none"> <li>● Confirm the anatomical structure(s) that the patient identified as the site(s) of his or her pain.</li> </ul>
<i>E5D. Adjusting lateral and protrusive movements; see Section 2 for further detail</i>	<none>	<ul style="list-style-type: none"> <li>● In order to accurately compare right and left lateral movements and to report lateral range of motion, measured right and left lateral movements need to be adjusted by incorporating any midline deviation,</li> <li>● To report full protrusion, add the incisal overjet (horizontal overlap) to the protrusive measurement.</li> </ul>

EXAM ITEM	COMMUNICATION TO PATIENT	EXAMINER PROCEDURE
<b>E6. TMJ Noises During Open &amp; Close Movements</b>		
<i>Instructions regarding joint noises</i>  <i>Figure 22</i>	Inform patient that the jaw joints will be evaluated for noises and would like him or her to pay attention as well, since you will ask the patient at the end whether s/he heard or felt any noises.	<ul style="list-style-type: none"> <li>● Fingers are placed over the TMJ(s).</li> </ul>
<i>Full closure of mandible</i>	Ask patient to firmly place his or her back teeth completely together (where they fit together the best).	<ul style="list-style-type: none"> <li>● Verify the teeth are in MICP.</li> </ul>
<i>Opening and closing joint noises</i>	Ask patient to slowly open as wide as s/he can regardless of pain, and then slowly close until his or her back teeth are completely together again.  Repeat 2 more times.	<ul style="list-style-type: none"> <li>● Record a noise as a “click” or “crepitus” if it is present on at least 1 of the 3 movements. Multiple types of noises can be present in a single joint.</li> </ul>
<i>Patient report of joint noises</i>	Ask patient if s/he heard or felt any noises on either side when s/he opened and closed.  If YES, ask what type of noise s/he heard in the right and/or left side, including clicking, popping, snapping, grating, grinding, or crunching, or any other noises.	<ul style="list-style-type: none"> <li>● Record patient’s response</li> </ul>
<i>Pain inquiry</i>	If patient reported clicking, popping or clicking noises, ask him or her if s/he experienced pain WHEN the noise occurred on one or both sides.  If pain was experienced, ask if the pain was familiar.	<ul style="list-style-type: none"> <li>● Record patient’s response</li> </ul>
<b>E7. TMJ Noises During Lateral &amp; Protrusive Movements</b>		
<i>TMJ noises during lateral and protrusive movements</i>  <i>Figure 23</i>	Ask patient to place his or her back teeth completely together (where they fit together the best), then to open slightly and move his or her jaw to the right as far as he can regardless of pain, and then move it back to its normal position and place his or her back teeth completely together. Repeat 2 more times.  Repeat same procedure with left lateral and protrusive movements.	<ul style="list-style-type: none"> <li>● Place fingers over the TMJ(s)</li> </ul>

EXAM ITEM	COMMUNICATION TO PATIENT	EXAMINER PROCEDURE
<i>Inquiry regarding joint noises</i>	<p>After completing each movement, ask patient if s/he heard or felt any noises on either side.</p> <p>If YES, ask what noise s/he heard in the right and/or left side, including clicking, popping, snapping, grating, grinding, or crunching, or any other noises.</p>	<ul style="list-style-type: none"> <li>● Record patient's response</li> </ul>
<i>Pain inquiry</i>	<p>If patient reports clicking, popping or clicking noises, ask him or her if s/he experienced pain WHEN the noise occurred on one or both sides.</p> <p>If pain was experienced, ask if the pain was familiar.</p>	<ul style="list-style-type: none"> <li>● Record patient's response.</li> </ul>
<b>E8. Joint Locking</b>		
<i>Locking Closed</i>	<p>For observed closed lock during the examination:</p> <p>Ask patient if s/he can "unlock" his or her jaw.</p>	<ul style="list-style-type: none"> <li>● Inability to further open the mouth from a partially opened position, even momentarily, is positive.</li> <li>● Record if the patient or examiner reduced the closed lock or if it could not be reduced.</li> </ul>
<i>Locking Open</i>	<p>For observed open lock during the examination:</p> <p>Ask patient if s/he can "unlock" his or her jaw.</p>	<ul style="list-style-type: none"> <li>● Inability to close the mouth from a wide-open position, even momentarily, is positive.</li> <li>● Also record if the patient or examiner reduced the open lock or if it could not be reduced.</li> </ul>
<b>E9. Muscle and TMJ Pain with Palpation</b>		
<i>General</i> <i>Figure 24</i>	<none>	<p>Select coverage method for palpation of the larger muscles: comprehensive where every part of the muscle is palpated, or sampling areas of the muscle.</p> <p>Select time duration for stimulus application: (a) 2 seconds for efficiency and ignoring referred pain diagnosis, (b) 5 seconds to minimize false negative diagnoses of referred pain and to better identify hyperalgesia, or (c) blend of 2 and 5 seconds.</p>

EXAM ITEM	COMMUNICATION TO PATIENT	EXAMINER PROCEDURE
<i>Temporalis and masseter muscles</i> <i>Figures 24 &amp; 26-30</i>	Inform the patient that you will ask him or her whether s/he feels pain or not when you press on different areas on his or her head and jaw. You can ask the patient to clench the teeth in order to identify the borders of the muscle.  Conduct Pain Interview.	<ul style="list-style-type: none"> <li>● Palpate the masseter and temporalis, muscles, one side at a time.</li> <li>● The intent is to palpate the whole muscle, including the tendonous attachments. To maximize systematic coverage, use three vertical bands for the temporalis and use three horizontal bands for the masseter.</li> <li>● Apply 1 kg of pressure.</li> </ul>
<i>TMJ: lateral pole</i> <i>Figures 31-33</i>	Ask the patient to slide his or her jaw forward and back in order to identify the lateral pole of the TMJ.  Conduct Pain Interview.	<ul style="list-style-type: none"> <li>● Place index finger anterior to the tragus of the ear and over their lateral pole.</li> <li>● Apply 0.5 kg of pressure</li> </ul>
<i>TMJ: around lateral pole</i> <i>Figures 34-36</i>	Ask patient to slide his or her jaw forward and back in order to identify the lateral pole of the TMJ. Then ask the patient, if necessary, to hold his or her jaw slightly forward, in order to maintain the TMJ lateral pole in an accessible position.  Conduct Pain Interview.	<ul style="list-style-type: none"> <li>● Place index fingertip over lateral pole.</li> <li>● Roll your finger around the lateral pole of the condyle; your finger should orbit completely around the lateral pole without losing contact with the lateral pole.</li> <li>● Apply 1 kg of pressure</li> </ul>
<b>E10. Supplemental palpation sites (0.5 kg)</b>		
<i>Posterior mandibular region</i> <i>Figures 37, 39</i>	Ask patient to relax his or her jaw.  Conduct Pain Interview.	This region is defined as that area between the insertion of the SCM and the posterior border of the mandible.
<i>Submandibular region</i> <i>Figures 37, 39</i>	Ask patient to relax his or her jaw.  Conduct Pain Interview.	This region is defined as the area 2 cm anterior to the angle of the mandible, and medial to the mandible.
<i>Lateral pterygoid area</i> <i>Figure 40</i>	Ask patient to open and move the jaw to the side that is being examined.  Conduct Pain Interview.	Ask patient to move his or her mandible toward the same side, and place finger on buccal side of alveolar ridge above the maxillary molars and move finger posteriorly, medially, and upward as far as possible, and palpate.
<i>Tendon of the temporalis</i> <i>Figure 41</i>	Ask patient to open his or her mouth.  Conduct Pain Interview.	Place finger on anterior ridge of the coronoid process. Palpate on the superior aspect of the process.



EXAM ITEM	COMMUNICATION TO PATIENT	EXAMINER PROCEDURE
<b>E11. Examiner Comments</b>		
	<none>	<ul style="list-style-type: none"><li>● Record any pertinent findings not included above.</li></ul>
<b>END OF DC/TMD EXAMINATION</b>		

## 5 Complete Specifications for DC/TMD Examination

### 5.1 Overview

The Complete Specifications are intended to facilitate maximal reliability in clinical technique for the researcher and clinician.

The verbal commands and associated procedures used for each component of the clinical examination are listed in a table format for ready reference. The reader should refer to Section 2 (General Instructions) and Section 3 (Description of DC/TMD Examination Procedures) for further details regarding these procedures. Figures, as referenced below, are found in Section 7. The enumeration of the examination procedures in this section corresponds to the enumeration in Section 3 and to the DC/TMD Examination Form (Section 9). Section 6 contains the Examination-Related Pain Interview, which is repeatedly referenced in the below Protocol. Section 8 lists only the required verbal commands (See 5.1, Conventions for clarification), which serve two purposes: facilitate learning the core component of the structured examination, and the required commands are the only part of the DC/TMD Clinical Examination Protocol that must be translated for use of the examination specifications in another language.

### 5.2 Conventions for Section 5.3

1. “Verbal Commands” as used by the examiner are of four forms:
  - a. **Bold text** identifies verbal commands that should be stated verbatim by the examiner.
  - b. Non-bold text identifies verbal commands or statements for which strict implementation is not expected. The examiner should follow the intent of the command or statement and convey that intent to the patient.
  - c. [Square-bracketed text] denotes optional commands.
    - i. “Place your mouth in a comfortable position [with your back teeth apart]” refers to a standard reference position by the patient which is required prior to most examination procedures. This command is used contingently on what the patient does. If the patient automatically returns his/her mandible to a “comfortable position” after completion of a procedure, then nothing more needs to be done by the examiner. Otherwise, the examiner should use the command. It is included with each set of procedures in order to remind the examiner that the next procedure takes as its starting point this neutral position.
    - ii. All other optional commands address common situations and should be used as needed depending on the patient response during the examination procedure.
  - d. <Angle-bracketed text> identifies instructions to the examiner.
2. Italicized text denotes comments and clarifications regarding verbal commands; overlap between the comments and clarifications in this section and that in Sections 1 and 2 is intentional.
3. ALL UPPERCASE TEXT under “Verbal Commands” or “Examiner Procedures” denotes conditional instructions.
4. [Response options] are placed between vertical bars.

## 5.3 Specifications

CONSTRUCT	VERBAL COMMAND	EXAMINER PROCEDURE
<b>E1. Examiner Confirmation of Pain and Headache Locations</b>		
<i>Identifying information</i>	<none>	Examiner enters patient name, examiner name, and date on examination form.
<i>Instructions to the patient</i>	<p><b>Before I start the exam, I want to review a few things with you.</b></p> <p><b>I will be asking you about pain, and only you know if you have pain. When I ask about pain, I want you to say either yes or no; if you are not sure, give me your best answer.</b></p> <p><b>If you feel pain, I will also ask if that pain is familiar. Familiar pain refers to pain that is similar or like the pain you may have had in that same part of your body in the last 30 days.</b></p> <p><b>If you feel pain in the temple area, I will ask if that pain is like any headache you may have had in the temple area in the last 30 days.</b></p>	<ul style="list-style-type: none"> <li>● Pain as defined here is absolute but translation into local terms (or other language) requires attention to cultural standards. Intention is to clearly place responsibility for determination of pain on the patient, and the only response that can be accepted is either “yes” or “no”.</li> <li>● Definition of “familiar pain” may require some elaboration when it is first asked during the examination. Other related words include “similar” or “feels like”.</li> </ul>
<i>Scope of examination: anatomic areas of interest</i> <i>Figure 1</i>	<p><b>For the purposes of this examination, I am interested in pain that you may have in these areas....</b></p> <p><b>.... and also inside the mouth.</b></p>	<ul style="list-style-type: none"> <li>● Examiner touches, bilaterally at the same time, the following 4 areas in sequence: temporalis, preauricular, masseter, and posterior/submandibular areas.</li> <li>● Examiner says “here” while touching each of the above areas.</li> <li>● The areas are <u>not</u> named anatomically as they are touched.</li> </ul>
<i>E1a</i> <i>Location of pain: last 30 days</i> <i>Figures 2 &amp; 3</i>	<p><b>In the last 30 days, have you had pain in these areas [that I touched]?</b></p> <p>IF “YES”: <b>Could you point with your finger to each of the areas where you have felt pain [in the last 30 days]?</b></p> <p><b>Are there any other areas where you have felt pain [in the last 30 days]?</b></p> <p>IF “YES”, EXAMINER CONFIRMS: Let me confirm where you just pointed.</p>	<p>IF PATIENT REPORTS NO PAIN IN THE AREAS OF INTEREST:</p> <ul style="list-style-type: none"> <li>● Record “None” for each of right side and left side in Q1a.</li> </ul> <p>IF PATIENT REPORTS PAIN IN THE AREAS OF INTEREST:</p> <ul style="list-style-type: none"> <li>● Examiner inquires into all locations.</li> <li>● Examiner touches involved areas to confirm location with patient and inquires “here?”</li> <li>● Record pain locations in Q1a.</li> </ul>

CONSTRUCT	VERBAL COMMAND	EXAMINER PROCEDURE
<p><i>E1b</i> <i>Location of headache in the last 30 days.</i></p>	<p><b>In the last 30 days, have you had any headaches?</b> IF "YES": <b>Could you point with your finger to each of the areas where you have felt headaches</b> [in the last 30 days]? <b>Are there any other areas where you have felt headaches</b> [in the last 30 days]? IF "YES", EXAMINER CONFIRMS: Let me confirm your headache locations where you just pointed.</p>	<p>IF PATIENT REPORTS NO HEADACHE OR NO HEADACHE IN INDICATED AREAS: ● Record "None" for each of right side and left side in Q1b.</p> <p>IF PATIENT REPORTS HEADACHE: ● Examiner inquires into all locations. ● Examiner touches involved areas to confirm location with patient, and inquires "here?". ● Record pain locations in Q1b.</p>
<p><b>E2. Incisal Relationships</b></p>		
<p><i>Select maxillary and mandibular reference teeth</i></p>	<p><i>In order to visualize the teeth</i> Open slightly.</p> <p>I will place some pencil marks on your teeth; I will remove them at the end of the examination.</p>	<ul style="list-style-type: none"> <li>● The potential maxillary and mandibular reference teeth need to be visualized at the same time as they are selected jointly.</li> <li>● Choose maxillary right central incisor (US #8; FDI #11) if the incisal edge is horizontal, the tooth is vertically oriented, and the tooth is not rotated; else, select tooth US#9 (FDI #21) if it better fits these criteria. See Section 3, E2, for further instructions. Enter selected tooth on the examination form.</li> <li>● Note that the mesial-distal center of the maxillary reference tooth will be the specific maxillary reference position for all vertical and protrusive mobility measurements.</li> <li>● Select mandibular reference tooth, which opposes the mesial-distal center of the maxillary reference tooth.</li> <li>● The location of the incisal edge of the mandibular reference tooth that is opposite the mesial-distal center of the maxillary reference tooth represents the mandibular reference position for all vertical mobility measurements.</li> <li>● The buccal surface of the mandibular reference tooth that is opposite the mesial-distal center of the maxillary reference tooth represents the mandibular reference position for protrusive mobility measurements.</li> </ul>

