

# Standardised Tool for the Assessment of Bruxism

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## Abstract

**Objective:** This paper aims to present and describe the Standardised Tool for the Assessment of Bruxism (STAB), an instrument that was developed to provide a multidimensional evaluation of bruxism status, comorbid conditions, aetiology and consequences.

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**Methods:** The rationale for creating the tool and the road map that led to the selection of items included in the STAB has been discussed in previous publications.

**Results:** The tool consists of two axes, specifically dedicated to the evaluation of bruxism status and consequences (Axis A) and of bruxism risk and etiological factors and comorbid conditions (Axis B). The tool includes 14 domains, accounting for a total of 66 items. Axis A includes the self-reported information on bruxism status and possible consequences (subject-based report) together with the clinical (examiner report) and instrumental (technology report) assessment. The Subject-Based Assessment (SBA) includes domains on Sleep Bruxism (A1), Awake Bruxism (A2) and Patient's Complaints (A3), with information based on patients' self-report. The Clinically Based Assessment (CBA) includes domains on Joints and Muscles (A4), Intra- and Extra-Oral Tissues (A5) and Teeth and Restorations (A6), based on information collected by an examiner. The Instrumentally Based Assessment (IBA) includes domains on Sleep Bruxism (A7), Awake Bruxism (A8) and the use of Additional Instruments (A9), based on the information gathered with the use of technological devices. Axis B includes the self-reported information (subject-based report) on factors and conditions that may have an etiological or comorbid association with bruxism. It includes domains on Psychosocial Assessment (B1), Concurrent Sleep-related Conditions Assessment (B2), Concurrent Non-Sleep Conditions Assessment (B3), Prescribed Medications and Use of Substances Assessment (B4) and Additional Factors Assessment (B5). As a rule, whenever possible, existing instruments, either in full or partial form (i.e. specific subscales), are included. A user's guide for scoring the different items is also provided to ease administration.

**Conclusions:** The instrument is now ready for on-field testing and further refinement. It can be anticipated that it will help in collecting data on bruxism in such a comprehensive way to have an impact on several clinical and research fields.

#### KEYWORDS

assessment, awake bruxism, bruxism, diagnosis, sleep bruxism, STAB

## 1 | INTRODUCTION

The definition of bruxism has evolved over the past few years, progressively going beyond the old belief that bruxism is synonymous with grinding the teeth while asleep.<sup>1,2</sup> With the increase in knowledge concerning the sleep correlates and the muscle activities that may equally be present also during wakefulness,<sup>3,4</sup> the bruxism construct has shifted from a pathology or disorder to a motor activity that may be a sign of underlying conditions and may even have possible physiological or protective relevance.<sup>5-8</sup>

In the 2018 consensus paper, sleep bruxism (SB) is defined as a masticatory muscle activity (MMA) during sleep that is characterised as rhythmic (phasic) or non-rhythmic (tonic) and is not a movement disorder or a sleep disorder in otherwise healthy individuals. Awake bruxism (AB) is defined as a masticatory muscle activity during wakefulness that is characterised by repetitive or sustained tooth contact and/or by bracing or trusting

of the mandible and is not a movement disorder in otherwise healthy individuals.<sup>2</sup>

Within these premises, while preparing the Standardised Tool for the Assessment of Bruxism (STAB), the need emerged for the identification of the best strategy to define the *bruxism status, comorbidities, aetiology and consequences*. As muscle activities, both sleep and awake bruxism require a thorough assessment that could be based on a combination of subject-based, clinically based and instrumentally based information.

The rationale for creating the tool and the road map that led to the selection of items included in the STAB has been discussed in previous publications.<sup>9,10</sup> This paper presents the first STAB version for on-field testing together with the user's guide (Appendix 1), the full STAB instrument with the list of items included in each specific axis and domain (Appendix 2) and a ToolKit version listing the original sources to the full versions of the questionnaires included in the STAB (Appendix 3).

## 2 | AXIS A—ASSESSMENT OF BRUXISM STATUS AND CONSEQUENCES

Axis A includes the self-reported information on bruxism status and possible consequences (subject-based report), as well as the clinical (examiner report) and instrumental assessment (technology report).

### 2.1 | Subject-based assessment—self-report

The *Subject-Based Assessment* (SBA) includes domains on Sleep Bruxism (A1), Awake Bruxism (A2) and Patient's Complaints (A3), with information based on patients' self-report. As a general rule, whenever possible, all items and questions are taken from existing instruments, and the original source is indicated as a reference for administration and scoring. When instruments did not exist for any specific item, new questions have been formulated and indicated as 'additional question'.

For the Sleep Bruxism domain (A1), two items are proposed, with questions selected from the Oral Behaviour Checklist (OBC)<sup>11</sup> to report on the current/last month habit of clenching or grinding the teeth when asleep, based on the information the patient has. The same reports were also asked for history. To assess the Awake Bruxism domain (A2), four items are proposed, with questions selected from the OBC to report on the current/last month habits of teeth grinding, teeth clenching, teeth contact and mandible bracing. The same conditions are investigated also as for history, by using questions based on the same formulation of the history of the SB report. Amongst the possible Patient's Complaints included in the A3 domain, the reports of Temporomandibular Disorders (TMD) and jaw-muscle symptoms (TMD pain screener and other Diagnostic Criteria for Temporomandibular Disorders [DC/TMD] items, items on non-painful symptoms),<sup>12–15</sup> headache (item from the DC/TMD Symptoms Questionnaire),<sup>13</sup> tooth wear (item from the Tooth Wear Evaluation System [TWES]),<sup>16</sup> tinnitus (item from the Research Diagnostic Criteria for Temporomandibular Disorders [RDC/TMD] History Questionnaire),<sup>17</sup> xerostomia (item from the Xerostomia Inventory)<sup>18</sup> and drooling (Radboud Oral Motor inventory for Parkinson—ROMP)<sup>19</sup> are investigated.

### 2.2 | Clinically based assessment (for examiner's use)—examiner report

The Clinically Based Assessment (CBA) includes domains on Joints and Muscles (A4), Intra- and Extra-Oral Tissues (A5), and Teeth and Restorations (A6), based on information collected by an examiner. Whenever possible, existing instruments and procedures have been included, to which the examiner should refer for administering, scoring and interpreting the results of the examination. When instruments did not exist, new items have been formulated and indicated as 'additional item'.

As part of the optional clinical assessment of the Joints and Muscles domain (A4), the examiner may assess the presence of one or multiple DC/TMD diagnoses<sup>13</sup> and evaluate masseter hypertrophy. As for the Intra- and Extra-oral Tissues domain (A5), the evaluation of the presence of several signs (i.e. linea alba, lip impression, tongue scalloping, tongue traumatic lesion, alveolar bone exostosis) is required. As part of this evaluation domain, tongue position is also evaluated based on the modified Friedman score.<sup>20</sup> Skeletal class (Class 1, 2, 3) and profile (hypo-, normo- and hyper-divergent) are optional items that may be included for selected research purposes. Concerning the Teeth and Restorations domain (A6), the evaluation of tooth wear from both a quantitative and qualitative perspective is suggested based on the TWES.<sup>16</sup> Also, periodontal screening and dental examination as well as an evaluation of restorations are suggested to evaluate mobility, thermal sensitivity, discomfort on biting and/or teeth fractures as well as the presence of lost/broken fillings, scratched restorations, ceramic fractures, mobile implants, implant fractures and/or implant screw loosening.<sup>21</sup> The evaluation of marks and/or perforations on oral appliances (if hard resin splint is worn by the patient) is also suggested.

### 2.3 | Instrumentally based assessment—technology report

The Instrumentally Based Assessment (IBA) includes domains on Sleep Bruxism (A7), Awake Bruxism (A8) and the use of Additional Instruments (A9), based on the information gathered with the use of biosignal-recording devices (i.e. technology report).

