

# Diagnostic Tools and Management Strategies used by Specialized Dentists and Physical Therapists for Patients with Bruxism: a Delphi Procedure

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## Abstract

**Background:** The most valid tool in bruxism diagnostics is considered electromyography/ polysomnography with audio/video recording. Given that this is too expensive and time-consuming for daily practice; many other tools are used to diagnose bruxism. Owing to the lack of knowledge about the etiology and (patho) physiology of bruxism, no definitive intervention exists and current management strategies mainly focus on reducing negative consequences of bruxism. This study aimed to identify diagnostic tools and management strategies that dentists and physical therapists who specialize in the orofacial region consider being the most clinically useful for patients with bruxism and which are actually used.

**Method:** The results of a literature study were used as a starting point for a Delphi procedure. The first round (36 participants) focused on collecting preferences in diagnostics and management of bruxism. In the second round (29 participants), the number of diagnostic tools and management strategies that were rated as clinically useful were narrowed down to those that were actually used by the participants in daily practice.

**Results:** For the diagnostics of both awake and sleep bruxism, mostly aspects of the anamnesis and the clinical examination were considered clinically useful and actually used in daily practice. Moreover, for sleep bruxism, more tools were combined to set the diagnosis than for awake bruxism. Both groups of participants valued habit reversal and lifestyle advice in the management of awake bruxism, and habit reversal, sleep hygiene advice and lifestyle advice for sleep bruxism. In addition, both groups suggested profession-specific strategies.

**Conclusion:** The diagnostic tools and management strategies used in daily practice among specialized dentists and physical therapists in the Netherlands form a colorful palette and, as expected, are determined by profession.

**Keywords:** Bruxism; Diagnostic techniques and procedures; Therapeutics; Delphi technique

## Introduction

Bruxism, a repetitive jaw-muscle activity characterized by clenching or grinding of the teeth [1], is a common clinical phenomenon, with a prevalence of about 8% of the adult population [2], which can cause several dental and musculoskeletal problems [3]. Because of these clinical consequences, both the dentist and the physical therapist are confronted with bruxism patients in their daily practice.

Recently, a diagnostic grading system of “possible”, “probable” and “definite” awake (AB) or sleep bruxism (SB) has been proposed for clinical and research purposes [1]. “Possible” bruxism should be based on self-report, by means of questionnaires and/or anamnesis. “Probable” bruxism should be based on self-report and clinical signs. “Definite” SB should be based on self-report, clinical signs and a

polysomnographic recording (PSG), preferably along with audio/video recordings. Since PSG, considered to be the most valid tool for SB diagnosis [1-4], is suited to small samples only, due to high cost, limited availability and the need for specific training, several other techniques are used in daily practice, each with their advantages and limitations. In addition, bruxism patients report different signs and symptoms in different disciplines (for example, tooth wear at the dentist, painful muscles at the physical therapist).

A lack of knowledge about the etiology and (patho) physiology of bruxism means that management strategies are mainly focused on reducing symptoms. Lobbezoo, et al [5] have proposed the so-called triple-P approach, which is based on a combination of oral appliances (i.e. plates), counselling/behavioural strategies (i.e. pep talk) and

centrally acting drugs (i.e. pills). This combination has become the usual care for (sleep) bruxism in daily practice. With this approach, researchers and clinicians emphasize the importance of a multimodal approach, even if the strategies used are not effective as stand-alone therapies. In an updated review, an expanded multiple-P approach was described, which consisted of plates, pep talk, pills, psychology and physiotherapy [6].

In summary, the most valid tool in bruxism diagnostics is too expensive and time-consuming for daily practice, while other diagnostic tools are less reliable and/or accurate. In addition, there is not enough evidence to define a standard approach for (sleep) bruxism management that is effective and safe for all patients. The most recent recommendation is to follow the multiple-P and, therefore, a wide variety of treatment modalities is used in daily practice.