CONSTRUCT	VERBAL COMMAND	EXAMINER PROCEDURE
<p><i>Reference line – vertical overlap</i></p> <p><i>Figure 4</i></p>	<p><b>Place your back teeth completely together.</b></p>	<ul style="list-style-type: none"> <li>● If anterior cross-bite or open bite, then specific measures will also include marking the “negative” field on the exam form.</li> <li>● With a pencil, mark the horizontal reference line where the central portion of the incisal edge of the maxillary reference tooth overlaps the opposing mandibular incisor.</li> <li>● If anterior cross-bite, reverse the instructions.</li> </ul>
<p><i>Reference line – mandibular reference midline</i></p> <p><i>Figures 5 &amp; 6</i></p>	<p>[Place your back teeth completely together.]</p> <p>&lt;If needed, then ask patient to open slightly so that the mandibular embrasures can be observed.&gt;</p>	<ul style="list-style-type: none"> <li>● Assess maxillary and mandibular dental midlines; if the discrepancy between the maxillary and mandibular dental midline is &lt; 1mm, then record ‘0’ mm.</li> <li>● If the discrepancy in the midline is <math>\geq 1</math> mm, select one of the following:</li> <li>● <b>Method 1:</b> Measure the distance of any discrepancy (<math>\geq 1</math>mm) in the frontal plane between the maxillary and mandibular dental midlines and note the direction of the discrepancy of the mandibular midline relative to the maxillary midline. The mandibular dental midline is now the reference for measuring lateral mandibular movement.</li> <li>● <b>Method 2:</b> Draw a vertical line on the face of the maxillary central incisor and extend the line to the opposing mandibular incisor. The vertical pencil marks on the two incisors are now the reference midlines.</li> <li>● <b>Method 3:</b> Extend, using a vertical pencil mark, the maxillary dental midline onto the corresponding mandibular incisor. The vertical pencil mark on the mandibular incisor is now the reference midline for the mandible.</li> <li>● If anterior cross-bite, reverse the above instructions with regard to maxillary and mandibular.</li> <li>● If using Method 1, record the measurement and direction.</li> <li>● If using Methods 2 or 3, record the value ‘0’.</li> </ul>

CONSTRUCT	VERBAL COMMAND	EXAMINER PROCEDURE
<p><i>Horizontal incisal overjet</i></p> <p><i>Figure 7</i></p>	<p>[Place your back teeth completely together.]</p>	<ul style="list-style-type: none"> <li>● Verify teeth are in maximum intercuspation.</li> <li>● Measure the distance from the mesiodistal midpoint of the facial surface of the selected maxillary central incisor to the facial surface of the opposing mandibular incisor on a horizontal plane.</li> <li>● If anterior cross-bite is present, then mark “negative”.</li> <li>● Record the measurement.</li> </ul>
<p><i>Vertical incisal overlap</i></p> <p><i>Figure 8</i></p>	<p>&lt;Ask patient to open sufficiently to measure the vertical overlap.&gt;</p>	<ul style="list-style-type: none"> <li>● Measure the distance that the maxillary tooth overlaps the mandibular tooth.</li> <li>● If an anterior open-bite is present, measure the distance between the edges of the maxillary and mandibular incisors and mark “negative”.</li> <li>● If anterior cross-bite is present, reverse the above instructions.</li> <li>● Record the measurement.</li> </ul>
<b>E3. Opening Pattern (Supplemental)</b>		
<p><i>Opening Pattern</i></p> <p><i>Figures 9 &amp; 10</i></p>	<p><b>Place your back teeth completely together.</b></p> <p><b>I would like you to slowly open your mouth as wide as you can, even if it is painful, close, and put your back teeth completely together again.</b></p> <p>Repeat 2 more times.</p> <p><u>Alternative Format:</u>  <i>In English, the common expression is “open as wide as you can” but other languages may differ; for example, “as much as you can” is often better in other languages.</i></p>	<ul style="list-style-type: none"> <li>● Observe if the opening movement is: straight (no observed deviation: <math>\leq 2\text{mm}</math> to either side of the midline), corrected (i.e., S- or C-curve deviation, <math>&gt;2\text{mm}</math>), or uncorrected (i.e., lateral deviation, <math>&gt;2\text{mm}</math>).</li> <li>● For uncorrected deviation, observe at full opening if the deviation is to the right or left side.</li> <li>● More than one option may be selected; this allows recording of any type of movement in case the movement is not consistent across repeated trials.</li> <li>● Repeat 2 more times.</li> </ul>
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CONSTRUCT	VERBAL COMMAND	EXAMINER PROCEDURE
<b>E4. Open and Close Movements</b>		
<b>4A. PAIN FREE OPENING</b>		
<i>Ruler position for vertical movement measurements</i>	<none>	<ul style="list-style-type: none"> <li>● Place the '0' edge of a prepared millimeter ruler (see Section 1) at the incisal edge of the mandibular reference tooth.</li> </ul>
<i>E4A Pain-free opening Figure 11</i>	<p><b>I would like you to open your mouth as wide as you can without feeling any pain, or without increasing any pain you may have right now.</b></p> <p><u>Alternative Format:</u> <i>In English, the common expression is "open as wide as you can" but other languages may differ; for example, "as much as you can" is often better in other languages. This alternative format applies to 4B and 4C as well.</i></p>	<ul style="list-style-type: none"> <li>● Measure the inter-incisal distance between the maxillary and mandibular reference teeth.</li> <li>● Record this measurement.</li> </ul>
<b>4B. MAXIMUM UNASSISTED OPENING</b>		
<i>Starting position</i>	<none>	<ul style="list-style-type: none"> <li>● Maximum unassisted opening can often be assessed immediately after taking the measurement for pain-free opening, without intervening closure of the mandible by the patient.</li> </ul>
<i>E4B Maximum unassisted opening Figure 12</i>	<p><b>I would like you to open your mouth as wide as you can, even if it is painful.</b></p>	<ul style="list-style-type: none"> <li>● Use ruler position as under 4A.</li> <li>● Measure the inter-incisal distance between the maxillary and mandibular reference teeth.</li> <li>● Record this measurement.</li> </ul>
<i>E4B Post-MUO pain Figure 13</i>	<p><b>Did you feel any pain with this movement?</b></p> <p>See PAIN INTERVIEW 6.2.1: Maneuver-induced pain 6.2.4: Familiar pain</p>	<ul style="list-style-type: none"> <li>● Confirm the anatomical structures that the patient identified as the sites of pain.</li> <li>● Record this finding.</li> </ul>
<b>4C. MAXIMUM ASSISTED OPENING</b>		
<i>Instructions</i>	<p><b>In a moment I will try, [if possible], to open your mouth wider with my fingers. If you want me to stop, raise your hand and I will stop immediately.</b></p>	<none>

CONSTRUCT	VERBAL COMMAND	EXAMINER PROCEDURE
<p><i>E4C</i> <i>Maximum assisted opening</i> <i>Figure 14</i></p>	<p>I will place my ruler. [pause]</p> <p><b>Now open [your mouth] as wide as you can, even if painful, just as you did before.</b> [pause]</p> <p>You will feel my fingers.</p> <p><b>Please relax your jaw so that I can help you open wider, if possible.</b> [pause]</p>	<ul style="list-style-type: none"> <li>● Use ruler position as under 4A.</li> <li>● Insure that the patient initially opens to the same extent as was measured for Maximum Unassisted Opening.</li> <li>● If not, ask patient to open more.</li> <li>● Place thumb on the patient's maxillary central incisors, and cross index finger over to the mandibular central incisors. (Orientation of fingers is relative to examiner standing in front of the patient.)</li> <li>● Provide support to the mandible with the fingers, before saying "Please relax...".</li> <li>● Using moderate pressure, push the mouth open further, until either (1) you feel resistance from the tissue, or (2) the patient raises his/her hand. NOTE: Use clinical judgment with respect to avoidance of over-stretching.</li> <li>● Measure the inter-incisal distance between the maxillary and mandibular reference teeth.</li> <li>● Record this measurement.</li> </ul>
<p><i>E4C</i> <i>Post –MAO pain</i> <i>Figures 15 &amp; 16</i></p>	<p><b>Did you feel any pain when I tried to open your mouth wider with my fingers?</b></p> <p>See PAIN INTERVIEW 6.2.1: Maneuver-induced pain 6.2.4: Familiar pain</p>	<ul style="list-style-type: none"> <li>● Confirm the anatomical structures that the patient identified as the sites of pain.</li> <li>● Record this finding.</li> </ul>
<b>4D. MAXIMUM ASSISTED OPENING TERMINATED</b>		
<p><i>E4D</i> <i>Opening terminated</i></p>	<p>&lt;none&gt;</p>	<ul style="list-style-type: none"> <li>● Record whether or not the patient raised his/her hand to terminate the opening.</li> </ul>

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CONSTRUCT	VERBAL COMMAND	EXAMINER PROCEDURE
<b>E5. Lateral &amp; Protrusive Movements</b>		
<b>5A. RIGHT LATERAL EXCURSION</b>		
<p><i>E5A</i> <i>Right lateral excursion</i> <i>Figure 17</i> <i>Also: Figure 21</i></p>	<p><b>Open slightly, and move your jaw as far as you can towards the right, even if it is painful.</b></p> <p>Hold your jaw in that position until I take a measurement.</p>	<ul style="list-style-type: none"> <li>● If the patient is confused about which direction to move the jaw, say “Move your jaw towards this hand” and touch the patient’s jaw or shoulder on the side of the desired movement.</li> <li>● Place ruler with zero end aligned with either the maxillary reference midline or the mandibular reference midline, depending on type of ruler.</li> <li>● Measure from the maxillary reference midline to the mandibular reference midline.</li> <li>● If ruler obscures the opposing reference point, move the ruler up or down in order to read the numbers.</li> <li>● Record this measurement.</li> </ul>
<p><i>Return jaw</i></p>	<p>[Move your jaw back to a comfortable position.]</p>	<p>&lt;none&gt;</p>
<p><i>E5A</i> <i>Post excursion pain</i> <i>Figure 18</i></p>	<p><b>Did you feel any pain with that movement?</b></p> <p>See PAIN INTERVIEW 6.2.1: Maneuver-induced pain 6.2.4: Familiar pain</p>	<ul style="list-style-type: none"> <li>● Confirm the anatomical structures that the patient identified as the sites of his or her pain.</li> <li>● Record this finding.</li> </ul>
<b>5B. LEFT LATERAL EXCURSION</b>		
<p><i>E5B</i> <i>Left lateral excursion</i> <i>Figure 19</i> <i>Also: Figure 21</i></p>	<p><b>Open slightly, and move your jaw as far as you can towards the left, even if it is painful.</b></p> <p>Hold your jaw in that position until I take a measurement.</p>	<ul style="list-style-type: none"> <li>● If the patient is confused about which direction to move the jaw, say “Move your jaw towards this hand” and touch the patient’s jaw or shoulder on the side of the desired movement.</li> <li>● Use ruler as for 5A.</li> <li>● Measure from the maxillary reference midline to the mandibular reference midline.</li> <li>● If ruler obscures the opposing reference point, move the ruler up or down in order to read the numbers.</li> <li>● Record this measurement.</li> </ul>
<p><i>Return jaw</i></p>	<p>[Move your jaw back to a comfortable position.]</p>	<p>&lt;none&gt;</p>

CONSTRUCT	VERBAL COMMAND	EXAMINER PROCEDURE
<i>E5B</i> <i>Post excursion pain</i> <i>Figure 18</i>	<b>Did you feel any pain with that movement?</b> See PAIN INTERVIEW 6.2.1: Maneuver-induced pain 6.2.4: Familiar pain	<ul style="list-style-type: none"> <li>● Confirm the anatomical structures that the patient identified as the sites of his or her pain.</li> <li>● Record this finding.</li> </ul>
<b>5C. PROTRUSIVE</b>		
<i>E5C</i> <i>Protrusive excursion</i> <i>Figure 20</i>	<b>Open slightly and move [slide] your jaw forward [straight out in front of you] as far as you can, even if it is painful.</b> Hold your jaw in that position until I take a measurement.	<ul style="list-style-type: none"> <li>● Place ruler with zero end against the mesial-distal center of the maxillary reference tooth and with ruler aligned forward such that the labioincisal edge of the opposing mandibular incisor touches the mm markings on the ruler.</li> <li>● Measure from labial surface of the maxillary reference tooth to the labial surface of the mandibular reference tooth.</li> <li>● Record this measurement.</li> </ul>
<i>Return jaw</i>	[Move your jaw back to a comfortable position.]	<none>
<i>E5C</i> <i>Post protrusion pain</i> <i>Figure 18</i>	<b>Did you feel any pain with that movement?</b> See PAIN INTERVIEW 6.2.1: Maneuver-induced pain 6.2.4: Familiar pain	<ul style="list-style-type: none"> <li>● Confirm the anatomical structures that the patient identified as the sites of his or her pain.</li> <li>● Record this finding.</li> </ul>
<b>E6. TMJ Noises During Open &amp; Close Movements</b>		
<i>General instructions to examiner</i>	<none>	<ul style="list-style-type: none"> <li>● Patients may use a variety of terms for the single-occurrence joint noise (e.g., “click”, “pop”, “snap”); any of these terms denote a “click” for purposes of the exam, and the instructions below refer to the term “Click” on the recording form.</li> <li>● Patients may use a variety of terms for the fine, multiple-occurrence joint noise (e.g., “grating”, “grinding”, “crepitus”); any of these terms denotes “crepitus” for purposes of the examination, and the instructions below refer to the term “Crepitus” on the recording form.</li> </ul>