As part of the Sleep Bruxism domain (A7), sleep-time electromyography (EMG) should be interpreted based on parameters concerning masseter events and work, such as the number of events exceeding 10% of the maximum voluntary contraction (MVC), the bruxism index, the bruxism time index and bruxism work index, if available.<sup>22,23</sup> The use of polysomnography (PSG) should be optionally evaluated based on the number of arousal-related and -unrelated SB events.<sup>24</sup> The same bruxism indices described for EMG should be used, if available. Refinement of these outcome measures will be provided based on the proposals of a Sleep Bruxism Task Force.<sup>25,26</sup> Other optional methods (e.g. smartphone application scores for grinding sounds; appliances with sensors) can also be adopted. As part of the Awake Bruxism domain (A8), an evaluation with technological Ecological Momentary Assessment (EMA) strategies is required, by the adoption of data collection over one week.<sup>27</sup> Patients' compliance and comprehension should be considered to enhance the validity of the data.<sup>28,29</sup> Wake-time EMG is also included in this domain.<sup>30</sup> The same interpretation strategies as for sleep-time EMG scoring are recommended.<sup>25</sup> Further outcome measures for the interpretation of wake-time EMG and other methods will be suggested based on the proposals of an Awake Bruxism Task Force.<sup>31</sup> For the Additional Instrument domain (A9), intraoral acidity evaluation is included as an optional item as a possible marker of stress-related or gastroesophageal reflux-induced salivary changes.

### 3 | AXIS B—RISK AND ETIOLOGICAL FACTORS AND COMORBID CONDITIONS

Axis B includes the self-reported information (subject-based report) on factors and conditions that may have an etiological or comorbid association with bruxism. It includes domains on Psychosocial Assessment (B1), Concurrent Sleep-related Conditions Assessment (B2), Concurrent Non-Sleep Conditions Assessment (B3), Prescribed Medications and Use of Substances Assessment (B4) and Additional Factors Assessment (B5). As a rule, whenever possible, existing instruments, either in full or partial (i.e. specific subscales) form are included.

As part of the Psychosocial Assessment domain (B1), four anxiety and depression screening items are included based on the Patient Health Questionnaire-4,<sup>32</sup> along with the four-item Brief Resilient Coping Scale as a coping evaluation instrument.<sup>33</sup> For the Concurrent sleep-related conditions assessment (B2), screening questions on possible sleep-related conditions that are associated with bruxism are proposed. The eight-item STOP-BANG questionnaire is included for sleep apnea screening.<sup>34</sup> The seven items of the insomnia scale and the seven items of the periodic limb movement disorders and restless leg syndrome scale of the Sleep Disorder Questionnaire are added.<sup>35</sup> An item on sleep position is also included in the OBC.<sup>11</sup> Within the concurrent non-sleep conditions assessment domain (B3), all the remaining OBC items investigating the report of oral behaviours during waking hours (i.e. Q7-21) are included.<sup>11</sup> As an optional item, the time of smartphone use can be indicated. Based on the International Network for Orofacial pain and Related disorders Methodology (INOFRM) recommendations, concurrent diagnoses of motor disorders should be indicated.<sup>36</sup> The six-item GERD-Q instrument is included to screen for gastroesophageal reflux disease (GERD-Q).<sup>37</sup> The report of known diagnoses of autoimmune diseases and/or attention deficit hyperactive disorder is also required. The domain on prescribed medications and use of substances assessment (B4) is based on the collection of information about the patient's report of the use of drugs, medications and substances that are known for their possible exacerbating or attenuating role on bruxism and its possible consequences. This list is based on literature suggestions about the bruxism-enhancing and attenuating substances.<sup>38</sup> In the final Additional Factors Assessment domain (B5), the patient is asked to report a known history of bruxism and other related conditions (i.e. tooth wear, obstructive sleep apnea, orofacial pain, gastroesophageal reflux disease) in the family.

### 4 | DISCUSSION

This paper aimed to present and describe the Standardised Tool for the Assessment of Bruxism (STAB), an instrument that was developed to provide a multidimensional evaluation of bruxism status, comorbid conditions, aetiology and consequences. The tool consists of two axes, specifically dedicated to the evaluation of bruxism status and consequences (Axis A) and bruxism risk and etiological factors

and comorbid conditions (Axis B). It includes 14 domains, accounting for a total of 66 items. A combination of self-reported, clinically based and instrumentally gathered data is provided to collect information on the above topics. A user's guide to the instrument is available in [Appendix 1](#), and the full instrument is presented in [Appendix 2](#).

The process that led to the development of the instrument, which started in 2018, after the publication of the 'work in progress' consensus paper on bruxism definition,<sup>2</sup> was described in two separate papers providing an introductory overview<sup>9</sup> and describing the road map to STAB finalisation, respectively.<sup>10</sup> In parallel, a screening instrument, viz., the Bruxism Screener (BruxScreen) has been prepared by the core group of STAB developers to be used in large-scale epidemiological research projects and, especially, in general, dental practices.<sup>39</sup> The screening instrument is particularly important to fit with the need to satisfy the A4 principle of Applicability, Affordability, Accessibility and Accuracy<sup>2</sup> that are prevented by the comprehensiveness of the STAB.

Concerning the STAB, the face validity of the tool, i.e. the degree to which the instrument looks as though it is an adequate reflection of the construct to be measured, was assessed subjectively by collecting feedback on the tool from amongst all authors of this paper. In the absence of any standards regarding how to assess face validity,<sup>40</sup> the outcomes could not be quantified. Rather, after several rounds of in-person and online meetings and exchanges, the discussants agreed that the STAB will likely yield a valid assessment of the frequency of the various awake and sleep bruxism-related jaw-muscle activities (i.e. teeth clenching, teeth grinding, teeth contact and mandible bracing),<sup>2</sup> as well as of its most common clinical signs, risk and etiological factors, comorbid conditions and consequences. However, clearly, the validation process of the STAB is far from completed yet, but the tool is now ready for on-field testing.

Depending on the specific clinical and/or research needs of the users, some sections of the STAB might specifically be picked up. For this purpose, the list of instruments that can be selected for specific uses is provided as a Toolkit in [Appendix S3](#). The inclusion of already existing tools and items, with special concern for the self-reported domains, should ease data collection and comparison with existing literature findings. Nonetheless, the presence of some additional items, some minor modifications to a few of the existing items and the lack of homogeneity between the answer options between the various instruments will be a challenging issue to design studies and provide proper statistical analysis and interpretation. For this reason, the STAB should be viewed as an open project, which will be reviewed from time to time by the core group of authors based on the emerging feedback from its on-field application. Researchers are free to use any additional tool that fits the needs of their specific projects, and in case of broad applicability, they can suggest their tools for possible future inclusion in the Toolkit of the STAB.

Within the above premises, there is no doubt that the STAB covers a much-needed gap in the dental and medical literature. From its use in the research and clinical settings, artificial intelligence models

can be created to predict diseases based on the presence of certain bruxism phenotypes. The inputs drawn from the bruxism field might be an important step to upgrade other classification systems within the areas of orofacial pain and dental sleep medicine with some further information concerning the aetiology and inter-relationship of the various conditions.

## 5 | CONCLUSIONS

After a long development process that started in 2018, a consensus approach amongst multidisciplinary experts has refined the first multidimensional system for the evaluation of bruxism, viz., the Standardised Tool for the Assessment of Bruxism (STAB). The instrument is now ready for on-field testing and further refinement, and it can be anticipated that it will help in collecting data on bruxism in such a comprehensive way to have an impact on several clinical and research fields.

### AUTHOR CONTRIBUTIONS

D.M. co-chaired all sessions and meetings leading to this paper, drafted the STAB and drafted this paper; F.L. conceptualised the STAB project, co-chaired all sessions and meetings leading to this paper, and revised the STAB and this paper; J.A. co-chaired all sessions and meetings leading to this paper, and revised the STAB and this paper; G.A., A.B., J.D., D.E., L.M.G., M.K., I.P., P.S. and P.W. took part to the sessions and meetings leading to this paper, and revised the STAB and this paper; S.B., P.A.C., P.C.C., R.D.L., A.E.-P., B.H.-H., C.H., T.K., G.K., G.J.L. and D.P. revised the STAB and this paper.

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### CONFLICT OF INTEREST STATEMENT

The authors declare they do not have any conflicts of interest.

### DATA AVAILABILITY STATEMENT

No data are available concerning this manuscript.

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## APPENDIX 1

### Standardized Tool for the Assessment of Bruxism (STAB): User's guide, with explanatory and scoring manual

#### SELECTION OF CONSTRUCTS AND INSTRUMENTS

As described in Manfredini et al., 2020<sup>9</sup> and in Manfredini et al., 2022,<sup>10</sup> many constructs and instruments have been considered for the inclusion in the STAB. The two above references describe the rationale for the structure of the tool, the format of axes and domains, and the selections of items. Readers are encouraged to refer to them for any additional info not included in this manual. The paper by Lobbezoo et al., 2022<sup>39</sup> also introduced a short screening instrument (i.e. BruxScreen) that should lead the examiner towards the need of using the comprehensive STAB after raising suspicion of a possible bruxism status and its consequences.