The aim of the study reported on in this paper was to identify the diagnostic tools and management strategies that dentists and physical therapists that are specialized in orofacial pain and dysfunction in the Netherlands actually use in daily practice for patients with bruxism. We hypothesised that in daily practice a wide variety of diagnostic tools and management strategies are used, depending on the professional background of the caregiver.

## Methods

### Study design

This study used a Delphi procedure of two rounds. A Delphi procedure is a series of sequential rounds, interspersed by feedback that seeks to achieve consensus of opinion among a panel of experts [7]. Although this present study did not aim for consensus, a Delphi procedure is the most adequate method for achieving the primary aim of this study. The questionnaire used in the first round was based on a systematic evaluation of the literature; the questionnaire used in the second round was based on the analysis of the first round. After the second round, the authors reached a good understanding of what dentists and physical therapists use in daily practice, so no further rounds were prepared.

The study was conducted according to the Delphi procedure following the recommendations of Hasson et al [7] the data was collected between November 2016 and July 2017.

The selection of professionals for the study was based on personal contacts and a search for registered dentists and physical therapists, taking into account their geographical distribution throughout the Netherlands. A total of 27 physical therapy experts (defined as orofacial physical therapists) and 27 dentists (defined as dentists specialized in orofacial pain and dysfunction) were identified and invited via email (using the online survey development cloud-based software Survey Monkey) to participate in the study. The letter of invitation included the researcher's details and information on the purpose of the study. It further explained how the acquired data would be used to design subsequent survey rounds. In total, 18 physical therapists and 18 dentists, all of Dutch nationality, with backgrounds ranging from primary care to multidisciplinary academic hospital settings, participated in the study (Table 1). Participants remained anonymous to their co-participants during all rounds, to meet the aim of encouraging free expression of opinions without influence from other participants.

### Procedure and data analysis

The survey procedures were predesigned and included the following steps:

1. A list of diagnostic tools and management strategies was generated following a systematic evaluation of the literature. PubMed was searched for articles published prior to June 2016.

2. In the first Delphi round, participants were asked to rate the clinical usefulness of the 30 diagnostic tools (question of awareness, clenching/grinding sounds by patient and partner, pain/discomfort/fatigue, temporal headaches, tight feeling around skull, joint lock, painful/sensitive teeth, increase of self-reported bruxism or pain/dysfunction by psychological distress or the use of alcohol, cigarettes, party drugs, caffeine or medication, tooth wear assessed visually or with impressions of the dentition, linea alba on oral mucosa or tongue, hypertrophy of the masseter muscle, mobility of dental elements, exposed root surfaces, wear of splint, Bruxcore plate, ambulatory electromyography (EMG) or polysomnography (PSG) device or sleep laboratory). They also rated 19 management modalities (occlusal interventions, occlusal appliances, biofeedback, cognitive behavioural therapy (CBT), hypnosis, relaxation therapy, meditation, habit reversal, lifestyle advice, pharmacological approaches, and physical therapy approaches) on a 5-point Likert scale ("extremely useful", "useful", "don't know", "probably not useful", "definitely not useful") for both AB and SB. In addition, the participants were invited to provide additional tools and modalities they considered as clinically relevant. Furthermore, demographic factors and open-ended questions about competence, treatment indication and, for the physical therapists, the use of muscle-stretching exercises in the management of bruxism were evaluated. The questionnaire was sent as an interactive secured web link using survey monkey after it had been tested amongst workgroup members for comprehensibility and feasibility. If questionnaires were not returned, reminder emails were sent to enquire whether the expert was still willing to continue the study.

3. For the second round, the group responses were analysed. The main focus of this round was to elucidate what is actually used in daily practice, instead of what would be eligible, and how the different management modalities are practised. All items with an average overall score of "extremely useful" and "useful" (respectively scored as 1 and 2, making the cut-off weighted value 2,0) were fed back to the participants, with the request to indicate whether the clinician actually used the tool/modality and how he or she used it. All items with an average overall score of "don't know" (scored as 3) were also fed back, with the request to determine the order in terms of degree of importance and again how the professional used the modality. All items with an average overall score of "probably not useful" (scored as 4) and "definitely not useful" (scored as 5) were excluded from round 2. The newly suggested management modalities were included, with the request to determine their clinical usefulness.