CONSTRUCT	VERBAL COMMAND	EXAMINER PROCEDURE
<p><i>Hand position for palpation of joint noise</i></p> <p><i>Figure 22</i></p>	<p>&lt;none&gt;</p>	<ul style="list-style-type: none"> <li>● Use of bilateral or unilateral palpation depends on examiner preference and circumstances.</li> <li>● <b>Bilateral palpation:</b> Place finger of each hand over the corresponding TMJ. This method requires that the patient monitor noises from both TMJs at the same time, which may be difficult.</li> <li>● <b>Unilateral palpation:</b> Use same finger placement for a single joint, as described for bilateral palpation, assessing first the right TMJ and then the left TMJ.</li> <li>● Repeat following instructions for each TMJ separately.</li> </ul>
<p><i>Instructions regarding joint noises</i></p>	<p><b>I will be evaluating the jaw joints for whether they make any noises. I would like you to pay attention as well, since I will ask you at the end whether you heard or felt any noises.</b></p> <p>[Focus on both joints.]</p>	<ul style="list-style-type: none"> <li>● If doing bilateral palpation, touch both joints and ask patient to attend to both joints.</li> <li>● If doing unilateral palpation, touch the targeted joint and ask patient to attend to that joint.</li> </ul>
<p><i>Full closure of mandible</i></p>	<p><b>Place your back teeth completely together.</b></p>	<ul style="list-style-type: none"> <li>● Insure that the teeth are in maximal intercuspal position in order to insure that the TMJ is in the closed position.</li> </ul>
<p><i>Examiner detection of open and closing joint noises</i></p>	<p><b>Slowly open as wide as you can, even if it is painful, and then slowly close until your back teeth are completely together again.</b></p> <p><b>Repeat 2 more times.</b></p>	<ul style="list-style-type: none"> <li>● Mandible should be opened and closed slowly, allowing about 2 seconds to open and about 2 seconds to close. Guide patient accordingly.</li> <li>● At the end of closing, distinguish noises from teeth contacting.</li> <li>● Record a noise as a “click” or “crepitus” if it is present on at least 1 of the 3 movements. Multiple types of noise can be present in a single joint.</li> </ul>
<p><i>Patient inquiry regarding joint noises</i></p>	<p><b>Did you hear or feel noises in either jaw joint when you opened or closed?</b></p> <p>IF “YES”: <b>What type of noise?</b></p> <p>&lt;The patient may be prompted by offering the words of different jaw joint sounds: click, pop, snap, grate, grind, crunch.&gt;</p>	<ul style="list-style-type: none"> <li>● Examiner can interview patient if necessary in order to confirm location (right vs left, or both) of noises.</li> <li>● If patient detects joint noise but is unable to classify the noise as a click or crepitus, then examiner may repeat the open-close movement again in order for the patient to reassess type of noise.</li> </ul>

CONSTRUCT	VERBAL COMMAND	EXAMINER PROCEDURE
<p><i>Pain inquiry</i></p>	<p>IF PATIENT REPORTS CLICK:  <b>Did you feel any pain when that click occurred?</b></p> <p>See PAIN INTERVIEW                      6.2.3: Click-related pain                      6.2.4: Familiar pain</p>	<p>IF EXAMINER DETECTS CLICK BUT PATIENT CANNOT DETECT THE NOISE, THEN "No" IS RECORDED FOR PATIENT DETECTION OF NOISE.</p>
<p><b>E7. TMJ Noises During Lateral &amp; Protrusive Movements</b></p>		
<p><i>General</i> <i>Figure 23</i></p>	<p>&lt;none&gt;</p>	<ul style="list-style-type: none"> <li>● Fingers are placed in the same position as indicated for TMJ noises on open and close.</li> <li>● Noises with excursive movement may be assessed while palpating both TMJs simultaneously or palpating one joint at a time.</li> <li>● Instructions below are written for examination of one joint at a time, but bilateral palpation and assessment is permitted.</li> <li>● Repeat instructions for other joint if examining each joint separately.</li> </ul>
<p><i>Joint noises: lateral and protrusive movements</i></p>	<p><b>Place your back teeth completely together, open slightly, and move your lower jaw to the right as far as you can, even if painful; move your jaw back and place your back teeth completely together.</b></p> <p><b>Repeat 2 more times.</b></p> <p><b>Place your back teeth completely together, open slightly, and move your lower jaw to the left as far as you can, even if painful; move your jaw back and place your back teeth completely together.</b></p> <p><b>Repeat 2 more times.</b></p> <p><b>Place your back teeth completely together, open slightly, and move your lower jaw forward as far as you can, even if painful; move your jaw back, and place your back teeth completely together.</b></p> <p><b>Repeat 2 more times.</b></p>	<ul style="list-style-type: none"> <li>● Place fingers over the TMJ(s)</li> <li>● If the patient is confused about which direction to move the jaw, say "Move your jaw towards this hand" and touch the patient's jaw or shoulder on the side of the desired movement.</li> <li>● Diagnosis of disc displacement with reduction requires presence of either a click during both opening <u>and</u> closing movements, OR a click during one of open <u>or</u> closing movements coupled with a click during any of protrusion, right lateral, or left lateral movement.</li> <li>● The presence of both types of noise (click and crepitus) in a joint in any direction may be sufficient finding for this test to then be stopped, depending on what other information the examiner wishes to obtain (such as whether a noise occurs in a particular movement).</li> <li>● Record this finding.</li> </ul>

CONSTRUCT	VERBAL COMMAND	EXAMINER PROCEDURE
<i>Inquiry regarding joint noises</i>	<p><b>Did you hear or feel any noises in this [right, left] joint when you moved your jaw forward or to the side?</b></p> <p>IF "YES": <b>What type of noise?</b></p> <p>&lt;The patient may be prompted with the words of different jaw joint sounds: click, pop, snap, grate, grind, crunch.&gt;</p>	<ul style="list-style-type: none"> <li>● Examiner touches the patient's right TMJ while asking the question.</li> <li>● Examiner can interview patient if necessary in order to localize location (right vs left) of noises.</li> </ul>
<i>Pain inquiry</i>	<p>IF PATIENT REPORTS CLICK: <b>Did you feel any pain when that click occurred?</b></p> <p>See PAIN INTERVIEW 6.2.3: Click-related pain 6.2.4: Familiar pain</p>	<ul style="list-style-type: none"> <li>● Record this finding.</li> </ul>
<i>Repeat for left joint</i>	<none>	<ul style="list-style-type: none"> <li>● Repeat all of the above for the left joint if assessing joints separately.</li> </ul>
<b>E8. Joint Locking</b>		
<i>Locking Closed</i>	<p>&lt;For observed closed lock during the examination:&gt;</p> <p><b>Can you "unlock" your jaw?</b></p>	<ul style="list-style-type: none"> <li>● Inability to further open the mouth from a partially opened position, even momentarily, is positive.</li> <li>● Record if the patient or examiner reduced the closed lock or if it could not be reduced.</li> </ul>
<i>Locking Open</i>	<p>&lt;For observed open lock during the examination:&gt;</p> <p><b>Can you "unlock" your jaw?</b></p>	<ul style="list-style-type: none"> <li>● Inability to close the mouth from a wide-open position, even momentarily, is positive.</li> <li>● Record if the patient or examiner reduced the open lock or if it could not be reduced.</li> </ul>

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CONSTRUCT	VERBAL COMMAND	EXAMINER PROCEDURE
<b>E9. Muscle and TMJ Pain with Palpation</b>		
<p><i>General</i></p> <p><i>Figure 24</i></p>	<p>&lt;none&gt;</p>	<ul style="list-style-type: none"> <li>● Select coverage method for palpation of the larger muscles: comprehensive where every part of the muscle is palpated, or sampling areas of the muscle.</li> <li>● Select time duration for stimulus application: (a) 2 seconds for efficiency and ignoring referred pain diagnosis, (b) 5 seconds to minimize false negative diagnoses of referred pain and to better identify hyperalgesia.</li> </ul>
<p><i>Instructions</i></p>	<p><b>Now I am going to apply pressure to different areas of your head, face and jaw, and I will ask you about pain, familiar pain, and familiar headache.</b></p> <p><b>In addition, I will ask whether the pain stays only under my finger or if you feel it also anywhere else besides under my finger.</b></p> <p>I will prompt you with the words “pain?”, “familiar pain?”, “familiar headache?”, and “only under my finger?”.</p> <p>[Inquiry “go anywhere else?” can be used instead of “only under my finger” if the examiner prefers.]</p> <p><b>Each time, I will apply pressure and hold it for 5 seconds.</b></p>	<p>&lt;none&gt;</p>
<p><i>Examiner calibration</i></p> <p><i>Figure 25</i></p>	<p>&lt;none&gt;</p>	<ul style="list-style-type: none"> <li>● Examiner uses “finger algometer” and calibrates the respective finger of each of right and left hand to 1.0 kg.</li> </ul>
<p><i>Temporalis and masseter muscles</i></p> <p><i>Figures 24 &amp; 26-30</i></p>	<p>[Patient can be asked to clench the teeth together in order to identify the borders of the muscles.]</p> <p>[Please relax your jaw.]</p> <p>See PAIN INTERVIEW 6.2.2: Palpation-Induced pain 6.2.4: Familiar pain 6.2.5: Referred pain</p>	<ul style="list-style-type: none"> <li>● Palpate the temporalis and masseter muscles, one side at a time.</li> <li>● Palpate the entire muscle. For systematic coverage, use three vertical zones for the temporalis and use three horizontal bands for the masseter.</li> <li>● Apply 1 kg for total of 5 seconds.</li> <li>● Record findings.</li> </ul>

CONSTRUCT	VERBAL COMMAND	EXAMINER PROCEDURE
<p><i>Examiner calibration</i> <i>Figure 33</i></p>	<p>&lt;none&gt;</p>	<ul style="list-style-type: none"> <li>● Examiner uses “finger algometer” and calibrates the respective finger of each of right and left hand to 0.5 kg; if unsure, use more, not less, force.</li> </ul>
<p><i>TMJ: lateral pole</i> <i>Figures 31-33</i></p>	<p><b>Open slightly, and move [slide] your lower jaw forward and then move [slide] it back to its normal position with your teeth slightly apart.</b></p> <p>See PAIN INTERVIEW 6.2.2: Palpation-Induced pain 6.2.4: Familiar pain 6.2.5: Referred pain</p>	<ul style="list-style-type: none"> <li>● Examine right side first, then examine left side. See Figures as a guide for the location of each individual palpation.</li> <li>● Place index finger anterior to the tragus of the ear and over the patient’s TMJ.</li> <li>● Apply 0.5 kg and hold for 5 seconds.</li> <li>● Record findings.</li> </ul>
<p><i>Examiner calibration</i> <i>Figure 36</i></p>	<p>&lt;none&gt;</p>	<ul style="list-style-type: none"> <li>● Examiner uses “finger algometer” and calibrates the respective finger of each of right and left hand to 1 kg.</li> </ul>
<p><i>TMJ: around lateral pole</i> <i>Figures 34-36</i></p>	<p><b>Open slightly, and move [slide] your lower jaw forward a little bit and keep it there.</b></p> <p>See PAIN INTERVIEW 6.2.2: Palpation-Induced pain 6.2.4: Familiar pain 6.2.5: Referred pain</p>	<ul style="list-style-type: none"> <li>● Examine right side first, then examine left side. See Figures as a guide for the location of each individual palpation.</li> <li>● Place finger at posterior aspect of lateral pole.</li> <li>● Mandible is protruded enough to gain access to the dorsal aspect of the lateral pole but also retain access to the anterior aspect as well.</li> <li>● Roll finger completely around the lateral pole of condyle. The finger should “hug” or contact the lateral aspect of the condylar pole while moving in one smooth circular movement that should take 5 seconds to complete.</li> <li>● Record findings.</li> </ul>

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CONSTRUCT	VERBAL COMMAND	EXAMINER PROCEDURE
<b>E10. Supplemental palpation sites</b>		
<i>Examiner calibration</i> <i>Figure 38</i>	<none>	Examiner uses “finger algometer” and calibrates the respective finger of each right and left hand to 0.5 kg.
<i>Posterior mandibular region</i> <i>Figures 37, 39</i>	<b>Relax your jaw.</b> [Extend your head.] See PAIN INTERVIEW 6.2.2: Palpation-Induced pain 6.2.4: Familiar pain 6.2.5: Referred pain	The target is the posterior digastric muscle. This region is defined as that area between the insertion of the sternocleidomastoid muscle and the posterior border of the mandible.
<i>Submandibular region</i> <i>Figures 37, 39</i>	<b>Relax your jaw.</b> [Drop your chin to your chest.] See PAIN INTERVIEW 6.2.2: Palpation-Induced pain 6.2.4: Familiar pain 6.2.5: Referred pain	The target is the medial pterygoid muscle. This region is defined as the area 2 cm anterior to the angle of the mandible, and medial to the mandible.
<i>Lateral pterygoid area</i> <i>Figure 40</i>	<b>Open slightly and move your jaw to the side.</b> See PAIN INTERVIEW 6.2.2: Palpation-Induced pain 6.2.4: Familiar pain 6.2.5: Referred pain	The target is the lateral pterygoid muscle. Place finger on buccal side of alveolar ridge above the maxillary molars and move finger distally, superiorly, and medially and palpate.
<i>Tendon of the temporalis</i> <i>Figure 41</i>	<b>Open your mouth.</b> See PAIN INTERVIEW 6.2.2: Palpation-Induced pain 6.2.4: Familiar pain 6.2.5: Referred pain	Place finger on anterior ridge of the coronoid process. Palpate on the superior aspect of the process.
<b>E11. Examiner Comments</b>		
<i>Examination comments</i>	<none>	Include description of any physical barriers to the examination as well as any exceptions or modifying circumstances.
<b>END OF DC/TMD EXAMINATION</b>		



## 6 Examination-Related Pain Interview

### 6.1 Overview

Examination-related Pain Interview is a structured format for repeatedly eliciting and clarifying the pain status with any positive examination findings. The intent is for the examiner to probe in a neutral manner, with the patient providing the description of any pain experienced.