As a rule, pre-existing items were selected for inclusion in the STAB, whenever possible. In some cases, items have been slightly modified with respect to the original version and/or have been extracted from a bigger instrument that has not been fully included in the STAB. For some purposes, additional, new items have been created. In these cases, any rules on scoring are available, and on-field studies are needed to validate findings and suggest interpretation criteria.

In the remainder of this guide, explanations for the STAB administration and guidelines for the interpretation of scores for the existing instruments are provided. Standard scoring rules, as based on published papers or on guidelines from the instrument developer, are provided for each instrument. The extent of missing data is also stated for the instruments for which such information is available; missing data exceeding the stated cut-offs should lead to either re-administration of the instrument or not reporting that score. Whenever possible, interpretation guidelines are provided, with reference to the original publication describing each instrument. The full instrument is available in [Appendix 2](#). A ToolKit version, referring to the full version of all instruments included, even partially, in the STAB is provided in [Appendix 3](#). Researchers and clinicians who are interested in specific topics for their investigations can pick a single or multiple instruments from the ToolKit.

#### GENERAL INTERPRETATION OF THE STAB

Interpretation guidelines are provided for each instrument, thus leading the clinician/researcher to gather valid info on specific factors. Classification of overall scores will be available in the future after on-field testing of the STAB. Interpretation of findings will be possibly based on a graphical representation of the full bruxism spectrum of status, aetiology, comorbid conditions and consequences. The overall interpretation across items and their correlation awaits further evidence.

#### List of instruments included in the STAB

##### The oral behaviour checklist

The OBC is a self-assessment tool designed for the evaluation of the frequency of different oral behaviours during the day or at night.<sup>11</sup> It consists of 21 items, out of which two refer to night-time behaviours, while the rest refer to daily oral function. For each item, a participant provides an answer describing the frequency of this behaviour: during the night (how many nights in a week such behaviour appears) or during the day (none of the time/a little of the time/some of the time/most of the time/all of the time). Please mark 'don't know' in case of any doubts.

The questions are formulated in the form of 'How often do you do each of the following activities, based on the last month?' If the frequency of the activity varies, choose the higher option. Please place a (√) response for each item and do not skip any items.

Scoring can be computed as the sum of the number of items with non-zero response or as a weighted sum (i.e. sum of the endorsed frequencies of the respective items).

For each item, a score of 0–4 points is assigned (for sleep questions: 0, none of the time; 1, <1 night/month; 2, 1–3 nights/month; 3, 1–3 nights/week; 4, 4–7 nights/week; for awake questions: 0, none of the time; 1, a little of the time; 2, some of the time; 3, most of the time; 4, all of the time). No information exists regarding how missing items might be managed.

The score may be interpreted as follows: 0–no, 1–24–low, 25–84–high. Please note that norms have not yet been established for this instrument. Based on comparison of individuals with chronic TMD vs those without TMD, an OBC summary score of 0–16 appears to represent normal behaviours, while a score of 17–24 occurs twice as often in those with TMD, and a score of 25–62 occurs 17 times more often. As a risk factor for TMD, only a score in the 25–62 range contributes to TMD onset.

##### Where to find it in the STAB

The full OBC is included in the STAB. OBC questions can be found at the following STAB items: A1.1(q1), A2.1(q3), A2.2(q4), A2.3(q5), A2.4(q6), B2.4(q2) and B3.1(q7–q21).

### TMD pain screener

The TMD Pain Screener is a self-reported instrument included in the DC/TMD Axis I and designed to screen for TMD signs and symptoms.<sup>14</sup> It is made of six short questions. The full instrument can be administered, which is recommended for assessing individuals, or only the first three items (q1, q2 and q3a) can be administered for population studies.

The first item has scores of 0-2 ( $a=0$ ,  $b=1$ ,  $c=2$ ), while the remaining items are scored simply as  $a=0$  or  $b=1$ . A sum is computed. No scoring can be done if responses to any items are missing, due to the nature of the item content.

Values equal to or exceeding the cut-offs of 3 (i.e.  $\geq 3$ ) for the full 6-item version or of 2 (i.e.  $\geq 2$ ) for the 3-item version indicate that TMD may be present.

### Where to find it in the STAB

The full TMD Pain Screener is included in the STAB. The questions can be found at the following STAB items: A3.1(q1), A3.2(q2), A3.4(q3a-d).

### DC/TMD symptom questionnaire

The Symptom Questionnaire (SQ) of the DC/TMD Axis I is used to fully assess jaw pain and factors necessary for a myalgia or arthralgia diagnosis, presence of temporal region headache and factors that modify that pain, and joint noises and locking of the TMJs.<sup>13</sup> It subsumes the TMD Pain Screener; if the SQ is administered, the TMD Pain Screener is redundant. The instrument was designed to be followed by an interview for clarification and confirmation of the responses to all items; it is not intended to be a self-complete instrument. In particular, the third section assessing TMJ noises and locking require further interview to establish whether right, left or both sides are involved; the instrument was designed in this way due to known poor reliability when asking about noises and locking regarding which side, but better (and acceptable) reliability when inquiring more generally. Consequently, the instrument should not be modified by asking the patient or participant to indicate which side.

Concerning the scoring, items from each section are used as part of the diagnostic algorithms for each disorder within the DC/TMD. Review for clarification and confirmation should ensure that all items are completed. Clarifications provided via interview are interpreted based on expert knowledge. The final responses are interpreted according to the diagnostic criteria.

### Where to find it in the STAB

The SQ is only partially included in the STAB. Three items (q5, q8 and q9) have been selected to complement the info drawn from the TMD Pain Screener. The questions can be found at the following STAB items: A3.3(q9), A3.5(q8), A3.8(q5).

As such, please note that no interpretation criteria can be suggested, unless the full SQ is used to reach a DC/TMD Axis I diagnosis. The full SQ is available as part of the STAB ToolKit (see [Appendix 3](#)) and should be used at clinician/researcher's need.

### Xerostomia inventory

The Xerostomia Inventory (XI) is designed to investigate self-reported symptoms of Xerostomia.<sup>18</sup>

It is composed of 11 items, which are scored based on the frequency of symptom occurrence, as 'never' (1), 'hardly ever' (2), 'occasionally' (3), 'fairly often' (4) or 'very often' (5).

No specific information is provided on how to interpret scores.

### Where to find it in the STAB

The XI is only partially included in the STAB. A single item (q4) has been selected and can be found at the STAB item A3.11. As such, please note that no interpretation criteria can be suggested for the use of single items, unless the full XI is used. The full XI is available as part of the STAB ToolKit (see [Appendix 3](#)) and should be used at clinician/researcher's need.

### Radboud oral motor inventory for Parkinson's disease (ROMP)—saliva questionnaire

The ROMP has been developed to evaluate oral motor functions in patients with Parkinson's disease and is divided in three domains (speech, swallowing and saliva).<sup>19</sup>

The saliva questionnaire is made of nine items, which should be answered based on the frequency of occurrence and scored from 0 (no occurrence) to 4 (all days/nights).

For scoring purposes, if the patient reports a '0' he/she is a non-drooler, with '1' or '2' a pre-drooler, and with '3' or '4' a drooler.

### Where to find it in the STAB

The ROMP-saliva questionnaire is only partially included in the STAB. A single item (q11) has been selected and can be found at the STAB item A3.12. As such, please note that no interpretation criteria can be suggested, unless the full questionnaire is used. The full ROMP is available as part of the STAB ToolKit (see [Appendix 3](#)) and should be used at clinician/researcher's need.

### Diagnostic criteria for temporomandibular disorders (DC/TMD) examination form—diagnoses

The DC/TMD Examination form, in combination with the DC/TMD SQ, leads the clinician to provide diagnoses concerning the joints and the muscles of the masticatory system.<sup>13</sup> A decision tree is provided to visualise diagnostic algorithms, and multiple diagnoses are allowed per patient and per side.

Interpretation of the clinical relevance of the DC/TMD diagnoses must be based on a comprehensive patient's evaluation by an experienced and calibrated clinician.