4. The results from both rounds were analysed (using a cut-off weighted value of 1,2) and compared between 1) dentists and physical therapists, 2) AB and SB, and 3) clinically useful and actually used.

## Results

The results regarding diagnostic tools (Table 2) and management strategies (Table 3) for both awake and sleep bruxism are presented for physical therapists and dentists. Round 1 focused on the tools and strategies that professionals found clinically useful, while round 2 focused on the tools and strategies that are actually used in daily practice.

### General aspects

Both dentists and physical therapists identified the specialized dentist and physical therapist as the most competent in diagnosing

**Table 1:** Characteristics of the participating experts.

CHARACTERISTIC	PHYSICAL THERAPISTS (n=18)	DENTISTS (n=18)	TOTAL (n=36)
<b>EXPERTS</b>			
Gender (male : female)	5 : 13	13 : 5	18 : 18
Age in years (mean ± SD)	49.94 ± 9.321	51.22 ± 7.960	50.58 ± 8.567
Highest level of education			
HVE	61.5%	-	
MSc	11.0%	88.9%	
PhD	27.5%	11.1%	
<b>Working years</b>			
As a general clinician (mean ± SD)	23.71 ± 11.629	25.89 ± 8.116	
As a specialized clinician (mean ± SD)	19.50 ± 12.232	9.06 ± 5.185	
<b>Work setting*</b>			
Primary setting	100%	50%	
Secondary setting	-	22.2%	
General hospital	-	27.8%	
Academic hospital	-	16.7%	
Special Dental Care Center	22.2%	55.6%	
Post doc	-	5.6%	
Total number of bruxism patients in treatment (mean ± SD)	24.89 ± 23.162	17.28 ± 11.891	20.83 ± 18.758

HVE = Higher Vocational Education, \*Participants could work in more than one setting

and managing bruxism, although dentists tended to prefer the dental specialist in diagnosing bruxism.

All participants reported bruxism as pathology if it led to pain, dysfunction and/or dental wear; otherwise they defined it as physiology. The dentists focused particularly on dental consequences such as tooth wear and tooth fracture.

Different treatment indications for (the consequences of) bruxism were described as being: if the consequences of bruxism complicate a physiotherapeutic or dental treatment; if the consequences of bruxism appear to have a strong association with other (pain) complaints; if there is a progressive course of the consequences of bruxism; and if the patient requests help.

### Diagnostic tools

In general, the number of different tools that are actually used by professionals is slightly higher than the number of tools that are considered to be clinically useful. Moreover, for SB more tools are combined to set the diagnosis than for AB (Table 2).

**Awake bruxism:** According to the calculated weighted value for each suggested diagnostic tool, it was clear that clenching/grinding sounds reported by partner, an increase of self-reported bruxism or pain/dysfunction by psychological distress, a linea alba on oral mucosa and impressions on the tongue were considered clinically useful by both dentists and physical therapists. In addition, physical therapists considered self-awareness of the patient, pain/discomfort/ fatigue, temporal headaches, visually assessed tooth wear and hypertrophy of the masseter muscle to be clinically useful. It is notable that some aspects that were not scored as clinically useful are actually used in daily practice, especially by dentist.

**Sleep bruxism:** Both dentists and physical therapists considered clenching/grinding sounds reported by partner, pain/discomfort/

fatigue upon awakening, temporal headaches, a linea alba on oral mucosa and impressions on the tongue to be clinically useful in diagnosing SB. Additionally, physical therapists valued the presence of a tight feeling around the skull, sensitive teeth, an increase by psychological distress and hypertrophy of the masseter muscle, whereas dentists preferred a night at a sleep laboratory with or without audio/video. There is a major overlap between what is considered clinically useful and what is actually used, with the exception of tooth wear and wear of splint.