### 6.2 Structured Pain Interview

ITEM	INTERVIEW QUESTION	COMMENTS
6.2.1	<b>For range of motion maneuver-induced pain</b>	
	<b>Did you feel pain with that movement?</b>	<i>The intent of “with that movement” is whether the procedure caused pain or caused existing pain to change.</i>
	IF YES to pain: <b>Could you point with your finger to each of the areas where you felt pain?</b> <b>Are there any other areas where you felt pain with that movement? Point [with your finger] to those areas.</b> Go to FAMILIAR PAIN INQUIRY.	<i>Refer to STRUCTURAL LOCALIZATION OF PAIN, Section 2.</i>
6.2.2	<b>For palpation-induced pain</b>	
	<b>Did you feel pain [in the area where I applied pressure]?</b>	
	IF YES to pain: Go to FAMILIAR PAIN INQUIRY.	
6.2.3	<b>For click-related pain</b>	
	<b>Was that click painful?</b>	<i>Insure that the patient distinguishes pain concurrent with the click vs pain associated with the movement (i.e., opening, closing, excursive movements).</i>
	IF YES to pain: Go to FAMILIAR PAIN INQUIRY.	
6.2.4	<b>Familiar Pain Inquiry</b>	
	<b>Is this pain familiar to any pain you have experienced in this area in the last 30 days?</b>	<i>COMMENT 1: Regarding “familiar”, the examiner might elaborate with something like “Is this pain familiar, that is, similar or like, the pain that you have experienced in that area in the last 30 days?” Capturing the construct of</i>

ITEM	INTERVIEW QUESTION	COMMENTS
		<p><i>replication is not always straightforward, as described in Section 2.9.</i></p> <p><i>COMMENT 2: When evoked pain intensity differs from usual pain, ask: “Regardless of intensity, is this pain like your usual pain?”</i></p> <p><i>COMMENT 3: While the inquiry about familiar pain relates to the prior 30 days, some patients may volunteer information about possible pain experience in the period preceding the prior 30 days and report that a particular examination-induced pain is “familiar” to that pain. For example, in an individual with recurrent pain who has been pain-free in the 30 days prior to a consultation, palpation might elicit a pain that the patient remembers from a pain episode more than 30 days previously. The default time-frame for pain relevant to a diagnosis per the DC/TMD is the prior 30 days. However, different clinical or research situations may require a different time period. Consequently the time frame for “familiar pain” might need to be altered. Record any alternative time period in Section 11 of the exam form.</i></p>
	<p><b>IF YES TO FAMILIAR PAIN: What is this pain familiar to?</b></p>	<p><i>COMMENT 1: For most clinical patients, the typical response is “the pain that I am complaining about”. Once this reference frame is established in the first several inquiries to positive pain from examination, this question can usually be omitted. An exception occurs when additional information in the history suggests that the disorder underlying the pain complaint overlaps with other potential diagnoses, in which case the inquiry regarding replication of pain can be more extensive.</i></p> <p><i>COMMENT 2: The query, “What is this pain familiar to?” in the patient seeking consultation may also result in new information that augments the history</i></p> <p><i>COMMENT 3: The query, “What is this pain familiar to?” may, in the asymptomatic individual, yield responses clearly not relevant to the present time, or it may yield responses that uncover a symptom history not previously reported. A common response in asymptomatic individuals is to report “familiar pain” referencing a dental visit or procedure.</i></p>
	<p><b>IF TEMPORALIS SITE IS POSITIVE: Is this pain familiar to your headache in this area, in the last 30 days?</b></p>	<p><i>COMMENT 1: If pain is produced in the temporalis region from an examination procedure, the headache replication question is always asked regardless of the response to the more general question regarding “familiar pain”. The responses to these two questions need not be the same.</i></p> <p><i>COMMENT 2. In distinguishing “pain” from “headache”, the most common question from the patient is whether it is sensible that his or her “headache” <u>is</u> familiar but “pain” is <u>not</u> familiar in response to the examination procedure. It is usually sufficient to simply reassure the patient that that</i></p>

ITEM	INTERVIEW QUESTION	COMMENTS
		<p><i>response is fine. Alternatively, the relevant examination procedure can be repeated: (“Would you like me to repeat that procedure?”), and this allows the patient to reassess his/her experience when s/he responds to the pain inquiry questions.</i></p> <p><i>COMMENT 3: When patients report “headache” in other masticatory structures (e.g., masseter region, TMJ region), this inquiry should also be performed for diagnostic purposes. The standard examination form does not have response option for this information but the finding can be recorded in the comments section of the examination form.</i></p> <p><i>COMMENT 4: A 30-day time frame is used here in order to retain congruence with the time-frame for the masticatory system pain. The International Classification of Headache Disorders, version 2 (ICHD-2) criteria specify different time periods for Infrequent, Frequent and for Chronic Tension-Type Headaches. The user may want to alter the reference time period in this protocol for headache in order to be consistent with the ICHD-2 criteria. However, for Headache Secondary to TMD, there are currently no established time periods.</i></p> <p><i>COMMENT 5: Palpation of asymptomatic areas can elicit a positive pain response, and during the inquiry a patient might report that the pain in such areas is “familiar”. It may be that the clinical pain is present in that location and which the patient believed to be asymptomatic, in which case the area is recoded as painful in item 1 of the examination. Alternatively, a patient may report that palpation pain in an asymptomatic location is “familiar” because that pain experience is similar to the pain that is experienced in another area of the body. The response for “familiar” pain in this example is [no] since the pain provoked by examination must be familiar to a pain experienced in the same body region.</i></p>
	Examiner verifies that reported pain areas in Q1 of the exam are consistent with body areas reported as positive for familiar pain.	
<b>6.2.5</b>	<b>Referred Pain Inquiry</b>	
	<b>Did you feel the pain just under my finger, or did you also feel it somewhere else [in different areas of your head, face, or jaw]?</b>	<i>COMMENT 1. For purposes of classifying “referred pain”, the location of perceived pain in response to palpation procedures needs to extend beyond the boundary of the structure that was examined. The examiner determines whether the pain location(s) denote a different anatomic structure or the same structure. Only if the pain is localized in a different anatomic structure is it termed “referred pain”.</i>

ITEM	INTERVIEW QUESTION	COMMENTS
		<p><i>If there is ambiguity with respect to what structure pain is felt in when described as “deep” by the patient, ask the patient to locate on the surface of the area of pain or, as appropriate, to inside the mouth.</i></p> <p><i>COMMENT 2. This inquiry can be productively shortened, as indicated in Section 5.3, to “only under my finger?” for purposes of the repeat administrations associated with an examination that has many positive findings to palpation. An alternative short-hand inquiry is “go anywhere else?”.</i></p>
	<p><b>[Show me where you felt the pain.] Point with your finger to all of the areas where you just felt pain [in response to my pressure].</b></p>	
	<p>After the patient points, ask: <b>Did you feel it anywhere else?</b></p>	

### 6.3 Efficient Completion

After the first several positive responses from pain-provoking procedures and depending on the purpose of the examination and the patient’s ability to easily distinguish the presence of pain, familiar pain, familiar headache, and referred pain, the examiner can instruct the patient to respond to the Pain Interview in a more abbreviated manner. For example, the patient might be instructed to report, in response to positive palpation findings, as follows: “yes, familiar” or “yes, not familiar” in order to eliminate asking whether each positive pain finding is familiar or not. After establishing that positive pain responses are familiar to the patient’s clinical pain from at least 2 positive examination procedures, the examiner need only ask if the pain is familiar but need not ask “familiar to what” unless an area not yet recorded in examination item 1 is reported as positive in response to a procedure.

## 7 Illustrations: Protocol for Calibrated Examination

### E1 Examiner Confirmation of Pain and Headache Location

#### Examiner Instructions of Locations for Pain Reporting



**Figure 1.** Examiner touches each area in turn (from left to right): temporalis, TMJ, masseter, and posterior and sub-mandibular areas. Both sides are touched at the same time, as illustrated. For the temporalis and masseter, the ventral aspects of the fingers contact the entire muscle.

#### Patient Pain Location Reporting

**Figure 2.** (left) Patient is instructed to point with one finger to all of the areas of pain.

(right) Sometimes the patient might use a full hand. Clarify if patient intended to point to the whole area.



#### Examiner Confirmation of Pain and Headache Locations

**Figure 3** (below right). The examiner touches the area(s) where the patient indicated experiencing pain in order to (1) confirm that the touched area is what the patient intended, and (2) identify simultaneously the structure (e.g., muscle, joint).

The left image identifies the TMJ and the right image identifies the masseter muscle. The center image illustrates finger placement for discriminating between muscle and joint. In this position, the patient is asked to clench the teeth—to confirm anatomical landmarks of a muscle, as well as to protrude the mandible—to confirm landmarks of the TMJ.



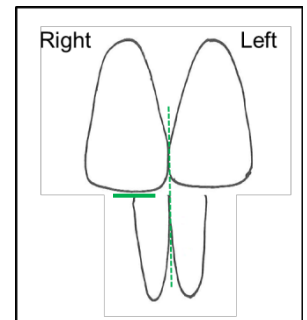
## E2 Incisal Relationships

### Reference Lines

**Figure 4.** Select the maxillary reference tooth. Draw a horizontal line on the facial surface of the opposing mandibular incisor, using the incisal edge of the maxillary incisor as the guide. Insure that the pencil mark is level with the maxillary incisal edge; holding the pencil at an angle to the patient’s horizontal plane will cause the overbite line to be displaced.

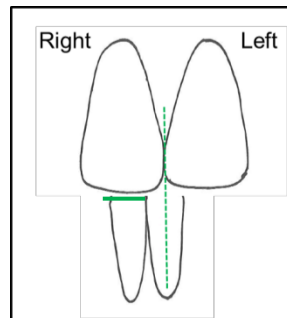


**Figure 5a.** (left) The mesial-incisal edge of the maxillary central incisor (US #8, FDI #11) is within 1.0 mm of being in line with the mandibular incisal midline; these midlines are acceptable landmarks for lateral excursive measurements.

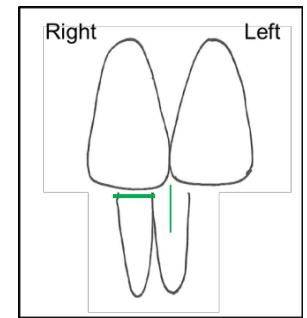


(right) Illustration of congruent midlines; horizontal line from Figure 4 also shown..

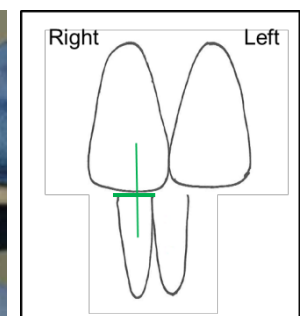
**Figure 5b.** (left) Mesial-incisal edge of the maxillary central incisor is more than 1.0mm away from the mandibular incisal midline. Horizontal line from Figure 4 also shown.



(right) A corresponding vertical line is drawn from the maxillary dental midline down the opposing mandibular incisor. Horizontal line from Figure 4 also shown.



**Figure 6.** (left) Alternative method for creating midline reference lines: draw a vertical line across the face of the maxillary reference incisor and down onto the opposing mandibular incisor.



(right) Illustration of line drawn across center of maxillary central incisor, extending to the opposing mandibular incisor. Horizontal line also shown for vertical overlap.

## Measurements

**Figure 7.** Extent of horizontal overlap is measured. Note that the ruler is contacting the mesial-distal center of the maxillary central incisor. If an incisor is rotated, as the maxillary central incisor is in this instance, the contact position with the incisor will influence the measured horizontal overlap.

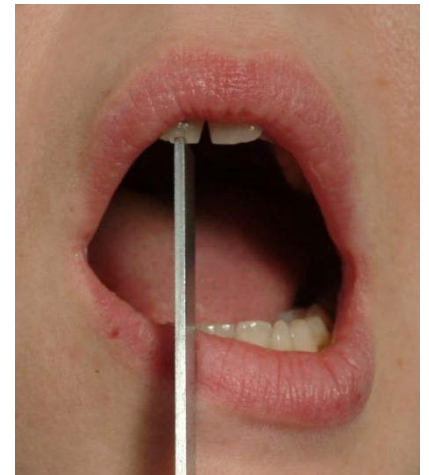


**Figure 8.** Extent of vertical overlap is measured. As shown, the tip of ruler is placed adjacent to the incisal edge, and the distance to the horizontal line is read. Alternatively, especially if the lower lip interferes with ruler placement, the ruler tip may be placed at the line, with the ruler extending toward the maxilla, and the distance to the mandibular incisal edge is read. For all measures, round down to the closest mm.

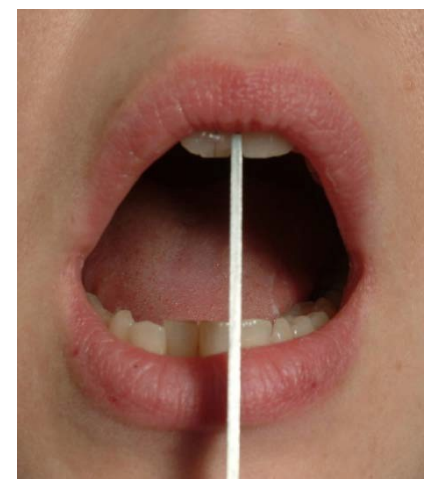


## E3 Opening Pattern (Supplemental)

**Figure 9.** (top) Opening pattern may be assessed with or without any reference lines. Illustrated is a ruler placed against the end of the maxillary central incisor; note that the edge of the ruler is about 2mm from the mesial incisal edge of the right central incisor. Because the lower lip deviated to the patient's left, it appears as though the mandible deviated to the left; however, inspection of the mandibular incisal midline reveals that that midline is also just to the patient's left of the ruler. Since the mandibular midline is within 2 mm of the maxillary midline and because the mandible opened along the path (not shown) illustrated by the ruler, this is a straight opening pattern. See illustrations in Figure 10 for further clarification. If the reference midline is an open incisal embrasure between two teeth (as shown here), placing the ruler against the incisal edge is a stable landmark compared to placing the ruler into the incisal embrasure.



(bottom) In this illustration, the ruler is now placed to the facial side of the incisal embrasure, but *not* in the embrasure between the two maxillary central incisors. Since the mandibular midline has moved more than 2mm to the patient's right during opening, this would be classified as an uncorrected deviation.