### Where to find it in the STAB

The DC/TMD Examination Form is only partially included in the STAB as an optional item. The summary item to recap diagnoses (E11) can be found at the STAB item A4.1. Please note that a fulfilment of this item requires that the clinician/researcher goes through the full DC/TMD diagnostic process, as described in the original publication, which is available as part of the STAB ToolKit (see [Appendix 3](#)).

### Tooth wear evaluation system (TWES)—quantification and qualification

The TWES provides a multimodular evaluation of tooth wear, with all necessary tools for a clinical guideline presented in different modules.<sup>16</sup> This allows the dental clinician, in a general practitioner setting and in a referral practice setting, to perform a state-of-the-art diagnostic process. To avoid the risk of a too cumbersome usage, the dental clinician can select only those modules that are appropriate for a given setting. The modules match with each other, which is indispensable and essential when different modules of the TWES are compared. With the TWES, it is possible to recognise the problem (qualifying), to grade its severity (quantifying), to diagnose the likely causes and to monitor (the progress of) the condition. In addition, a proposal for the classification of tooth wear is made. Further, it is possible to determine when to start a treatment, to make the decision which kind of treatment to apply and to estimate the level of difficulty of a restorative treatment.

For the module 'quantification, screening module', scores are based on a five-point ordinal scale for occlusal and incisal grading. Per sextant the highest score is noted. 0=no (visible) wear; 1=visible wear within the enamel; 2=visible wear with dentin exposure and loss of clinical crown height  $\leq 1/3$ ; 3=loss of clinical crown height  $>1/3$  but  $<2/3$ ; 4=loss of clinical crown height  $\geq 2/3$ . A three-point ordinal scale is adopted for non-occlusal/non-incisal grading. The highest score of the palatal surfaces of the second sextant is noted. 0=no (visible) wear; 1=wear within the enamel; 2=wear with dentin exposure.

### Where to find it in the STAB

The tooth wear quantification, screening module is included in the STAB (Item A6.1). When during quantification a grade  $\geq 2$  is detected for occlusal/incisal wear, qualification is needed. Qualification is provided with Item A6.2, based on the TWES qualification module.

### Patient Health Questionnaire-4 (PHQ-4: Distress—depression and anxiety)

The Patient Health Questionnaire-4 is comprised of two 2-item subscales, anxiety and depression, and it is intended to be an ultra-brief screener for distress as the composite construct of anxiety and depression.<sup>32</sup> The core items for each of the two component constructs are identical to those on the parent instruments, the GAD-7 and the PHQ-9.

Items are scored based on a 4-point Likert scale. A total sum score is computed. In principle and according to the instrument's developers, the two subscales can be scored separately; however, reliability is then compromised. Consequently, only the single score based on all four items is recommended. With only four items, it is permissible to have one missing item response; the total score should be adjusted accordingly since the cut-offs are based on responses to all four items. For example, if one item is missing, the sum of the remaining three items is computed, divided by 3, and then multiplied by 4. Note that this approach assumes that the score on the missing item would have been the mean of the remaining items; this assumption may or may not be appropriate, given that only four items are addressing two complex constructs and there are only two items for each of the complex constructs.

Concerning the interpretation, scores of 3, 6 and 9 represent cut-points for mild, moderate and severe distress, respectively.

### Where to find it in the STAB

The full PHQ-4 is included in the STAB. The four questions can be found at the STAB item B1.1.

### Brief resilient coping scale (BRCS)

The Brief Resilient Coping Scale (BRCS) is a four-item measure designed to capture tendencies to cope with stress in a highly adaptive manner.<sup>33</sup> The patient is asked to consider how well certain statements describe his/her behaviour and actions. Answers are structured according to a 5-point Likert scale, rating from 1 point ('Does not describe me at all') to 5 ('Describes me very well'). No information on how to manage missing data is provided.

A total score is calculated and interpreted as follows: 4-13 points, low resilient copers; 14-16 points medium resilient copers; 17-20, high resilient copers.

**Where to find it in the STAB**

The full BRCP is included in the STAB. The four questions can be found at the STAB item B1.2.

**STOP-BANG questionnaire**

The STOP-Bang Questionnaire is intended to give physicians an easy-to-use tool to identify people who might have obstructive sleep apnoea. The questionnaire consists of eight yes-or-no questions based on the major risk factors for OSA.<sup>34</sup> The name STOP-Bang is an acronym for the first letter of each symptom or physical attribute often associated with OSA:

- Snoring: This question assesses whether or not you snore loudly enough to bother a bed partner.
- Tiredness: This symptom involves feeling daytime tiredness, which may include falling asleep during daily tasks.
- Observed Apnoea: If a sleep partner has noticed that you stop breathing or gasp for air as you sleep, this can be a sign of OSA.
- Pressure: High blood pressure is also a symptom.
- BMI: Physicians look for a body mass index that is higher than 35.
- Age: Those who are older than 50 are at higher risk for OSA.
- Neck Circumference: Physicians measure your neck circumference. A measurement greater than 16 inches is considered a risk factor.
- Gender: Males are considered to be more likely to have OSA.

When filling out the STOP-Bang questionnaire, a person receives one point for each symptom or risk factor, for a maximum of eight points. In general, the higher a person scores on the questionnaire, the greater risk they face of having moderate or severe OSA.

A STOP-Bang score of 2 or less is considered low risk, and a score of 5 or more is high risk for having either moderate or severe OSA. For people who score 3 or 4, doctors may need to perform further assessment to determine how likely they are to have OSA.

**Where to find it in the STAB**

The full STOP-BANG is included in the STAB. The eight questions can be found at the STAB item B2.1.

**Sleep disorder questionnaire (SDQ)**

This questionnaire gives a good understanding about problems with sleeping and waking. In answering the questions, consider each question as applying to the past six months of life (35). Some people work night shift, or rotating shifts. Others have a very changeable bedtime. For these people, questions which ask about 'day, daytime, morning, etc.' will mean the time when they wake from their longest sleep of the day and become active. Similarly, 'night, nighttime, bedtime, nocturnal' would refer to whenever they are having their longest sleep of the day.

Most of the questions are simple statements that the patient should answer by circling a number from 1 ('strongly disagree with the statement') to 5 ('strongly agree').

No interpretation criteria are currently available for the full questionnaire of 176 items, but there are criteria for the subscales (i.e. sleep apnoea (SA), narcolepsy (NAR), periodic limb movement disorder (PLM) and psychiatric (PSY)), based on cut-off scores of different sensitivity and specificity.<sup>35</sup>

**Where to find it in the STAB**

A selection of modified items to screen insomnia as well as periodic limb movement disorder and restless leg syndrome can be found in the STAB items B2.2 and B2.3. No interpretation criteria can be suggested, unless the full questionnaire is used, for which some scoring criteria are available for selected sub scales. The full SDQ is available as part of the STAB ToolKit (see [Appendix 3](#)) and should be used at clinician/researcher's need.

**Gastroesophageal reflux disease questionnaire (GERD-Q)**

The GERD-Q instrument explores symptoms potentially related with gastroesophageal reflux. It consists of six questions, formatted as to ask for the frequency (days per week) of each specific symptom.<sup>37</sup> For all questions, a score of '0' is assigned if the symptom occurs on 0 days/week, '1' if it occurs on 1 day, '2' if it occurs on 2-3 days and '3' if it occurs on 4-7 days.

A total score of 0-2 is associated with a GERD Likelihood of 0%, 3-7 points have a GERD likelihood of 50%, 8-10 points a GERD likelihood of 79%, and 11-18 points a GERD likelihood of 89%.

**Where to find it in the STAB**

The full GERD-Q is included in the STAB. The six questions can be found at the STAB item B3.4.

**OTHER ITEMS NOT LISTED ABOVE: SELF-REPORTED ITEMS (AXIS A)**

History questions on awake (A1.1.1) and sleep bruxism (A2.1.1, A2.2.1, A2.3.1, A2.4.1) These questions have been included in the absence of existing items that satisfied the need to collect info on the different forms of past bruxism activities. The patient should be asked to answer

'yes' or 'no', and invited to mark 'don't know' in case of any doubts. No frequency grading is provided. Validity of these items has not been tested yet.

#### **Waketime muscle pain (A3.6) and fatigue (A3.6.1) items**

These questions have been modified (minor text changes and timeframe to last 30 days) from the paper by Van Grootel et al.<sup>12</sup> Four answer options are provided, based on the different time frames of the day in which symptoms may occur. Currently, no information is available on the interpretation of answers.