For both AB and SB, with the exception of the sleep laboratory evaluation suggested by dentists, only aspects of the anamnesis and the clinical examination were both considered clinically useful and actually used.

The top 5 diagnostic tools for both AB and SB were quite similar for physical therapists and dentists (awareness of the patient, self-report by sounds, reported by partner, pain/discomfort/fatigue, temporal headaches), although physical therapists chose to use aspects of the clinical examination (linea alba oral mucosa) in addition to the anamnesis.

### Management strategies

**Awake bruxism:** The five highest-rated management strategies for AB in both the dental and physiotherapeutic professional groups were identical. Biofeedback, CBT, relaxation therapy, habit reversal and lifestyle advice were considered to be the most useful in clinical practice.

On top of these strategies, muscle-stretching techniques were actually used as strategies for managing bruxism in both groups. Physical therapists also used massage techniques and other physical therapy modalities, while dentists also used occlusal splint therapy and antidepressants.

**Table 2:** Results of Delphi regarding clinically useful (round 1) and actually used (round 2) diagnostic tools for both awake and sleep bruxism.

TOOL	ROUND 1 (CLINICALLY USEFUL)				ROUND 2 (ACTUALLY USED)			
	PT		D		PT		D	
	AB	SB	AB	SB	AB	SB	AB	SB
Question of awareness								
Self-report by sounds								
Reported by partner								
Pain, discomfort, fatigue								
Temporal headaches								
Tight feeling							X	X
Joint lock							X	X
Sensitive teeth								
Increase by alcohol					X	X	X	X
Increase by smoking					X	X	X	X
Increase by party drugs								
Increase by caffeine					X	X	X	X
Increase by distress								
Increase by medication								
Visually assessed tooth wear								
Tooth wear assessed by impressions								
Linea alba oral mucosa								
Linea alba tongue								
Hypertrophy of m. masseter								
Mobility of dental elements					X	X	X	X
Exposed root surfaces					X	X	X	X
Wear of splint								
Bruxcore plate					X	X	X	X
Ambulant EMG					X	X	X	X
Ambulant PSG (EEG/EMG)					X	X	X	X
Ambulant PSG (EEG/EMG/EOG)					X	X	X	X
Ambulant PSG (EEG/EMG/EOG/audio)					X	X	X	X
Ambulant PSG (EEG/EMG/EOG/audio/video)					X	X	X	X
Sleep laboratory PSG (EEG/EMG/EOG)					X	X	X	X
Sleep laboratory PSG (EEG/EMG/EOG/audio/video)					X	X	X	X

PT = Physical Therapists (dark blue); D = Dentists (light blue); EMG = Electromyography; PSG = Polysomnography; EEG = Electroencephalography; EOG = Electrooculography; coloured box = mean score below the cut-off weighted value and therefore scored as valuable; X = excluded after round 1 and therefore scored as not valuable; NTI = Nociceptive Trigeminal Inhibition

The top 5 management strategies for AB were quite similar for both professions. Both dentists and physical therapists reported occlusal splint therapy, CBT, relaxation therapy and habit reversal in the top 5. Dentists completed the top 5 with physical therapy modalities other than massage- and muscle-stretching techniques, whereas physical therapists valued biofeedback. (Table 3)

**Sleep bruxism:** Occlusal splint therapy, sleep hygiene advice and lifestyle advice were reported as clinically useful. Physical therapists also valued relaxation therapy.

Both dentists and physical therapists actually used habit reversal, sleep hygiene advice, lifestyle advice, and muscle-stretching

techniques. Physical therapists and dentists used the same additional strategies as for AB.

The top 5 management strategies for SB differed considerably between professions. Both valued occlusal splint therapy and habit reversal. Physical therapists also valued using a Nociceptive Trigeminal Inhibition (NTI) splint, antidepressants and massage techniques, while dentists preferred CBT, relaxation therapy and botulin toxin.