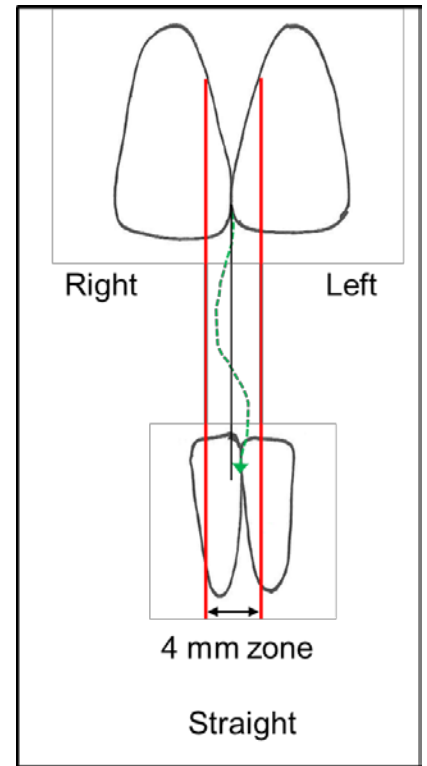
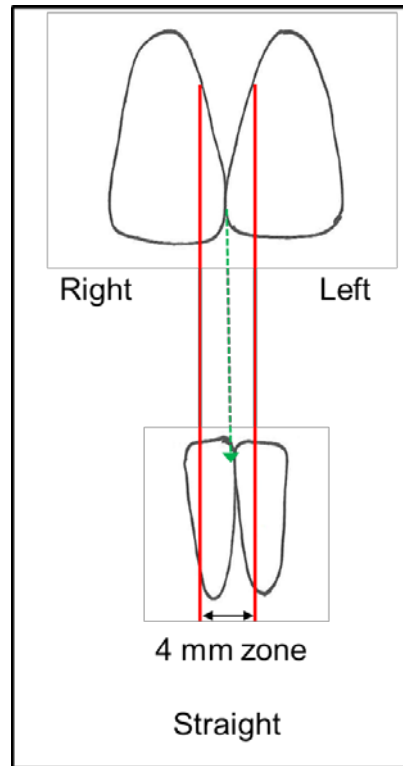


**Figure 10a.** Illustration of the 4 types of opening patterns.

(left) Straight opening; note that mandibular midline is not coincident with maxillary midline.

(right) Slight deviation in opening, but less than 2mm zone from the midline; this is recorded as straight.

**Legend.** Solid red line denotes the 2mm threshold on each of right and left sides from the midline, creating a middle 4mm wide zone. Dotted green line denotes path of mandibular movement. Black line denotes the sagittal midline, as would be visualized if a ruler were placed vertically as shown in Figure 9 (bottom).

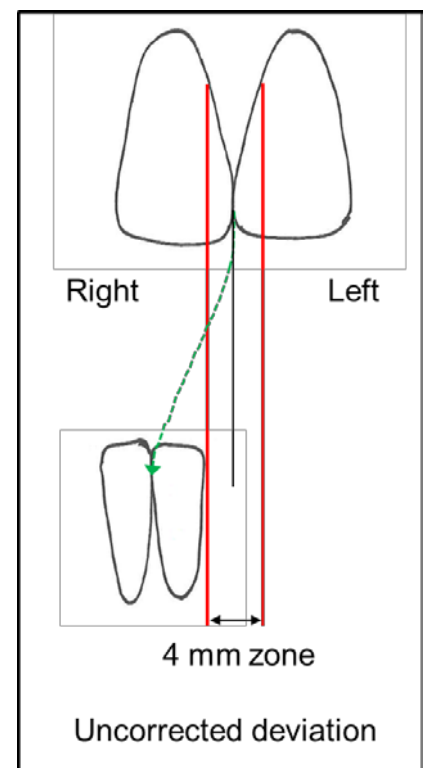
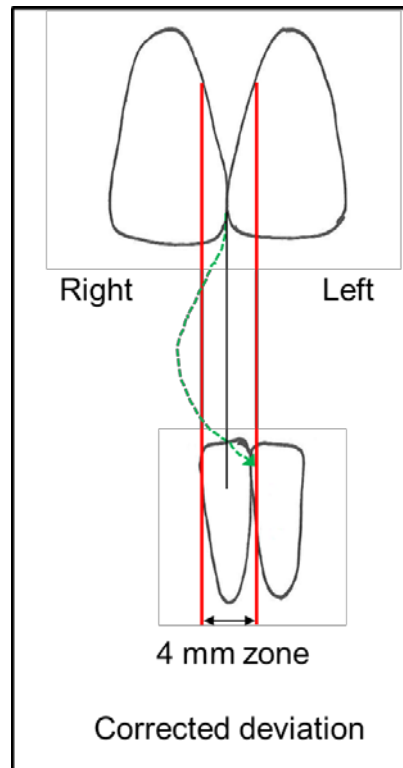


**Figure 10b.** Illustration of the 4 types of opening patterns (continued).

(left) Mandible deviates to the right side, more than 2mm from the midline, and returns to the midline zone (i.e., within the 4mm zone). This would be classified as an corrected deviation.

(right) Mandible deviates to the right side and does not return to the midline zone; this is classified as an uncorrected deviation. The side (whether to the right or left) to which the mandible deviates is also selected.

See Figure 10a for legend.





## **E4    Open Movements**

### **E4\_A    Pain Free Opening**

**Figure 11.** The tip of the ruler is placed against the incisal edge of the mandibular reference incisor, and the distance to the mesial-distal center of the edge of the maxillary central incisor is read. Round the value down to the nearest full mm.



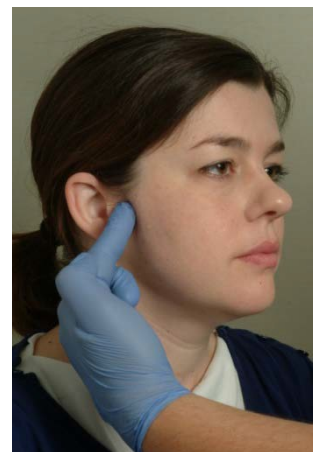
### **E4\_B    Maximum Unassisted Opening**

**Figure 12.** Tip of ruler is placed as before, and patient is asked to open as wide as possible, even if painful.



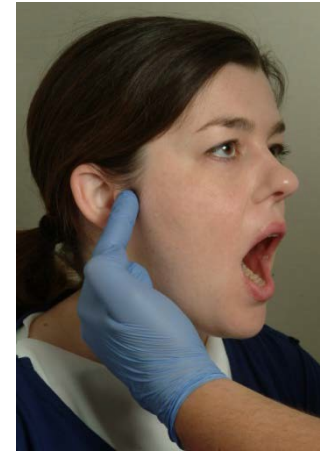
**Figure 13.** (left) Patient is asked to point to any area(s) of pain experienced with this movement.

(right) The examiner touches the indicated area to confirm underlying structure, and then asks if this pain is "familiar".



**Figure 14.** (left) Pain that is provoked by a range of motion procedure is sometimes difficult for the patient to localize after returning the mandible to the closed position. In this instance, the examiner asked the patient to again open as wide as possible, even if painful, and the patient is then asked to point to any area of pain while the mandible is still in the maximally open position.

(right) With the mandible in the same position (i.e., maximally open), the examiner touches the indicated area to confirm underlying structure, and then asks if this pain is “familiar”.



### E4\_C Maximum Assisted Opening

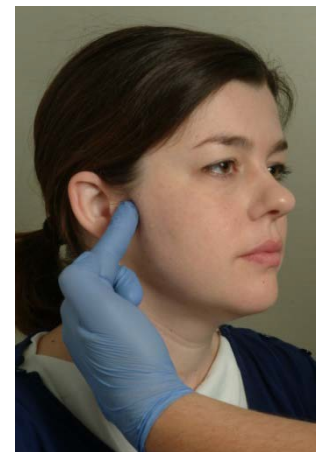
**Figure 15.** Examiner first places the ruler in position and after insuring that the patient opened to the same extent as during the prior Maximum Unassisted Opening, the fingers are placed in the scissors-position and the examiner then stretches the mouth further open, if possible.

(not illustrated) If patient requests examiner to stop, then **E4\_D Opening Terminated** is recorded as “yes”. Otherwise, it is recorded as “no”.



**Figure 16.** (left) Patient is asked to point to any area of pain experienced with this movement.

(right) Examiner touches area to confirm underlying structure, and then asks if this pain is “familiar”.



## **E5** Lateral & Protrusive Movements

### **E5\_A** Right Lateral Excursion

**Figure 17.** Ruler is placed in horizontal position with tip at the mandibular midline reference position. Patient moves mandible to right while examiner retracts lips as necessary with other hand. The extent of movement is 5mm, reading from the mesial-incisal edge of the maxillary right central incisor.



**Figure 18.** Patient is asked to point to any area(s) of pain. As necessary, examiner touches area to confirm underlying structure, and then asks if this pain is “familiar”.



### **E5\_B** Left Lateral Excursion

**Figure 19.** Ruler is placed in horizontal position with tip at the maxillary midline reference position. In this instance, the ruler tip is about 1mm short of being in line with the reference position (i.e., mesial-incisal edge of the maxillary right central incisor), a common source of error with these measurements. Patient moves mandible to left while examiner retracts lips as necessary with other hand. The measured value at the mandibular incisal midline is not quite 6.0mm, so the recorded value would be 5 mm.



The pain location is investigated as described in Figure 18.

### E5\_C Protrusion



**Figure 20.** The ruler is placed in horizontal position with tip on the buccal surface of the maxillary reference tooth (as indicated by the vertical line in the center area of the incisor, which is partially visible in this image). Patient moves mandible in protrusive direction while examiner retracts lips as necessary with other hand.

The pain location is investigated as described in Figure 18.

(left) Ruler is held with face of the ruler directed upward; (right) ruler is held with face of the ruler directed to the side. In this situation, holding the ruler as shown in the left image is generally better than the position shown in the right image since the examiner can read downward from ruler to mandibular incisal edge.

## ALTERNATIVE MEASUREMENT METHOD FOR LATERAL EXCURSIONS

### E5\_A & B Right and Left Lateral Excursions

**Figure 21.** If the alternative vertical reference marks as shown in Figure 6 are used, then lateral excursions are measured as shown. In order to demonstrate the line markings on the mandibular incisors, the ruler is held further away (inferior) from the maxillary incisal edge than would be done in practice.

(top) Ruler is placed in horizontal position with tip at the mandibular midline reference position, as indicated by the vertical line on the mandibular incisor. Patient moves mandible to right while examiner retracts lips as necessary with other hand. The read value on the ruler, corresponding with the vertical reference line on the maxillary reference incisor, is 7mm.

(bottom) Ruler is placed in horizontal position with tip corresponding to the line on the maxillary reference incisor. Patient moves mandible to the left, examiner retracts lips as necessary, and the ruler is read. Although the line on the mandibular incisor is barely visible, the read value is 7mm.



## E6 TMJ Noises During Open & Close Movements



**Figure 22.** The TMJ may be examined in one of two ways. In the left and center illustrations, the examiner is standing off to the side in order to facilitate the photography.

(left) Examine each TMJ separately: the examiner places one fingertip on the skin overlying the right TMJ, and the other hand stabilizes the head.

(center) Examine each TMJ simultaneously: one fingertip from each hand is placed on the skin overlying the respective TMJs.

(right) While palpating the joint, the patient is asked to open and close. The left TMJ would be examined in the same manner.

## E7 TMJ Noises During Lateral & Protrusive Movements



**Figure 23.** As illustrated, the right TMJ is examined while the mandible is moved (left) to the right, (center) to the left, and (right) protrusively. Not shown is the same examination for the left TMJ.

## **E8 Joint Locking**

**There are no illustrations for this part of the examination protocol.**

If no open or closed locking occurred during any part of the examination, then the examination form is marked to indicate that neither type of locking occurred. If locking occurred, again during any part of the examination, then on the examination form indicate when the locking occurred (during opening movement, or at maximal opening) as well as whether the patient reduced the lock(s) or the examiner assisted in reducing the lock.

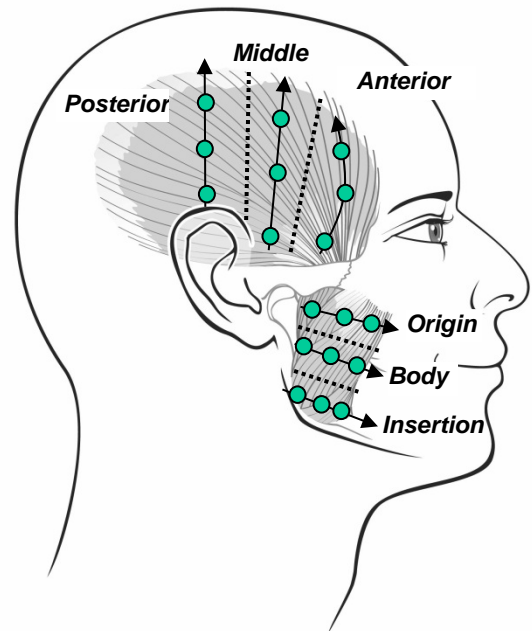
## **E9 Muscle and TMJ Pain with Palpation**

**Figure 24.** Extraoral masticatory muscles: temporalis and masseter. Illustration demonstrates palpation pathways for temporalis and masseter, and with three palpation areas per zone. Note that the anterior zone of the temporalis is slightly curved, corresponding to the outline of the muscle. The goal is to palpate each zone as fully as possible, so palpate a minimum of three areas within each zone using 1 kg of pressure.

The DC/TMD examination form within this protocol provides a recording field for each of the three bands. The use of zones for palpation is recommended because such usage enhances systematic coverage of the muscle during the palpation examination.

An alternative examination form (available on the Consortium web site) denotes only a single recording field for each of masseter and temporalis (given that a diagnosis is muscle based, not muscle-zone based), in case that is more useful in a given setting.

Key: filled circle denotes one finger tip.



**Figure 25.** Finger pressure is calibrated (1.0 kg) using a simple hand-held algometer prior to palpation examination of the temporalis and masseter. Note that a single finger is calibrated, and that the palpating finger of each hand must be calibrated if using both hands during the examination.



### Temporalis (1 kg of pressure)

**Figure 26.** Orange areas illustrate the zones of palpation for the three areas of the temporalis: posterior, middle, and anterior.



**Figure 27.** Palpation sequence for the temporalis muscle. Note that the other hand stabilizes the head.

(left) Starting with the anterior zone (posterior to the bony margin of the anterior temporalis), the examiner starts at the area just above the zygomatic arch, as shown by the lowest filled circle in this zone as shown in Figure 24, and continues within the zone until the superior boundary of the muscle is reached. In this image, a middle area of the anterior zone is palpated.

(center) Middle zone (in front of the ear): the examiner starts just above the zygomatic arch, and continues until the superior boundary of the muscle is reached. The tendonous area immediately above the arch should also be included, as shown by the lowest filled circle in this zone as shown in Figure 24.

(right) Posterior zone (in line with the top of the ear): the examiner starts just above the ear corresponding to the lowest filled circle in this zone as shown in Figure 24, and continues until the superior boundary of the muscle is reached.