#### **Awakening symptoms question (A3.7)**

This item includes a list of six possible symptoms that may occur upon awakening, based on the history taking suggestions by the American Academy of Sleep Medicine.<sup>15</sup> Currently, no information is available on the interpretation of answers.

#### **Tooth wear-related complaints (A3.9)**

This item provides a question to report on five symptoms that may be related with tooth wear. The list is taken from the Tooth Wear Evaluation System.<sup>16</sup> The patient should answer 'yes' or 'no'. Currently, no information is available on the interpretation of answers.

#### **Tinnitus question (A3.10)**

The question 15F of the 1992 RDC/TMD History Questionnaire has been selected to ask patients if they have noises or ringing in their ears.<sup>17</sup> The patient should answer 'yes' or 'no'. Currently, no information is available on the interpretation of answers.

#### **Other items not listed above: Examiner report**

##### **Masseter muscle hypertrophy (A4.2)**

The examiner should mark the presence of clearly visible masseter muscle hypertrophy (i.e. muscle size that exceeds the expected size for the patient's face). No grading is currently available, nor is any information available on the validity of this report.

##### **Soft and bone tissues (A5.1)**

The examiner should mark the presence of clearly visible linea alba, lip impression, tongue scalloping, tongue ulceration and alveolar bone exostosis. No grading is currently available, nor is any information available on the validity of this report.

##### **Tongue position (A5.2)**

The examiner can use a pictorial guide to mark the tongue position according to the modified Friedman criteria, as proposed by Laharnar et al.<sup>20</sup> Four answer options are provided based on the categorisation of uvula and palatal arch visualisation without phonation, with phonation and with tongue depressor. Currently, no information is available on the validity of this report.

##### **Skeletal class (A5.3) and profile (A5.4)—Optional items**

The examiner can use a pictorial guide to mark the skeletal class 1, 2 or 3, and to mark the profile as normo-, hypo- or hyperdivergent. These items are optional.

##### **Periodontal and dental examinations (A6.2) and restorations (A6.3)**

The examiner should explore possible signs related to bruxism consequences at the tooth/periodontium level (i.e. mobility, thermal sensitivity, discomfort/pain on biting and fractured teeth) and concerning restorations (i.e. lost/broken fillings, scratched restorations, ceramic fractures, mobile implants, implant fractures and implant screw loosening). The number of affected teeth per sextant should be indicated.

##### **Oral appliance evaluation (A6.4)**

The examiner can use a pictorial guide to mark the presence of different patterns of wear signs on oral appliances. This item applies only if a hard acrylic resin stabilization appliance is worn by the patient. The examiner is also asked, whenever possible, to take note of the appliance design.

#### **Other items not listed above: Technology report**

##### **Sleep bruxism (A7.1-A7.4)**

Electromyography (EMG) recordings are the main item to assess sleep bruxism with instrumental approaches. The literature has pointed out a variety of possible reporting strategies, summarised by Thymi et al.<sup>25</sup> Minimum quality of data acquisition is needed. The number of masseter

EMG events exceeding 10% of the maximum voluntary clenching must be reported to ease comparison with most previous studies (A7.1). If available, the bruxism time and work indices should also be reported.

Polysomnography (PSG) recordings are based on the EMG findings of type I or type II sleep-time monitoring. The number of arousal-related and arousal-unrelated EMG events (i.e. EMG activity exceeding 10% MVC) should be reported (A7.2), as suggested by previous publications on PSG/SB screening criteria. The clinical validity of those measures has never been demonstrated, but they represent the best available strategy for comparison across studies. If available, the bruxism time and work indices should also be reported, if available. This item is optional and should be considered for endorsement by any clinician who is interested in studying the sleep correlates of SB.

Other methods such as smartphone application scores for grinding sounds (A7.3) and appliances with sensors (A7.4) could be also optionally considered.

Currently, no information is available on the validity of a possible diagnostic grading achieved with these approaches and their correlation with other assessment methods.

### **Awake bruxism (A8.1–A8.3)**

Ecological Momentary Assessment report via smartphone technology should be based on the early recommendations described in Bracci et al.<sup>31</sup> One week monitoring in home environment is required, and frequency of the main awake bruxism behaviours (i.e. percentage with respect to the answered alerts) is reported (A8.1). A compliance of more than 60% answered alerts is needed to consider daily monitoring valid, as reported by Colonna et al.<sup>28</sup>

Wake-time EMG should be performed with minimum quality of data acquisition, as per sleep time EMG recommendations. The number of masseter EMG events exceeding 10% of the maximum voluntary clenching must be reported to ease comparison with most previous studies (A8.2). If available, the bruxism time and work indices should also be reported.

Other methods to assess awake bruxism instrumentally are currently not available, and the item A8.3 is left open for future recommendations.

### **Additional instruments (A9.1)—Optional item**

Intraoral acidity to measure salivary PH in different conditions using commercial test is an optional item.

### **Other items not listed above: Self-reported items (Axis B)**

#### **Question on smartphone use (B3.2)—Optional item**

If available, the patient should report the average time/day of smartphone use over the past week.

#### **Concurrent diagnoses of orofacial motor disorders (B3.3)**

A list of orofacial motor disorders that may potentially be associated with bruxism is provided, based on INFORM network recommendations for an expanded orofacial pain taxonomy.<sup>36</sup> The patient should endorse positively the specific item referring to a known diagnosis of orofacial dyskinesia, oromandibular dystonia, Parkinson's disease, Huntington's disease, Tourette's syndrome, Hemifacial spasms or Tardive dyskinesia.

#### **Concurrent diagnoses of autoimmune or connective tissue disorders (B3.5)**

A list of autoimmune or connective tissue disorders that may potentially be associated with bruxism or facial symptoms is provided, modified from the RDC/TMD History Questionnaire question 16a.<sup>17</sup> The patient should endorse positively the specific item referring to a known diagnosis of rheumatoid arthritis, lupus, other systemic rheumatic diseases (including fibromyalgia) or other systemic conditions (including systemic sclerosis, rheumatic polymyalgia and mixed connective disease).

#### **Attention deficit hyperactivity disorder (B3.6)**

The patient is asked to report if he/she has been previously diagnosed with attention deficit hyperactivity disorder.

#### **Prescribed medications and use of substances assessment (B4.1–B4.7)**

The patient is asked to report, and give details whenever possible, about the use of recreational or street drugs (B4.1), medications that may be associated with the possibility of exacerbating or attenuating bruxism, based on a list taken by De Baat et al (38) (B4.2), tobacco (B4.3), alcohol (B4.4), soft drinks (B4.5), juices and fruits (B4.6) and caffeinated drinks (B4.7).

#### **Familiar conditions report (B5.1–B5.5)**

The patient is asked to report if anyone in the family (e.g. father, mother and children) had an history of occurrence of bruxism (B5.1), tooth wear (B5.2), obstructive sleep apnoea (B5.3), orofacial pain (B5.4) or gastroesophageal reflux (B5.5).

## APPENDIX 2

## Standardized Tool for the Assessment of Bruxism (STAB)

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## Demographics Questionnaire

## Sex

Male

Female

Unspecified/Other

Age	Height	Weight
----	----	----

## What is your current marital status?

Married

Living as married

Divorced

Separated

Widowed

Never married

## What is the highest grade or level of schooling that you have completed?

Compulsory school (&lt;16 years)

Secondary school (e.g., high school) up to 18 years

Some University (no degree)

University graduate

Post-graduate level

**AXIS A – Assessment of Bruxism Status and Consequences****Subject Based Assessment (SBA)—Self Report****A1. Sleep Bruxism report***A1.1 Sleep bruxism question*

How often do you clench or grind your teeth when asleep based on the last month (based on any information you may have)?

- None of the time
- Less than one night/month
- 1-3 nights/month
- 1-3 nights/week
- 4-7 nights/week
- Don't know

*A1.1.1 Sleep bruxism history question*

Did you use to clench or grind your teeth when asleep in the past, based on any information you have?

- No
- Yes
- Don't know

**A2. Awake bruxism report***A2.1 Awake teeth grinding question*

How often do you grind your teeth together during waking hours, based on the last month?