**Additional management strategies:** The following additional management strategies were suggested in round 1: evaluate/treat cervical spine disorders; Bruxstop; dry needling; dental restoration of tooth wear; speech therapy; multidisciplinary consultation with

**Table 3:** Results of Delphi regarding clinically useful (round 1) and actually used (round 2) management strategies for both awake and sleep bruxism.

TOOL	ROUND 1 (CLINICALLY USEFUL)				ROUND 2 (ACTUALLY USED)			
	PT		D		PT		D	
	AB	SB	AB	SB	AB	SB	AB	SB
Occlusal interventions					X	X	X	X
Occlusal splint								
Occlusal NTI splint					X	X	X	X
Biofeedback								
Cognitive behavioural therapy								
Hypnosis					X	X	X	X
Relaxation therapy								
Meditation					X	X	X	X
Habit reversal								
Sleep hygiene advice	X		X		X		X	
Lifestyle advice								
Muscle relaxants					X	X	X	X
Botulin toxin					X	X	X	X
Serotonergic and dopaminergic medication					X	X	X	X
Anticonvulsants					X	X	X	X
Antidepressants					X	X		
Massage techniques								
Muscle-stretching techniques								
Other physical therapy modalities								

PT = Physical Therapists (dark blue); D = Dentists (light blue); NTI = Nociceptive Trigeminal Inhibition; coloured box = mean score below the cut-off weighted value and therefore scored as valuable; X = not applicable or excluded after round 1 and therefore scored as not valuable

specialized physical therapist, psychologist and dental specialist; and pain education. By calculating the weighted value for each suggested additional management strategy in round 1, the following were evaluated as actually used: evaluate/treat cervical spine disorders, pain education, dry needling and speech therapy.

**Muscle-stretching exercises:** All physical therapists used muscle-stretching exercises in the management of bruxism or related symptoms. The implementation and considerations regarding the stretching parameters were largely the same for all therapists. Stretching exercises were performed manually, intra-orally, 2-3 times a day, with 2-3 repetitions of 20-30 second stretches at intensity within the pain threshold.

## Discussion

The present study evaluated the diagnostic tools and management strategies used in daily practice of the specialized dentist and physical therapist in the Netherlands. As expected, a wide variety of strategies is used, determined by profession. In general, it is understandable that the dentist would use intraoral signs to diagnose bruxism and occlusal splint therapy in the management of bruxism, while the physical therapist evaluates musculoskeletal consequences in the diagnostic process and habit reversal and muscle techniques for bruxism management, because these modalities are available within their practices. One of the major pitfalls in clinical practice is a tunnel view, meaning that we only see problems and solutions from our own profession-specific perspective.

## Bruxism diagnosis

The most used diagnostic tools for both AB and SB are aspects of the anamnesis (report by patient or partner, pain/discomfort/fatigue of the muscles) and aspects of the clinical examination (intraoral signs). This was an expected result because of the limited options available to the clinician in daily practice. Therefore, according to the diagnostic grading system [1], the highest attainable diagnosis level in daily practice would be 'probable' bruxism. Both professions tend to use multiple tools combined for the diagnostic process, and for SB more tools are combined to set the diagnosis than for AB. This is in line with the general opinion that bruxism is difficult to diagnose. Although EMG/PSG registration is the most valid tool, it is not feasible for daily practice. Since there is still discussion about the definition and diagnosis of bruxism [1,8], clinicians are limited to evaluating signs and symptoms related to bruxism instead of measuring the actual phenomenon. Studies have shown that both self-reporting [9] and findings of the extra- and intraoral inspection [10-13] are not highly valid and specific. To date, various research groups have engaged in the development and validation of simple but valid (EMG) devices [14-17]. This would be a valuable addition to the current daily practice of bruxism diagnostics.

It is remarkable that psychological stress was the only risk factor mentioned by both professions. Other well-studied risk factors [3,18-25], e.g. alcohol, cigarettes, amphetamine-related drugs, caffeine and certain medication, may not be known to professionals.