### Masseter (1 kg of palpation pressure)

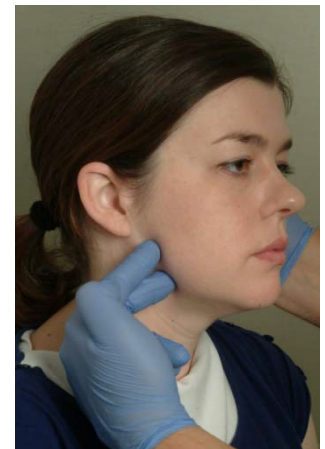
**Figure 28.** Orange areas illustrate the zones of palpation for the three areas of the masseter: superior, middle, and inferior. Note that the superior zone begins just anterior to the condyle when the mandible is in the relaxed position.

See Figure 24 legend for description of examination forms.



**Figure 29.** Palpation sequence for the masseter muscle while the other hand stabilizes the mandible. (left) Origin zone (inferior to the bony margin of the zygomatic process): the examiner started at the area just anterior to the condyle, corresponding to the filled circle in this zone as shown in Figure 24. (center) Body zone (in front of ear lobe): start at the most posterior aspect of the muscle. (right) Insertion zone: start at the area superior and anterior to the mandibular angle. In each zone, the palpation continues until the anterior boundary of the muscle is reached.

**Figure 30.** Alternative form of palpation for the insertion of the masseter muscle. The skin overlying the insertion area of the masseter often rolls when applying pressure in this area. The forefinger is being used for palpation, as shown in Figure 29 (right), while the middle finger is placed beneath the mandibular border and held in light but firm contact. While placing the middle finger, the skin is drawn downward, thus providing a firmer base for the forefinger to palpate the muscle and simultaneously providing better support for the palpating hand.

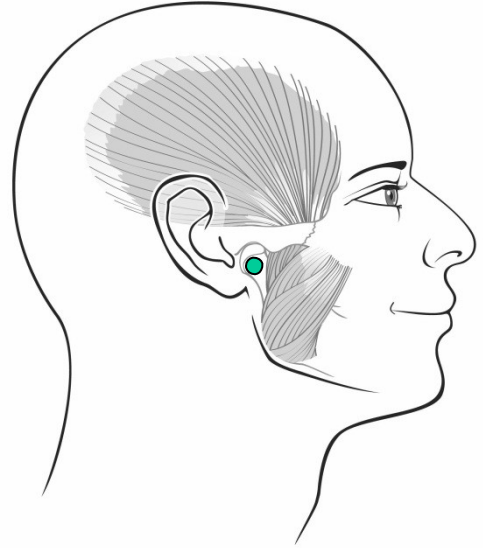




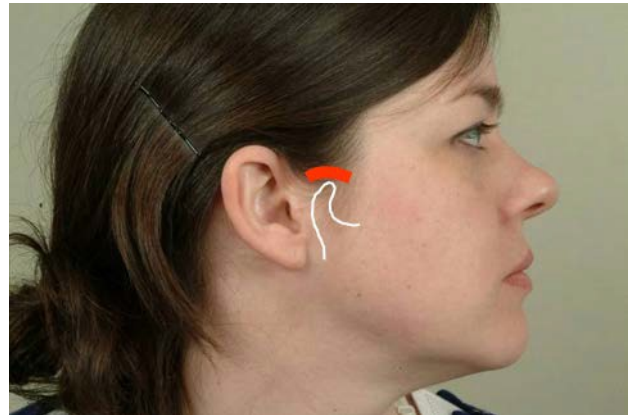
## Temporomandibular Joint

### TMJ lateral pole (0.5 kg of palpation pressure)

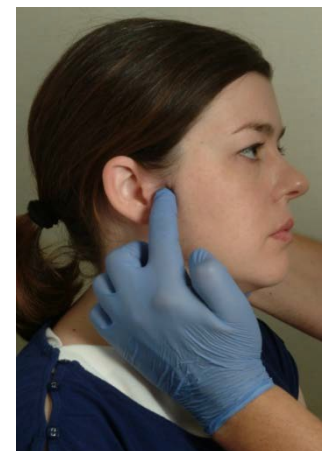
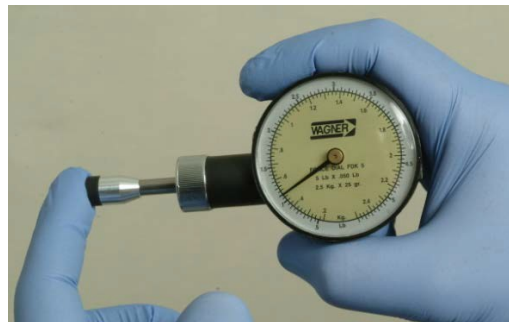
**Figure 31.** Target area for lateral pole palpation of the TMJ.



**Figure 32.** Anatomical landmarks relative to tragus of the ear, with teeth in lightly closed position.

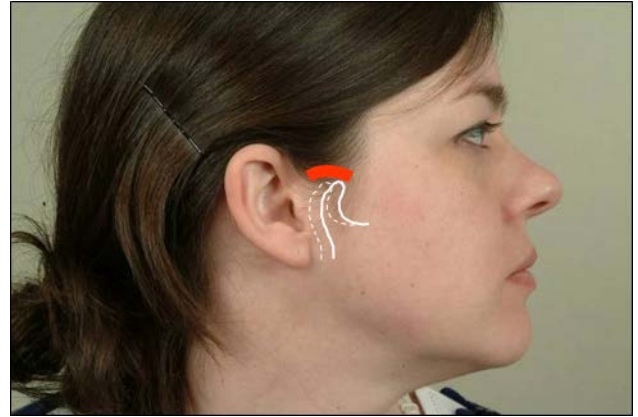


**Figure 33.** One finger is used, and one joint is palpated at a time; the other hand is used to stabilize the head. Note that mouth remains closed. Use 0.5 kg.

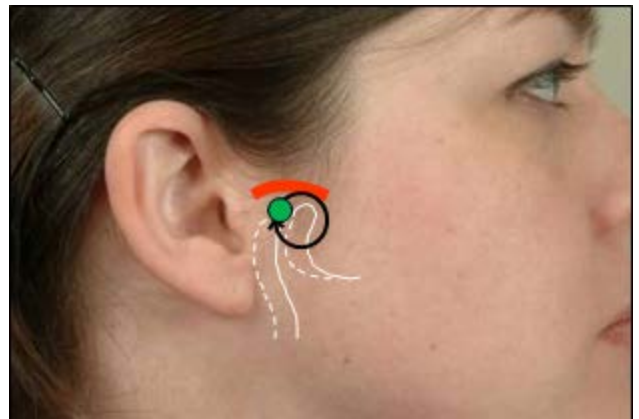


**Dynamic TMJ lateral pole palpation (1 kg of palpation pressure)**

**Figure 34.** Condyle is protruded to a forward position (indicated by solid white solid line, as shown here), sufficient to allow access for palpation of the dorsal aspect of the condylar head. Dashed white line corresponds to closed condylar position.

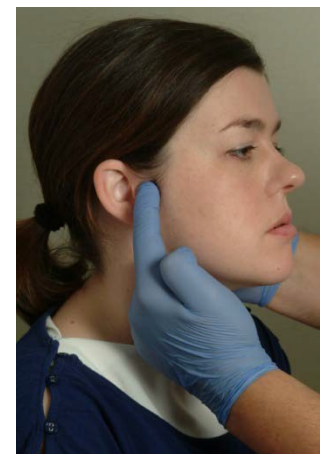
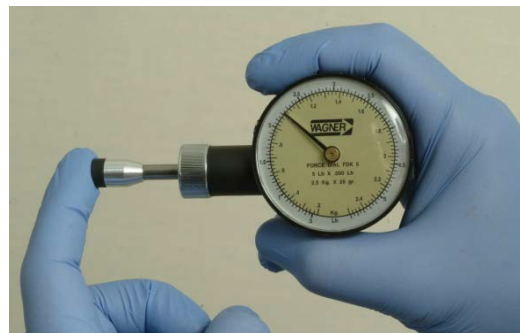


**Figure 35.** The lateral pole is identified after the mandible is sufficiently protruded. The filled green dot indicates the position of the finger at the posterior aspect of the lateral pole; the green dot is the starting point for the finger which is rolled first anteriorly and superiorly around the superior circumference of the lateral pole, as shown here. The finger continues around the condyle, while maintaining contact with the circumferential aspect of the lateral pole, and the orbital movement continues until the finger returns to the dorsal aspect of the lateral pole.



**Figure 36.** Photo shows placement of finger, with pad of finger adjacent to the dorsal aspect of the lateral pole; photo also demonstrates that condyle is moved forward slightly via protrusion.

Use 1.0 kg.

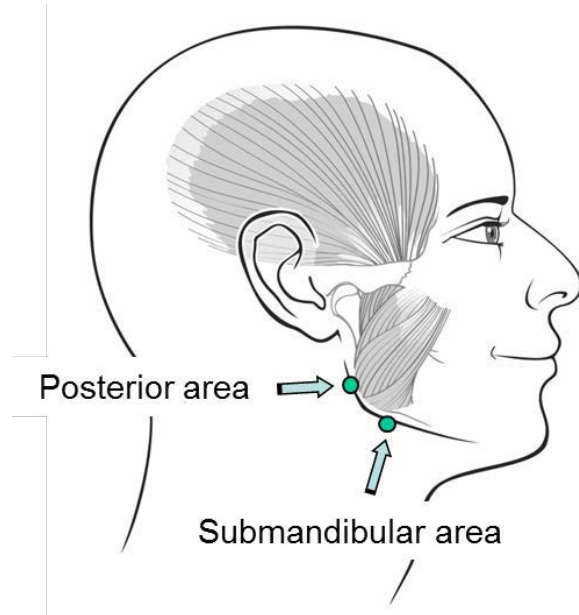


**E10 Supplemental Muscles Palpation Areas (0.5 kg palpation pressure)**

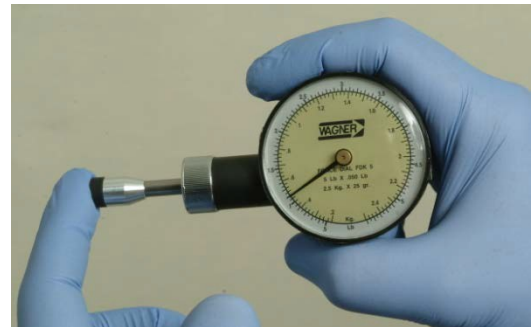
**Posterior and Sub-mandibular Areas**

**Figure 37.** Posterior and submandibular masticatory muscle areas: green dot indicates finger placements and arrows illustrate direction of the respective forces.

Key: filled circle denotes one finger tip.

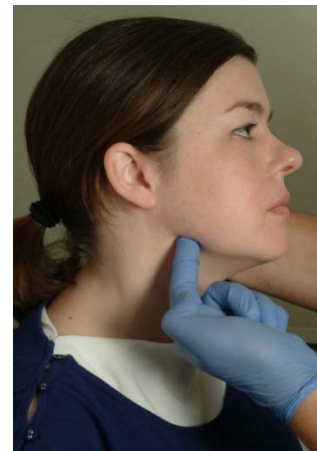
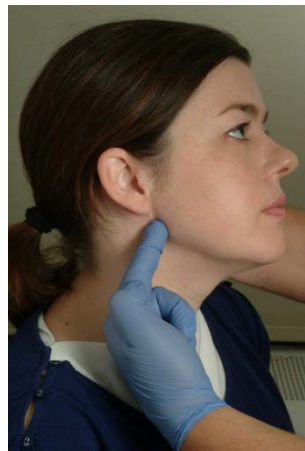


**Figure 38.** Use 0.5 kg.



**Figure 39.** (left) Patient extends head anteriorly in order to open the space posterior and medial to the posterior border of the mandible. The examiner places the finger in the space that is opened, and presses anteriorly and medially.

(right) Finger is placed on the medial aspect of the inferior border of the mandible, as shown, with force directed superiorly and laterally (i.e., against the medial wall of the mandible). The patient can be asked to retract her head and drop the chin in order to allow the palpating finger to move as described.



### Lateral Pterygoid Area

**Figure 40.** Finger is placed as shown, while mandible is deviated to the same side. Palpate the most medial, superior, and posterior area in the vestibule.



### Temporalis Tendon

**Figure 41.** Finger is placed against the ascending ramus while the mandible is slightly open, and the finger is moved superiorly as far as possible while maintaining contact with the underlying hard surface.



### E11 Comments

Examiner records pertinent comments regarding the examination.

## 8 Required Examination Commands

### 8.1 Overview

The examiner commands that are required to be used verbatim, as shown in the complete examination sequence (Section 4) are reproduced here in order to facilitate learning and review.

### 8.2 Examination-related Pain Interview

Sub-section numbering follows that of the Examination-Related Pain Interview (Section 6)

#### 6.2.1 For range of motion maneuver-induced pain

- Did you feel pain with that movement?**
- IF YES to pain:
  - Could you point with your finger to each of the areas where you felt pain?**
  - Are there any other areas where you felt pain with that movement? Point [with your finger] to those areas.**
  - Go to FAMILIAR PAIN INQUIRY.

#### 6.2.2 For palpation-induced pain

- Did you feel pain [in the area where I applied pressure]?**
- IF YES to pain: Go to FAMILIAR PAIN INQUIRY.

#### 6.2.3 For click-related pain

- Was that click painful?**
- IF YES to pain: Go to FAMILIAR PAIN INQUIRY.

#### 6.2.4 Familiar Pain Inquiry

- Is this pain familiar to any pain you have experienced in this area in the last 30 days?**
- IF YES TO FAMILIAR PAIN: **What is this pain familiar to?**
- IF TEMPORALIS SITE IS POSITIVE: **Is this pain familiar to your headache in this area, in the last 30 days?**
- Examiner verifies that reported pain areas in the past 30 days are consistent with positive familiar pain reports.

#### 6.2.5 Referred Pain Inquiry

- Did you feel the pain just under my finger, or did you also feel it somewhere else [in different areas of your head, face or jaw]?**
- [Show me where you felt the pain.] Point with your finger to each of the areas where you just felt pain [in response to my pressure].**
- Did you feel it anywhere else?**

### 8.3 Required Components from Section 5: Complete Examiner Commands

CONVENTIONS FOR THIS TABLE: Bold text under “Verbal Command” must be used verbatim; procedures associated with cells containing bold text may require additional (ordinary) language for the completion of the procedure. Blank cells under “Verbal Command” indicate that ordinary language is sufficient for that entire procedure; non-bolded text is also used to illustrate ordinary language use associated with particular procedures. Procedures with <none> under “Verbal Command” indicate that there is no verbal command from the examiner.