- None of the time
- A little of the time
- Some of the time
- Most of the time
- All of the time
- Don't know

*A.2.1.1 Awake teeth grinding history question*

Did you use to grind your teeth together during waking hours in the past?

- No
- Yes
- Don't know

*A2.2 Awake teeth clenching question*

How often do you clench your teeth together during waking hours, based on the last month?

- None of the time
- A little of the time
- Some of the time
- Most of the time
- All of the time
- Don't know

#### A2.2.1 Awake teeth clenching history question

**Did you use to clench your teeth together during waking hours in the past?**

- No
- Yes
- Don't know

#### A2.3 Awake teeth contact question

**How often do you press, touch, or hold your teeth together other than while eating (that is, contact between upper and lower teeth), based on the last month?**

- None of the time
- A little of the time
- Some of the time
- Most of the time
- All of the time
- Don't know

#### A2.3.1 Awake teeth contact history question

**Did you use to press, touch, or hold your teeth together other than while eating (that is, contact between upper and lower teeth) in the past?**

- No
- Yes
- Don't know

#### A2.4 Awake mandible bracing question

**How often do you hold, tighten, or tense your muscles without clenching or bringing teeth together, based on the last month?**

- None of the time
- A little of the time
- Some of the time
- Most of the time
- All of the time
- Don't know

#### A2.4.1 Awake mandible bracing history question

**Did you use to hold, tighten, or tense your muscles without clenching or bringing teeth together in the past?**

- No
- Yes
- Don't know

### A3. Patient's complaints

#### *Temporomandibular disorders*

##### A3.1 TMD pain

**In the last 30 days, how long did any pain last in your jaw or temple area on either side?**

- No pain
- Pain comes and goes
- Pain is always present

### A3.2 Pain or stiffness on awakening

**In the last 30 days, have you had pain or stiffness in your jaw on awakening?**

- No
- Yes

### A3.3 Closed lock

**In the last 30 days, have you had your jaw locked or caught, even for a moment, so it would not open ALL THE WAY?**

- No
- Yes

### A3.4 Pain change with activities

**In the last 30 days, did the following activities change any pain (that is, make it better or make it worse) in your jaw or temple on either side?**

- Chewing hard or tough food
- Opening your mouth or moving your jaw forward or to the side
- Jaw habits (e.g., holding teeth together, clenching, grinding, chewing gum)
- Other jaw activities such as talking, kissing, or yawning

### A3.5 Jaw joint noises

**In the last 30 days, have you had any jaw joint noise(s) when you moved or used your jaw?**

- No
- Yes

### A3.6 Waketime muscle pain

**In the last 30 days, did you have jaw muscle pain during any of the following times of the day?**

- Between waking up and breakfast
- Between breakfast and lunch
- Between lunch and dinner
- Between dinner and bedtime

#### A3.6.1 Waketime muscle tiredness or fatigue

**In the last 30 days, did you have jaw muscle stiffness or sensation or tiredness or fatigue during any of the following times of the day?**

- Between waking up and breakfast
- Between breakfast and lunch
- Between lunch and dinner
- Between dinner and bedtime

### A3.7 Awakening symptoms question

**Are you aware of any of the following symptoms upon awakening?**

- Sensation of fatigue, soreness or tightness of your jaw
- Feeling that your teeth are clenched or that your mouth is sore
- Aching of your temples
- Feeling of tension in your jaw joint upon awakening and feeling that you have to move your lower jaw to release it
- Difficulty in opening mouth wide upon awakening
- Hearing or feeling a click in your jaw joint upon awakening that disappears afterwards

## Headache

### A3.8 Headache

**In the past 30 days, have you had any headache that included the temple areas of your head?**

- No
- Yes
- If yes – how many days?

## Tooth wear

### A3.9 Tooth wear

Do you experience any of the following symptoms because of the existing tooth wear?

- Sensitivity and/or pain
- Functional problems (difficulties chewing and eating)
- Deterioration of esthetic appearance (compromised dental attractiveness)
- Crumbling of dental hard tissue and restorations
- Phonetic impairment

## Tinnitus

### A3.10 Tinnitus

Do you have noises or ringing in your ears (tinnitus)?

- No
- Yes

## Xerostomia and drooling

### A3.11 Xerostomia

Does your mouth feel dry?

- Never
- Occasionally
- Often

### A3.12 Drooling

Do you experience loss of saliva during the night?

- I do not experience loss of saliva during the night at all
- My pillow sometimes gets wet during the night
- My pillow regularly gets wet during the night
- My pillow always gets wet during the night
- Every night my pillow and other bedclothes get wet

Clinically based assessment (CBA) examiner report (for examiner's use)

## A4. Joints and muscles

### A4.1 TMD diagnoses (optional item)

Mark the presence of the following diagnoses

#### A4.1.1. Pain disorders\*

\*Please fill this section only if the item A3.3 (TMD Pain Screener) is positively endorsed by the patient

- Myalgia
- Myofascial pain with spreading
- Myofascial pain with referral
- Right arthralgia
- Left arthralgia
- Headache attributed to TMD

#### A4.1.2. Right TMJ disorders\*

\*Please specify if diagnosis is based upon clinical or imaging assessment

- Disc displacement with reduction
- Disc displacement with reduction, with intermittent locking
- Disc displacement without reduction with limited opening
- Disc displacement without reduction without limited opening
- Degenerative joint disease
- Subluxation

#### A4.1.3. L-eft TMJ disorders\*

Please specify if diagnosis is based upon clinical or imaging assessment

- Disc displacement with reduction
- Disc displacement with reduction, with intermittent locking
- Disc displacement without reduction with limited opening
- Disc displacement without reduction without limited opening
- Degenerative joint disease
- Subluxation

#### A4.2 Masseter muscle hypertrophy

Mark the presence of masseter hypertrophy

- Left
- Right

#### A5 Intra- and extra-oral tissues

##### A5.1 Soft and bone tissues

Mark the presence of the following signs

Linea alba	Left	Right	
Lip impression	Upper	Lower	
Tongue scalloping	Right	Front	Left
Tongue ulceration*	Right	Front	Left
Alveolar bone exostosis	Mandible (Buccal/Lingual)	Maxilla (Buccal/Lingual/Midpalatal)	

\*If positive for firm, indurated, rolled borders – red flag for further urgent investigation

##### A5.2 Modified Friedman tongue position



Category I:

No phonation/ tongue depressor –  
uvula and palatal arch visible

Category II:

With phonation –  
uvula and palatal arch visible

Category III:

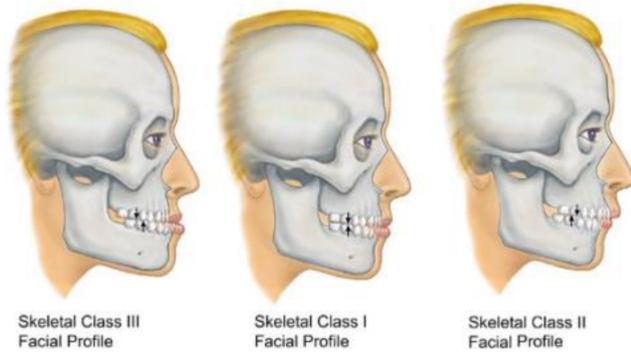
With tongue depressor –  
uvula and palatal arch visible

Category IV:

With phonation/ tongue depressor –  
uvula and palatal arch not visible

##### A5.3 Skeletal class (optional item)

- Class 1
- Class 2
- Class 3



A5.4 Skeletal profile (optional item)

Normodivergent profile (medium gonial angle)

Hypodivergent profile (low gonial angle)

Hyperdivergent profile (high gonial angle)



A6. Teeth and restorations

A6.1 Tooth wear screening - quantification

Indicate the highest tooth wear score per sextant

	Sextant 1	Sextant 2	Sextant 3	Sextant 4	Sextant 5	Sextant 6
Occlusal/Incisal						
Palatal						

A.6.1.1 Tooth wear qualification\*

\*When during quantification a grade  $\geq 2$  is detected, qualification is needed.