## Bruxism management

The most used management strategies varied widely and differed between dentists and physical therapists, although in both rounds and by both groups aspects of counseling (i.e. habit reversal, lifestyle advice and sleep hygiene advice) were valued highly. This could be expected since self-management of the patient is highly valued in both dentistry and physical therapy and is supported by evidence [26-28]. Depending on the specialty, other approaches were submitted. All strategies of the so-called multiple-P approach [6], i.e. plates, pep talk, pills, psychology and physiotherapy, were used, with pharmacological strategies the least used in daily practice.

More management strategies are actually used (round 2) than recognized as clinically useful (round 1). For example, the use of antidepressants and physical therapy modalities, such as massage techniques and muscle-stretching techniques, did not score for clinical usefulness, but were in fact used in daily practice. Worthwhile mentioning is that, for physical therapists, the occlusal NTI splint and, for dentists, botulinum toxin is in the top 5, without a score exceeding the cut-off weighted value in both round 1 and round 2. These discrepancies may be explained by the impossibility of implementing these strategies, for example due to the absence of facilities or specific skills or due to organization of the Dutch health care system or the Dutch insurance system.

A review of management strategies for bruxism [6] and some later published randomized controlled trials [29-31] concluded that the effect of oral appliances on bruxism is variable and hard to interpret, the effect of botulinum toxin on bruxism was supportive in reducing the intensity but not frequency of SB episodes whilst the duration of the effect was unclear, benzodiazepine clonazepam and the antihypertension drug clonidine might have SB-reducing effects, effects of EMG-based biofeedback training on both AB and SB were contradictory; sleep hygiene and muscle relaxation techniques were not effective to reduce SB, and findings of electrical stimuli on the masseter muscles to suppress SB were suggestive and may interrupt normal sleep structure.

## Methodological considerations

A strong feature of the present study was the inclusion of participants with different backgrounds. Both dentists and physical therapists, working in different settings were included, aiming to achieve a representative overview of daily bruxism practice in the Netherlands. It would be of interest to prepare a similar study design in a multinational study population.

The present study had a few limitations. First, the software used for the questionnaires, survey monkey, offered limited functions. This means that the layout of the different items of the questionnaires that was most optimal for a good understanding of the questions could not be achieved. Alternative answers were not suitable for all items. Finally, due to technical problems, some participants had difficulties with completing the questionnaires and dropped out.

## Clinical relevance and recommendations for further research

As already recommended by Lobbezoo et al [1], combining as much signs and symptoms of bruxism as possible, for example using anamnesis, the structured BRUX-scale [32] and extra- and intraoral signs, will provide the most reasonable diagnosis of bruxism. If specific tools are not available in daily practice of a general practitioner, referral to specialists might be recommended. Further development and validation of simple and reliable EMG-devices could improve bruxism diagnosis in daily practice. However, there is ongoing discussion

whether bruxism is pathologic or physiologic [18,33]. This raises the question if diagnosing bruxism is really necessary.

With regard to the management of bruxism and its negative consequences, it would be interesting to prepare a consensus guideline. First, the participating professionals in this study agreed that there is only a treatment indication if bruxism has negative consequences for the patient, such as muscle pain or tooth wear. Because the etiology of the phenomenon bruxism is still unclear and bruxism has a wide range of possible consequences regarding different body systems, i.e. dental and musculoskeletal, a consensus guideline should include general recommendations for management, suggestions for the most effective (and feasible) strategy-combinations and collaboration between different professions.

## Conclusion

In daily clinical practice of dentists and physical therapists in the Netherlands, multiple tools, mostly aspects of self-report and clinical examination, are combined to diagnose 'possible' and 'probable' bruxism. Diagnostic tools and management strategies used in daily practice are determined by profession. Also, different management strategies, covering all strategies of the so-called multiple-P approach (i.e. plates, pep talk, pills, psychology and physiotherapy), are combined to manage (the negative consequences of) bruxism, although counselling is the most valued and often used by both dentists and physical therapists.

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