CONSTRUCT	VERBAL COMMAND
<b>E1. Examiner Confirmation of Pain and Headache Locations</b>	
<i>Identifying information</i>	<none>
<i>Instructions to the patient</i>	<p><b>Before I start the exam, I want to review a few things with you.</b></p> <p><b>I will be asking you about pain, and only you know if you have pain. When I ask about pain, I want you to say either yes or no; if you are not sure, give me your best answer.</b></p> <p><b>If you feel pain, I will also ask if that pain is familiar. Familiar pain refers to pain that is similar or like the pain you may have had in that same part of your body in the last 30 days.</b></p> <p><b>If you feel pain in the temple area, I will ask if that pain is like any headache you may have had in the temple area in the last 30 days.</b></p>
<i>Scope of examination: anatomic areas of interest</i>	<p><b>For the purposes of this examination, I am interested in pain that you may have in these areas....</b></p> <p><b>.... and also inside the mouth.</b></p>
<i>E1a Location of pain: last 30 days</i>	<p><b>In the last 30 days, have you had pain in these areas [that I touched]?</b></p> <p>IF “YES”: <b>Could you point with your finger to each of the areas where you have felt pain [in the last 30 days]?</b></p> <p><b>Are there any other areas where you have felt pain [in the last 30 days]?</b></p>
<i>E1b Location of headache in the last 30 days.</i>	<p><b>In the last 30 days, have you had any headaches?</b></p> <p>IF “YES”: <b>Could you point with your finger to each of the areas where you have felt headache [in the last 30 days]?</b></p> <p><b>Are there other areas where you have felt headache [in the last 30 days]?</b></p>
<b>E2. Incisal Relationships</b>	
<i>Select maxillary and mandibular reference teeth</i>	I will place some pencil marks on your teeth; I will remove them at the end of the examination.
<i>Reference line – vertical overlap</i>	<b>Place your back teeth completely together.</b>
<i>Reference line – mandibular reference midline</i>	[Place your back teeth completely together.]

CONSTRUCT	VERBAL COMMAND
<i>Horizontal incisal overjet</i>	[Place your back teeth completely together.]
<i>Vertical incisal overlap</i>	<Ask patient to open sufficiently to measure the vertical overlap.>
<b>E3. Opening Pattern (Supplemental)</b>	
<i>Starting Position</i>	<b>Place your back teeth completely together.</b>
<i>Opening Pattern</i>	<b>I would like you to slowly open your mouth as wide as you can, even if it is painful, close, and put your back teeth completely together again.</b> Repeat 2 more times.
<b>E4. Open Movements</b>	
<b>4A. PAIN FREE OPENING</b>	
<i>Starting position</i>	[Place your mouth in a comfortable position.]
<i>Ruler position for vertical movement measurements</i>	<none>
<i>E4A Pain-free opening</i>	<b>I would like you to open your mouth as wide as you can without feeling any pain, or without increasing any pain you may have right now.</b>
<b>4B. MAXIMUM UNASSISTED OPENING</b>	
<i>Starting position</i>	[Place your mouth in a comfortable position.]
<i>E4B Maximum unassisted opening</i>	<b>I would like you to open your mouth as wide as you can, even if it is painful.</b>
<i>E4B Post-MUO pain</i>	<b>Did you feel any pain with this movement?</b>
<b>4C. MAXIMUM ASSISTED OPENING</b>	
<i>Starting position</i>	[Place your mouth in a comfortable position.]
<i>Instructions</i>	<b>In a moment I will try, [if possible], to open your mouth wider with my fingers. If you want me to stop, raise your hand and I will stop immediately.</b>
<i>E4C Maximum assisted opening</i>	I will place my ruler. [pause] <b>Now open [your mouth] as wide as you can, even if painful, just as you did before.</b> [pause] You will feel my fingers. <b>Please relax your jaw so I can help you open wider, if possible.</b> [pause]
<i>E4C Post-MAO pain</i>	<b>Did you feel any pain when I tried to open your mouth wider with my fingers?</b>

CONSTRUCT	VERBAL COMMAND
<b>4D. MAXIMUM ASSISTED OPENING TERMINATED</b>	
<i>E4D</i> <i>Opening terminated</i>	<none>
<b><u>E5. Lateral and Protrusive Movements</u></b>	
<b>5A. RIGHT LATERAL EXCURSION</b>	
<i>Right lateral excursion</i>	<b>Open slightly, and move your jaw as far as you can to the right, even if it is painful.</b> Hold your jaw in that position until I take a measurement.
<i>E5A</i> <i>Measurement</i>	<none>
<i>Return jaw</i>	
<i>E5A</i> <i>Post excursion pain</i>	<b>Did you feel any pain with that movement?</b>
<b>5B. LEFT LATERAL EXCURSION</b>	
<i>Left lateral excursion</i>	<b>Open slightly, and move your jaw as far as you can to the left, even if it is painful.</b> Hold your jaw in that position until I take a measurement.
<i>E5B</i> <i>Measurement</i>	<none>
<i>Return jaw</i>	
<i>E5B</i> <i>Post excursion pain</i>	<b>Did you feel any pain with that movement?</b>
<b>5C. PROTRUSIVE</b>	
<i>Protrusive excursion</i>	<b>Open slightly, and move your jaw forward as far as you can, even if it is painful.</b> Hold your jaw in that position until I take a measurement.
<i>E5C</i> <i>Measurement</i>	<none>
<i>Return jaw</i>	
<i>E5C</i> <i>Post protrusion pain</i>	<b>Did you feel any pain with that movement?</b>



CONSTRUCT	VERBAL COMMAND
<b>E6. TMJ Noises During Open &amp; Close Movements</b>	
<i>Hand position for palpation of joint noise</i>	<none>
<i>Instructions regarding joint noise</i>	<p><b>I will be evaluating the jaw joints for whether they make any noises. I would like you to pay attention as well, since I will ask you at the end whether you heard or felt any noises.</b></p> <p>[Focus on both joints.]</p>
<i>Full closure of mandible</i>	<b>Place your back teeth completely together.</b>
<i>Examiner detection of open and closing joint noise</i>	<p><b>Slowly open as wide as you can, even if it is painful, and then slowly close until your back teeth are completely together again.</b></p> <p><b>Repeat 2 more times.</b></p>
<i>Patient inquiry regarding joint noise</i>	<p><b>Did you hear or feel noises in either jaw joint when you opened or closed?</b></p> <p><b>What type of noise?</b></p>
<i>Pain inquiry</i>	<p>IF PATIENT REPORTS CLICK:</p> <p><b>Did you feel any pain when that click occurred?</b></p>
<b>E7. TMJ Noises During Lateral &amp; Protrusive Movements</b>	
<i>General</i>	<none>
<i>Joint sounds: lateral and protrusive movements</i>	<p>[Perform the following set of procedures for examining each of the right joint, then the left joint. Inform patient which joint to focus on.]</p> <p><b>Place your back teeth completely together, open slightly, and move your jaw to the right as far as you can, even if painful; move your jaw back and place your back teeth completely together.</b></p> <p><b>Repeat 2 more times.</b></p> <p><b>Place your back teeth completely together, open slightly, and move your jaw to the left as far as you can, even if painful; move your jaw back and place your back teeth completely together.</b></p> <p><b>Repeat 2 more times.</b></p> <p><b>Place your back teeth completely together, open slightly, and move your jaw forward as far as you can, even if painful; move your jaw back, and place your back teeth completely together.</b></p> <p><b>Repeat 2 more times.</b></p>
<i>Inquiry regarding joint sounds</i>	<p><b>Did you hear or feel any noises in this [right, left] joint when you moved your jaw forward or to the side?</b></p> <p><b>What type of noise?</b></p>

CONSTRUCT	VERBAL COMMAND
<i>Pain inquiry</i>	IF PATIENT REPORTS CLICK: <b>Did you feel any pain when that click occurred?</b>
<b>E8. Joint Locking</b>	
<i>Locking Closed</i>	<b>Can you “unlock” your jaw?</b>
<i>Locking Open</i>	<b>Can you “unlock” your jaw?</b>
<b>E9. Muscle and TMJ Pain with Palpation</b>	
<i>Introduction</i>	<p><b>Now I am going to apply pressure to different areas of your head, face and jaw, and I will ask you about pain, familiar pain, and familiar headache.</b></p> <p><b>In addition, I will ask whether the pain stays only under my finger or if you feel it also anywhere else besides under my finger.</b></p> <p>I will prompt you with the words “pain”, “familiar pain”, “familiar headache”, and “only under my finger?”.</p> <p>[Inquiry “go anywhere else?” can be used instead of “only under my finger” if the examiner prefers.]</p> <p><b>Each time, I will apply pressure and hold it for 5 seconds.</b></p>
<i>Calibration</i>	<none>
<i>Temporalis &amp; masseter</i>	<none>
<i>Calibration</i>	<none>
<i>TMJ: lateral pole</i>	<b>Open slightly, and move your lower jaw forward and then move it back to its normal position with your teeth slightly apart.</b>
<i>Calibration</i>	<none>
<i>TMJ: around lateral pole</i>	<b>Open slightly, and move your lower jaw forward a little bit and keep it there.</b>
<b>E10. Supplemental Palpation Sites</b>	
<i>Calibration</i>	<none>
<i>Posterior mandibular region</i>	<b>Relax your jaw.</b>
<i>Submandibular region</i>	<b>Relax your jaw.</b>
<i>Lateral pterygoid area</i>	<b>Open slightly and move your jaw to the side.</b>
<i>Tendon of the temporalis</i>	<b>Open your mouth.</b>

CONSTRUCT	VERBAL COMMAND
<b>E11. Examiner Comments</b>	
<i>Examination comments</i>	<none>
<b>END OF DC/TMD EXAMINATION</b>	

# 9 Examination Form

## 9.1 North American Format

**DC/TMD Examination Form**

Patient \_\_\_\_\_ Examiner \_\_\_\_\_

Date filled out (mm-dd-yyyy)

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**1a. Location of Pain: Last 30 days (Select all that apply)**

RIGHT PAIN	LEFT PAIN
<input type="radio"/> None <input type="radio"/> Temporalis <input type="radio"/> Other m muscles <input type="radio"/> Non-mast structures <input type="radio"/> Masseter <input type="radio"/> TMJ	<input type="radio"/> None <input type="radio"/> Temporalis <input type="radio"/> Other m muscles <input type="radio"/> Non-mast structures <input type="radio"/> Masseter <input type="radio"/> TMJ

**1b. Location of Headache: Last 30 days (Select all that apply)**

<input type="radio"/> None <input type="radio"/> Temporal <input type="radio"/> Other	<input type="radio"/> None <input type="radio"/> Temporal <input type="radio"/> Other
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**2. Incisal Relationships**      Reference tooth    #8    #9    Other

Horizontal Incisal Overjet	<input type="radio"/> If negative		mm	Vertical Incisal Overlap	<input type="radio"/> If negative		mm	Midline Deviation	<input type="radio"/> Right <input type="radio"/> Left <input type="radio"/> N/A		mm
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**3. Opening Pattern (Supplemental; Select all that apply)**

<input type="radio"/> Straight <input type="radio"/> Corrected deviation	Uncorrected Deviation <input type="radio"/> Right <input type="radio"/> Left
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**4. Opening Movements**

**A. Pain Free Opening**

		mm
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	RIGHT SIDE			LEFT SIDE		
	Pain	Familiar Pain	Familiar Headache	Pain	Familiar Pain	Familiar Headache
Temporalis	<input type="radio"/> N <input type="radio"/> Y	<input type="radio"/> N <input type="radio"/> Y	<input type="radio"/> N <input type="radio"/> Y	Temporalis	<input type="radio"/> N <input type="radio"/> Y	<input type="radio"/> N <input type="radio"/> Y
Masseter	<input type="radio"/> N <input type="radio"/> Y	<input type="radio"/> N <input type="radio"/> Y		Masseter	<input type="radio"/> N <input type="radio"/> Y	<input type="radio"/> N <input type="radio"/> Y
TMJ	<input type="radio"/> N <input type="radio"/> Y	<input type="radio"/> N <input type="radio"/> Y		TMJ	<input type="radio"/> N <input type="radio"/> Y	<input type="radio"/> N <input type="radio"/> Y
Other M Musc	<input type="radio"/> N <input type="radio"/> Y	<input type="radio"/> N <input type="radio"/> Y		Other M Musc	<input type="radio"/> N <input type="radio"/> Y	<input type="radio"/> N <input type="radio"/> Y
Non-mast	<input type="radio"/> N <input type="radio"/> Y	<input type="radio"/> N <input type="radio"/> Y		Non-mast	<input type="radio"/> N <input type="radio"/> Y	<input type="radio"/> N <input type="radio"/> Y

**B. Maximum Unassisted Opening**

		mm
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Temporalis	<input type="radio"/> N <input type="radio"/> Y	<input type="radio"/> N <input type="radio"/> Y	<input type="radio"/> N <input type="radio"/> Y	Temporalis	<input type="radio"/> N <input type="radio"/> Y	<input type="radio"/> N <input type="radio"/> Y
Masseter	<input type="radio"/> N <input type="radio"/> Y	<input type="radio"/> N <input type="radio"/> Y		Masseter	<input type="radio"/> N <input type="radio"/> Y	<input type="radio"/> N <input type="radio"/> Y
TMJ	<input type="radio"/> N <input type="radio"/> Y	<input type="radio"/> N <input type="radio"/> Y		TMJ	<input type="radio"/> N <input type="radio"/> Y	<input type="radio"/> N <input type="radio"/> Y
Other M Musc	<input type="radio"/> N <input type="radio"/> Y	<input type="radio"/> N <input type="radio"/> Y		Other M Musc	<input type="radio"/> N <input type="radio"/> Y	<input type="radio"/> N <input type="radio"/> Y
Non-mast	<input type="radio"/> N <input type="radio"/> Y	<input type="radio"/> N <input type="radio"/> Y		Non-mast	<input type="radio"/> N <input type="radio"/> Y	<input type="radio"/> N <input type="radio"/> Y