**Clinical signs indicating the influence of mechanical factors:**

- Shiny facets, flat and glossy
- Enamel and dentin wear at the same rate
- Matching wear on occluding surfaces, corresponding features at the antagonistic teeth
- Fracture of cusps or restorations
- Impressions in cheek, tongue and/or lip
- Located at cervical areas of the teeth, Non Carious Cervical Lesions (NCCL)
- Buccal/cervical lesions more wide than deep, Non Carious Cervical Lesions (NCCL)
- Cervical areas of premolars and cuspids are affected
- Cracks within the enamel
- Torus mandibulae

### A6.2 Periodontal and dental examination

Indicate the number of teeth with the following signs

	Sextant 1	Sextant 2	Sextant 3	Sextant 4	Sextant 5	Sextant 6
Mobility						
Thermal sensitivity						
Discomfort/pain on biting						
Fractured teeth						

### A6.3 Restorations

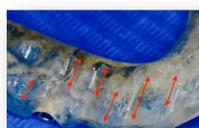
Indicate the number of teeth/implants with the following signs

	Sextant 1	Sextant 2	Sextant 3	Sextant 4	Sextant 5	Sextant 6
Lost/broken fillings						
Scratched restorations						
Ceramic fractures						
Mobile implants						
Implant fractures						
Implant screw loosening						

### A6.4 Oral appliance evaluation (if hard resin splint is used by the patient)

Mark the presence of the following signs

Prevalence of grinding marks (i.e., stripes)	Right	Front	Left
Prevalence of clenching marks (i.e., circle-like spots)	Right	Front	Left
Combination of grinding and clenching marks	Right	Front	Left
Fractures or perforations	Right	Front	Left



Example of grinding marks



Example of clenching marks.



Example of combined marks.

## Instrumentally Based Assessment (IBA) Technology Report

### A7. Sleep bruxism

#### A7.1 Electromyography

Number of masseter events over 10% MVC	----
Bruxism time index (if available)	----
Bruxism work index (if available)	----

#### A7.2 Polysomnography (optional)

Number of arousal-related SB events	----
Number of arousal-unrelated SB events	----
Bruxism time index (if available)	----
Bruxism work index (if available)	----

### A7.3 Other methods (optional)

Smartphone application scores for grinding sounds

### A7.4 Appliance with sensors (optional)

Number of events of bite pressure

## A8. Awake Bruxism

### A8.1 Ecological momentary assessment – one week report

Condition	Week 1 (in %)	Additional week(s) (in %)
Relaxed jaw muscles (no teeth contact)		
Mandible bracing (no teeth contact)		
Teeth Contact (light steady touching)		
Teeth Clenching (strong steady touching)		
Teeth Grinding		

### A8.2 Wake-time electromyography

Number of masseter events over 10% MVC	----
Bruxism time index	----
Bruxism work index	----

### A8.3 Other methods: To be determined

## A9. Additional instruments

### A9.1. Intraoral acidity (optional)

Rest salivary pH	----
Rest salivary flow	----
Stimulated salivary pH (paraffin)	----
Stimulated salivary flow	----

## AXIS B – Risk and etiological factors and comorbid conditions

### B1. Psychosocial assessment—Self report

#### B1.1 Anxiety and depression screening

In the last two weeks, how often have you been bothered by the following problems?

- Feeling nervous, anxious or on edge
  - Not at all
  - Several days
  - More than half the days
  - Nearly every day

2. Not being able to stop or control worrying

Not at all

Several days

More than half the days

Nearly every day

3. Little interest or pleasure in doing things

Not at all

Several days

More than half the days

Nearly every day

4. Feeling down, depressed, or hopeless

Not at all

Several days

More than half the days

Nearly every day

### B1.2 Coping

Consider how well the following statements describe your behaviors and actions

1. I look for creative ways to alter difficult situations

Does not describe me at all

Does not describe me

Neutral

Describes me

Describes me very well

2. Regardless of what happens to me, I believe I can control my reaction to it

Does not describe me at all

Does not describe me

Neutral

Describes me

Describes me very well

3. I believe I can grow in positive ways by dealing with difficult situations

Does not describe me at all

Does not describe me

Neutral

Describes me

Describes me very well

4. I actively look for ways to replace the losses I encounter in life

Does not describe me at all

Does not describe me

Neutral

Describes me

Describes me very well

## B2. Concurrent sleep-related conditions assessment—Self report

### B2.1 Sleep apnea screening

Please mark which of the following questions is answered positively

- Do you snore loudly?
- Do you often feel tired, fatigued or sleepy during daytime?
- Has anyone observed you stop breathing or choking/gasping during sleep?
- Do you have or are being treated for high blood pressure?
- Body mass Index more than 35?
- Age older than 50?
- Neck size large (43 cm or larger for males; 41 cm or larger for females)?
- Gender=male?

### B2.2 Insomnia screening

Indicate which of the following statements can be applied to you

- I have difficulty falling asleep
- Thoughts race through my mind and prevent me from sleeping
- I anticipate a problem with sleep several times a week
- I wake up and cannot go back to sleep
- I worry about things and have problems relaxing
- I wake up earlier in the morning than I would like to
- I lie awake for half an hour or more before I fall asleep

### B2.3 Periodic limb movement disorder and restless leg syndrome screening

Indicate which of the following statements can be applied to you

- Other than when exercising, I still experience muscle tension in my legs
- I have noticed (or other have commented) that parts of my body jerk during sleep
- I have been told that I kick at night
- When trying to go sleep, I experience an aching or crawling sensation in my legs
- I experience leg pain and cramps at night
- Sometimes I can't keep my legs still at night. I just have to move them to feel comfortable
- Even though I slept during the night, I feel sleepy during the day

### B2.4 Oral behaviors – sleep position

How often do you sleep in a position that puts pressure on the jaw, based on the last month?

- None of the time
- A little of the time
- Some of the time
- Most of the time
- All of the time
- Don't know

### B3. Concurrent non-sleep conditions assessment—Self report

#### B3.1 Oral behaviors – activities during waking hours

How often do you do each of the following activities, based on the last month?

Q7. Hold or jut jaw forward or to the side

- None of the time
- A little of the time
- Some of the time
- Most of the time
- All of the time
- Don't know

Q8. Press tongue forcibly against teeth

- None of the time
- A little of the time
- Some of the time
- Most of the time
- All of the time
- Don't know

Q9. Place tongue between teeth

- None of the time
- A little of the time
- Some of the time
- Most of the time
- All of the time
- Don't know

Q10. Bite, chew or play with your tongue, cheeks or lips

- None of the time
- A little of the time
- Some of the time
- Most of the time
- All of the time
- Don't know

Q11. Hold jaw in rigid or tense position, such as to brace or protect the jaw

- None of the time
- A little of the time
- Some of the time
- Most of the time
- All of the time
- Don't know

Q12. Hold between the teeth or bite objects such as hair, pipe, pencil, pens, fingers, fingernails etc

- None of the time
- A little of the time
- Some of the time
- Most of the time
- All of the time
- Don't know

Q13. Use chewing gum

- None of the time
- A little of the time
- Some of the time
- Most of the time
- All of the time
- Don't know

Q14. Play musical instrument that involves use of mouth or jaw

- None of the time
- A little of the time
- Some of the time
- Most of the time
- All of the time
- Don't know

Q15. Lean with your hand on the jaw, such as cupping or resting the chin in the hand

- None of the time
- A little of the time
- Some of the time
- Most of the time
- All of the time
- Don't know

Q16. Chew food on one side only

- None of the time
- A little of the time
- Some of the time
- Most of the time
- All of the time
- Don't know

Q17. Eating between meals

- None of the time
- A little of the time
- Some of the time
- Most of the time
- All of the time
- Don't know

Q18. Sustained talking (e.g., teaching, sales, customer services)

- None of the time
- A little of the time
- Some of the time
- Most of the time
- All of the time
- Don't know

## Q19. Singing

- None of the time
- A little of the time
- Some of the time
- Most of the time
- All of the time
- Don't know

## Q20. Yawning

- None of the time
- A little of the time
- Some of the time
- Most of the time
- All of the time
- Don't know

## Q21. Hold telephone between your head and shoulders

- None of the time
- A little of the time
- Some of the time
- Most of the time
- All of the time
- Don't know

*B3.2 Smartphone use (optional item)*

**Indicate the average time/day of smartphone use**

*B3.3 Orofacial motor disorders*

**Have you been diagnosed with or do you suffer from possible signs of one of the following conditions?**

- Orofacial Dyskinesia
- Oromandibular Dystonia
- Parkinson's Disease
- Huntington's Disease
- Tourette's Syndrome
- Hemifacial Spasms
- Tardive Dyskinesia