**C. Maximum Assisted Opening**

		mm
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Temporalis	<input type="radio"/> N <input type="radio"/> Y	<input type="radio"/> N <input type="radio"/> Y	<input type="radio"/> N <input type="radio"/> Y	Temporalis	<input type="radio"/> N <input type="radio"/> Y	<input type="radio"/> N <input type="radio"/> Y
Masseter	<input type="radio"/> N <input type="radio"/> Y	<input type="radio"/> N <input type="radio"/> Y		Masseter	<input type="radio"/> N <input type="radio"/> Y	<input type="radio"/> N <input type="radio"/> Y
TMJ	<input type="radio"/> N <input type="radio"/> Y	<input type="radio"/> N <input type="radio"/> Y		TMJ	<input type="radio"/> N <input type="radio"/> Y	<input type="radio"/> N <input type="radio"/> Y
Other M Musc	<input type="radio"/> N <input type="radio"/> Y	<input type="radio"/> N <input type="radio"/> Y		Other M Musc	<input type="radio"/> N <input type="radio"/> Y	<input type="radio"/> N <input type="radio"/> Y
Non-mast	<input type="radio"/> N <input type="radio"/> Y	<input type="radio"/> N <input type="radio"/> Y		Non-mast	<input type="radio"/> N <input type="radio"/> Y	<input type="radio"/> N <input type="radio"/> Y

**D. Terminated?**       N  Y

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**5. Lateral and Protrusive Movements**

	RIGHT SIDE			LEFT SIDE			
	Pain	Familiar Pain	Familiar Headache	Pain	Familiar Pain	Familiar Headache	
<b>A. Right Lateral</b>	Temporalis	<input type="radio"/> N <input type="radio"/> Y	<input type="radio"/> N <input type="radio"/> Y	<input type="radio"/> N <input type="radio"/> Y	Temporalis	<input type="radio"/> N <input type="radio"/> Y	<input type="radio"/> N <input type="radio"/> Y
	Masseter	<input type="radio"/> N <input type="radio"/> Y	<input type="radio"/> N <input type="radio"/> Y		Masseter	<input type="radio"/> N <input type="radio"/> Y	<input type="radio"/> N <input type="radio"/> Y
	TMJ	<input type="radio"/> N <input type="radio"/> Y	<input type="radio"/> N <input type="radio"/> Y		TMJ	<input type="radio"/> N <input type="radio"/> Y	<input type="radio"/> N <input type="radio"/> Y
	Other M Musc	<input type="radio"/> N <input type="radio"/> Y	<input type="radio"/> N <input type="radio"/> Y		Other M Musc	<input type="radio"/> N <input type="radio"/> Y	<input type="radio"/> N <input type="radio"/> Y
	Non-mast	<input type="radio"/> N <input type="radio"/> Y	<input type="radio"/> N <input type="radio"/> Y		Non-mast	<input type="radio"/> N <input type="radio"/> Y	<input type="radio"/> N <input type="radio"/> Y
<b>B. Left Lateral</b>	Temporalis	<input type="radio"/> N <input type="radio"/> Y	<input type="radio"/> N <input type="radio"/> Y	<input type="radio"/> N <input type="radio"/> Y	Temporalis	<input type="radio"/> N <input type="radio"/> Y	<input type="radio"/> N <input type="radio"/> Y
	Masseter	<input type="radio"/> N <input type="radio"/> Y	<input type="radio"/> N <input type="radio"/> Y		Masseter	<input type="radio"/> N <input type="radio"/> Y	<input type="radio"/> N <input type="radio"/> Y
	TMJ	<input type="radio"/> N <input type="radio"/> Y	<input type="radio"/> N <input type="radio"/> Y		TMJ	<input type="radio"/> N <input type="radio"/> Y	<input type="radio"/> N <input type="radio"/> Y
	Other M Musc	<input type="radio"/> N <input type="radio"/> Y	<input type="radio"/> N <input type="radio"/> Y		Other M Musc	<input type="radio"/> N <input type="radio"/> Y	<input type="radio"/> N <input type="radio"/> Y
	Non-mast	<input type="radio"/> N <input type="radio"/> Y	<input type="radio"/> N <input type="radio"/> Y		Non-mast	<input type="radio"/> N <input type="radio"/> Y	<input type="radio"/> N <input type="radio"/> Y
<b>C. Protrusion</b>	Temporalis	<input type="radio"/> N <input type="radio"/> Y	<input type="radio"/> N <input type="radio"/> Y	<input type="radio"/> N <input type="radio"/> Y	Temporalis	<input type="radio"/> N <input type="radio"/> Y	<input type="radio"/> N <input type="radio"/> Y
	Masseter	<input type="radio"/> N <input type="radio"/> Y	<input type="radio"/> N <input type="radio"/> Y		Masseter	<input type="radio"/> N <input type="radio"/> Y	<input type="radio"/> N <input type="radio"/> Y
	TMJ	<input type="radio"/> N <input type="radio"/> Y	<input type="radio"/> N <input type="radio"/> Y		TMJ	<input type="radio"/> N <input type="radio"/> Y	<input type="radio"/> N <input type="radio"/> Y
	Other M Musc	<input type="radio"/> N <input type="radio"/> Y	<input type="radio"/> N <input type="radio"/> Y		Other M Musc	<input type="radio"/> N <input type="radio"/> Y	<input type="radio"/> N <input type="radio"/> Y
	Non-mast	<input type="radio"/> N <input type="radio"/> Y	<input type="radio"/> N <input type="radio"/> Y		Non-mast	<input type="radio"/> N <input type="radio"/> Y	<input type="radio"/> N <input type="radio"/> Y

If negative

<b>6.</b>	<p><b>TMJ Noises During Open &amp; Close Movements</b></p> <table border="1" style="width:100%; border-collapse: collapse; text-align: center;"> <thead> <tr> <th colspan="5">RIGHT TMJ</th> <th colspan="5">LEFT TMJ</th> </tr> <tr> <th rowspan="2"></th> <th colspan="2">Examiner</th> <th rowspan="2">Patient</th> <th rowspan="2">Pain w/ Click</th> <th rowspan="2">Familiar Pain</th> <th rowspan="2"></th> <th colspan="2">Examiner</th> <th rowspan="2">Patient</th> <th rowspan="2">Pain w/ Click</th> <th rowspan="2">Familiar Pain</th> </tr> <tr> <th>Open</th> <th>Close</th> <th>Open</th> <th>Close</th> </tr> </thead> <tbody> <tr> <td>Click</td> <td>N</td><td>Y</td> <td>N</td><td>Y</td> <td>N</td><td>Y</td> <td>N</td><td>Y</td> <td>N</td><td>Y</td> <td>N</td><td>Y</td> </tr> <tr> <td>Crepitus</td> <td>N</td><td>Y</td> <td>N</td><td>Y</td> <td>N</td><td>Y</td> <td>N</td><td>Y</td> <td>N</td><td>Y</td> <td>N</td><td>Y</td> </tr> </tbody> </table>	RIGHT TMJ					LEFT TMJ						Examiner		Patient	Pain w/ Click	Familiar Pain		Examiner		Patient	Pain w/ Click	Familiar Pain	Open	Close	Open	Close	Click	N	Y	N	Y	N	Y	N	Y	N	Y	N	Y	Crepitus	N	Y	N	Y	N	Y	N	Y	N	Y	N	Y																																																																																				
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RIGHT SIDE					LEFT SIDE																																																																																																																																				
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Temporalis (posterior)	N	Y	N	Y	N	Y	N	Y	N	Y																																																																																																																															
Temporalis (middle)	N	Y	N	Y	N	Y	N	Y	N	Y																																																																																																																															
Temporalis (anterior)	N	Y	N	Y	N	Y	N	Y	N	Y																																																																																																																															
Masseter (origin)	N	Y	N	Y	N	Y	N	Y	N	Y																																																																																																																															
Masseter (body)	N	Y	N	Y	N	Y	N	Y	N	Y																																																																																																																															
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Around lateral pole (1 kg)	N	Y	N	Y	N	Y	N	Y	N	Y																																																																																																																															
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<b>11.</b>	<p><b>Comments</b></p>																																																																																																																																								



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## 10 Research

Concerns specific to research applications of the DC/TMD protocol are addressed here.

### 10.1 Palpation calibration

- (a) Rationale for use and types of scales. Training and on-going skill monitoring of finger pressure improves examiner technique and consistency of applied pressure over time, resulting in improved intra-examiner reliability and, ultimately, improved inter-examiner reliability. A pressure-measurement device, which could either be an algometer or a scale, is used to provide feedback to the examiner so that s/he can accurately monitor technique through force training and calibration of his/her pressure sensitivity of the finger tips used in palpation. The goal of monitoring at the time of performing clinical examinations is to provide standardization of palpation pressure. Each finger used in palpation for pain needs to be trained and monitored.
- (b) Hardware. Different devices are available; postage scales are acceptable for initial training while small hand-held algometers are more useful in the clinic.
  1. For purposes of initial training, a digital postage scale (e.g., Pelouze<sup>®</sup>) provides very sensitive feedback suitable for motor skills development via its highly sensitive continuous display of the current time-varying applied force. The high sensitivity will clearly reveal not only the magnitude of applied pressure but the stability of the applied pressure during the steady-force phase of a palpation. The load-cell based technology of the digital postage scale is quite useful, albeit challenging, as a feedback tool for developing motor skills with respect to monitoring and maintaining the stability of the applied force.
  2. When using a postage scale with a firm platform, some examiners find that covering the surface of the scale with several layers of a compressible material (such as felt) provides some flexibility beneath the finger, which may be an analogue to “tissue compliance”. The flexibility may provide more realistic feedback for training the finger sensations of applying force to skin and underlying muscle. Other examiners find the presence of such material distracting. Each examiner should experiment in order to discover what works best; palpation using a consistent amount of force is the only criterion that matters.
  3. Another pressure-measuring instrument useful for training is a force meter that can provide an output voltage which can be presented on a strip chart-type software display; the pressure over time gradient is in particular very instructive for developing the timing pattern for pressure application. The equipment (algometer with voltage output, A/D device, software) for this type of instrumentation is readily available as individual parts.
  4. A simple algometer with a peak-hold feature (e.g., Wagner<sup>®</sup> 0-5 lb) provides the ability to calibrate and verify skill ability at the time of the clinical examination and to make corrections as needed. The Wagner algometer can be used as a dynamic measuring tool, by depressing the peak-hold button, or as a static device recording the peak force, by not depressing the peak-hold button. Other algometers such as the Algometer II produced by Somedic can also be used.



- (c) Time-of-use skills monitoring. The hand-held algometer-type device is more convenient for use in the clinic. For feedback training of active calibration, the user would depress the peak-hold button in order to view a dynamic display of generated force. To check oneself, the user would leave the peak-hold button in the default (unpressed) position and not look at the device while generating the desired force, and then review what was produced.

## 10.2 Palpometers

Palpation is challenging to standardize across examiners to a small level of error. Consequently, other methods are recommended for improving upon this manual technique. As with any psychophysical procedure, one important aspect of manual palpation is to reduce the variability related to the presentation of the stimulus. Two methods utilizing a palpometer – a device that attaches to the end of the finger tip in order to provide better control of the actual force applied in real time – have been published. Bernhardt et al<sup>1</sup> used a thin pressure-sensitive material connected to an amplifier and digital display and placed the material over the finger tip. Futarmal et al<sup>2</sup> developed a simple spring-loaded device that provides tactile feedback when the correct force has been exerted. Contact the authors for more information.

Standard algometers may also be used to provide a constant force. Somedic has released a new algometer that resolves some of the problems associated with the previously available instruments.

## 10.3 Reliability studies

A number of examination procedures require further decisions when reliability studies are performed in order to test the procedure. Those procedures and decisions considered by the authors are described. General procedures for reliability studies are presented elsewhere. The examination-specific instructions are presented here because the principles also potentially apply to usage of the DC/TMD protocol in clinical settings.

- (a) Patient positioning. Each study manager will decide how patients should be positioned. It is traditional for patients to sit in chairs with the chair-back in approximately a vertical position, but this may be tailored for each subject-examiner pairing. One example is the patient in a reliability study who, because of lower back pain, finds it very uncomfortable for the back to sit in the upright position. However, any position can be used from a reclined to an upright position.
- (b) Supplemental procedures. The study manager or investigators need to decide whether the supplemental procedures of Opening Pattern and Supplemental Muscle Palpation sites need to be included in the particular study. Reliability study length is determined by the number of procedures, and resources also influence what can or must be done as part of a reliability study.
- (c) Instructions. All examiners repeat the special instructions for the examination.
- (d) Repeating procedures. Certain aspects of patient performance during the DC/TMD examination have a greater potential for being less reliable. The study manager should decide which procedures will be accompanied by any explicit modifications in number of repetitions in order for the examiner to be confident of the data. For example, the instructions for Pain-Free Opening, despite following Opening Pattern, will sometimes result in a “pain-free” opening range less than the patient will produce once the patient better understands the intent of the procedure. In a clinical setting, this may be acceptable or even desirable in that “pain-free opening” is a construct and

the extent of opening is determined by many factors. But in a reliability study, the first examiner will likely be less reliable if the subject understands the instructions differently with the subsequent examiners. Similarly, opening pattern and joint sounds are not very consistent, and repetition is often needed to be fully confident of what the “truth” is, and in a reliability study, later examiners will often benefit from improved consistency on the part of the subject due to either “warm-up” or better subject understanding. An upper limit for possible repetitions of these procedures should be established at the beginning of the study.

- (e) “Familiar to what?” probe. Valid responses should not include pain from any prior examinations in the reliability study.

#### 10.4 Modifying procedures to address specific research hypotheses

The time period for diagnosis (e.g., pain within the prior 30 days in the DC/TMD) is the most likely anticipated area of the diagnostic criteria that an investigator might want to modify for assessing a given hypothesis. This is simple to implement, simple to report, and simple to interpret. Another area that an investigator might modify is the palpation procedure for referred pain, either by extending the palpation pressure beyond 5 seconds or by using an alternative method. Modifications such as these are encouraged in order for the DC/TMD to be a living protocol via on-going hypothesis testing, but any modifications in the DC/TMD protocol must be clarified in any published use of data based on this protocol so that the scientific and TMD communities can accurately interpret new findings.

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<sup>1</sup> Bernhardt O, Schiffman ES, Look JO (2007). Reliability and validity of a new fingertip-shaped pressure algometer for assessing pressure pain thresholds in the temporomandibular joint and masticatory muscles. *J Orofacial Pain* 21:29-38.

<sup>2</sup> Futarmal S, Kothari M, Ayesh E, Baad-Hansen L, Svensson P (2011). New palpometer with implications for assessment of deep pain sensitivity. *J Dent Res* 90:918-922.

## 11 Changes to this Document

January 6, 2014

- “Incisor overlap” changed to “incisal overlap” throughout document.
- Reference to “spreading pain” is added in section 2.10 (c)
- Full citation for DC/TMD publication is added.

June 2, 2013

- First official release version