*B3.4 Gastroesophageal reflux disease screening*

**How many times per week do each of the following symptoms occur?**

- A. Burning feeling behind the breastbone (heartburn)
  - 0 Days
  - 1 Day
  - 2–3 Days
  - 4–7 Days

**B. Stomach contents moving up to the throat or mouth (regurgitation)**

0Days

1 Day

2–3 Days

4–7 Days

**C. Pain in the middle or upper stomach area**

0Days

1 Day

2–3 Days

4–7 Days

**D. Nausea**

0Days

1 Day

2–3 Days

4–7 Days

**E. Trouble getting a good night's sleep because of heartburn or regurgitation**

0Days

1 Day

2–3 Days

4–7 Days

**F. Need for over-the-counter medicine for heartburn or regurgitation**

0Days

1 Day

2–3 Days

4–7 Days

**B3.5 Autoimmune or connective tissue disorders screening****Have you been diagnosed with one of the following conditions?**

Rheumatoid Arthritis

Lupus

Other systemic rheumatic diseases, including fibromyalgia

Other systemic conditions, including systemic sclerosis, rheumatic polymyalgia, mixed connective disease

**B3.6 Attention deficit hyperactivity disorder****Have you been diagnosed with Attention Deficit Hyperactive Disorder?**

No

Yes

**B4. Prescribed medications and use of substances assessment—Self report****B4.1 Drugs****Mark if you use recreational or street drugs**

If yes, please state which drugs you use for recreational purposes ———

#### B4.2 Medications

Are you currently under one of the following medications?

- Antidepressants (e.g., Selective serotonin-reuptake inhibitors)
  - Benzodiazepines
  - Neuroleptics, Antipsychotics, Antiemetics (Dopamine antagonists)
  - ADHD medication
  - Anti-allergic medication
  - Medical marijuana CBD
  - Medical marijuana TSH
  - Opioids
  - Others
- If yes, please list all the medications and dosage -----

#### B4.3 Tobacco

Do you smoke or use any tobacco products?

- No
  - Yes
  - Quit
- If yes, how many cigarettes/day do you smoke? N°-----

#### B4.4 Alcohol

Do you ever drink alcoholic beverages (beer, wine, hard liquor)?

- No
  - Yes
  - Quit
- If yes, what is your approximate intake of these alcoholic beverages (glasses/day)? -----

#### B4.5 Soft drinks

Do you regularly drink sparkling drinks (e.g., Cola – RedBull – Sprite – Fanta)?

- No
  - Yes
  - Quit
- If yes, what is your approximate intake (glasses/day)? -----

#### B4.6 Juices and fruits

Do you regularly drink juices or citric fruits (e.g., lemon, orange, grapefruit)?

- No
  - Yes
  - Quit
- If yes, what is your approximate intake (glasses/day)? -----

### B4.7 Caffeinate

Do you regularly drink coffee, tea, or other caffeine beverages?

No

Yes

Quit

If yes, what is) your approximate intake (cups/day)? -----

### B5. Additional factors assessment

#### B5.1 Familiar bruxism screening

Do you know of anyone in your family (for example, father, mother, children) who has had any history of bruxism occurrence?

No

Yes Father/Mother/Son/Daughter/Grandfather/Grandmother

Don't know

#### B5.2 Familiar tooth wear screening

Do you know of anyone in your family (for example, father, mother, children) who has tooth wear?

No

Yes Father/Mother/Son/Daughter/Grandfather/Grandmother

Don't know

#### B5.3 Familiar OSA screening

Do you know of anyone in your family (for example, father, mother, children) who has sleep apnea?

No

Yes Father/Mother/Son/Daughter/Grandfather/Grandmother

Don't know

#### B5.4 Familiar orofacial pain screening

Do you know of anyone in your family (for example, father, mother, children) who has non-dental facial pain?

No

Yes Father/Mother/Son/Daughter/Grandfather/Grandmother

Don't know

#### B5.5 Familiar GERD screening

Do you know of anyone in your family (for example, father, mother, children) who has gastroesophageal reflux disease?

No

Yes Father/Mother/Son/Daughter/Grandfather/Grandmother

Don't know

## APPENDIX 3

## Standardized Tool for the Assessment of Bruxism (STAB): ToolKit

## LINKS TO SOURCES OF FULL VERSIONS OF INSTRUMENTS THAT ARE FULLY OR PARTIALLY INCLUDED IN THE STAB

## THE ORAL BEHAVIOR CHECKLIST

[https://ubwp.buffalo.edu/rdc-tmdinternational/wp-content/uploads/sites/58/2017/01/Oral-Behavior-Checklist\\_2013-05-12.pdf](https://ubwp.buffalo.edu/rdc-tmdinternational/wp-content/uploads/sites/58/2017/01/Oral-Behavior-Checklist_2013-05-12.pdf)

## TMD PAIN SCREENER

[https://ubwp.buffalo.edu/rdc-tmdinternational/wp-content/uploads/sites/58/2017/01/TMD-Pain-Screener\\_revised-10Aug2011.pdf](https://ubwp.buffalo.edu/rdc-tmdinternational/wp-content/uploads/sites/58/2017/01/TMD-Pain-Screener_revised-10Aug2011.pdf)

## DC/TMD SYMPTOMS QUESTIONNAIRE

[https://ubwp.buffalo.edu/rdc-tmdinternational/wp-content/uploads/sites/58/2017/01/DC-TMD\\_SQ\\_shortform\\_2013-05-12.pdf](https://ubwp.buffalo.edu/rdc-tmdinternational/wp-content/uploads/sites/58/2017/01/DC-TMD_SQ_shortform_2013-05-12.pdf)

## XEROSTOMIA INVENTORY

[https://www.researchgate.net/profile/William-Thomson-11/publication/12619006\\_The\\_Xerostomia\\_Inventory\\_A\\_multi-item\\_approach\\_to\\_measuring\\_dry\\_mouth/links/0046351d1077da2701000000/The-Xerostomia-Inventory-A-multi-item-approach-to-measuring-dry-mouth.pdf](https://www.researchgate.net/profile/William-Thomson-11/publication/12619006_The_Xerostomia_Inventory_A_multi-item_approach_to_measuring_dry_mouth/links/0046351d1077da2701000000/The-Xerostomia-Inventory-A-multi-item-approach-to-measuring-dry-mouth.pdf)

## RABDOUD ORAL MOTOR INVENTORY FOR PARKINSON'S DISEASE

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3251785/>

## TOOTH WEAR EVALUATION SYSTEM

<https://onlinelibrary.wiley.com/doi/10.1111/joor.12340>

## PATIENT HEALTH QUESTIONNAIRE - 4

[https://ubwp.buffalo.edu/rdc-tmdinternational/wp-content/uploads/sites/58/2017/01/PHQ-4\\_2013-05-12.pdf](https://ubwp.buffalo.edu/rdc-tmdinternational/wp-content/uploads/sites/58/2017/01/PHQ-4_2013-05-12.pdf)

## BRIEF RESILIENT COPING SCALE

<https://emdrfoundation.org/toolkit/brcs.pdf>

## STOP-BANG QUESTIONNAIRE

<http://www.stopbang.ca/osa/screening.php>

## SLEEP DISORDERS QUESTIONNAIRE

<https://stanfordhealthcare.org/content/dam/SHC/for-patients-component/sleep-medicine/docs/ess-sdq-2-25-11.pdf>

## GERD-Q

<https://fpnotebook.com/gi/Exam/GrdqQstnr.htm>

## ADDITIONAL INSTRUMENTS FOR POSSIBLE USE

## PATIENT HEALTH QUESTIONNAIRE-9

[https://ubwp.buffalo.edu/rdc-tmdinternational/wp-content/uploads/sites/58/2017/01/PHQ-9\\_2013-05-12.pdf](https://ubwp.buffalo.edu/rdc-tmdinternational/wp-content/uploads/sites/58/2017/01/PHQ-9_2013-05-12.pdf)

## PATIENT HEALTH QUESTIONNAIRE-15

[https://ubwp.buffalo.edu/rdc-tmdinternational/wp-content/uploads/sites/58/2017/01/PHQ-15\\_2013-05-12.pdf](https://ubwp.buffalo.edu/rdc-tmdinternational/wp-content/uploads/sites/58/2017/01/PHQ-15_2013-05-12.pdf)

## PERCEIVED STRESS SCALE

<https://www.mindgarden.com/documents/PerceivedStressScale.pdf>