How valid and applicable are current diagnostic criteria and assessment methods for dentin hypersensitivity? An overview

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Abstract

Objectives Although dentin hypersensitivity is a common clinical condition and is generally reported by the patient after experiencing a sharp, short pain caused by one of several different external stimuli, it is often inadequately understood. The purpose of this paper is to discuss different available diagnostic approaches and assessment methods used in order to suggest a basis to diagnose, monitor, and measure these challenging painful conditions related to dentin hypersensitivity in daily practice and scientific projects properly.

Material and methods A PubMed literature search strategy including the following MeSH terms were used as follows: “dentin sensitivity”[MeSH Terms] OR “dentin”[All Fields] AND “sensitivity”[All Fields] OR “dentin sensitivity”[All Fields] OR “dentin”[All Fields] AND “hypersensitivity”[All Fields] OR “dentin hypersensitivity”[All Fields] AND “diagnosis”[Subheading] OR “diagnosis”[All Fields] OR “diagnosis”[MeSH Terms] AND “assessment”[All Fields] AND (“methods”[Subheading] OR “methods”[All Fields] OR “methods”[MeSH Terms]). Furthermore, alternative terms such as “validity,” “reliability,” “root,” “cervical,” “diagnostic criteria,” and “hypersensitivities” were additionally evaluated.

Results The literature search, also including the alternative terms and journals, revealed only a small number of specific papers related to valid diagnosis, diagnostic criteria, and assessment methods of dentin hypersensitivity. Outcomes from these publications showed that the response to different stimuli varies substantially from one person to another and is, due to individual factors, often difficult to assess correctly. Furthermore, the cause of the reported pain can vary, and the patient’s description of the history, symptoms, and discomfort might be different from one to another, not allowing a reliable and valid diagnosis.

Conclusions The dental practitioner, using a variety of diagnostic and measurement techniques each day, will often have difficulties in differentiating dentin hypersensitivity from other painful conditions and in evaluating the success of a conducted therapy in a reliable way.

Clinical relevance Correct diagnosis of dentin hypersensitivity including a patient’s history screening and a brief clinical examination in combination with the identification of etiologic and predisposing factors, particularly dietary and oral hygiene habits associated with erosion and abrasion, is essential. The relevant differential diagnosis should be considered to exclude all other dental conditions with similar pain symptoms.

Keywords Dentin hypersensitivity · Diagnosis · Differential diagnosis · Diagnostic criteria · Dentin hypersensitivity assessment · Monitoring dentin hypersensitivity

Introduction

Previously, dentin hypersensitivity (DHS) was described as “an enigma being frequently encountered yet poorly understood” [1]. More recently, an internationally accepted and widely used definition in the international literature for dentin hypersensitivity is available [2]. Dentin hypersensitivity is characterized by distinctive short, sharp pain arising from exposed cervical dentin in response to various external stimuli that are typically thermal, evaporative, tactile, electrical, osmotic, or chemical, which cannot be ascribed to any other form of dental pathology, defect, or disease (Fig. 1)
The definition provides a clinical description of the condition and identifies dentin hypersensitivity as a special clinical entity [6]. The most frequently experienced pain from dentin hypersensitivity is characterized by a rapid onset, sharp burst of pain of short duration strongly assigned to the application time and site of the used stimuli. Since several oral conditions may cause dental pain, such as untreated caries, a cracked tooth or marginal leakage around insufficient restorations, the diagnosis of dentin hypersensitivity can be very difficult [2, 7, 8]. Although there are numerous publications on all topics related to dentin hypersensitivity, a relatively high number of dental professionals are confused about the diagnosis, etiology, predisposing factors, and mechanism of this clinical condition [4, 9–12]. Time is needed to make a correct diagnosis, because dentin hypersensitivity is always a diagnosis of exclusion; it could only definitely be confirmed after all possible other conditions have been diagnostically eliminated. Therefore, the correct attribution of dental pain to dentin hypersensitivity is essential for dentists to develop and implement appropriate treatment options to help suffering patients effectively [4, 13]. However, despite an enormous number of products that are available for dental professionals and patients, a conclusive evidence of a successful treatment is still missing [14]. Although most of these agents have been proposed and developed to treat dentin hypersensitivity successfully, many clinical studies have shown contradictory results [15]. One explanation might be that in all pain studies, it is notoriously difficult to assess the subjective and individual different nature and complexity of pain [16]. Therefore, the correct and reliable diagnosis with valid measurement and assessment of dentin hypersensitivity is also a key factor in monitoring patients and judging therapeutic approaches in clinical trials.

Material and methods

A PubMed literature search strategy including the following MeSH terms was used: “dentin sensitivity”[MeSH Terms] OR “dentin”[All Fields] AND “sensitivity”[All Fields] OR “dentin sensitivity”[All Fields] OR “dentin”[All Fields] AND “hypersensitivity”[All Fields] OR “dentin hypersensitivity”[All Fields] AND “diagnosis”[Subheading] OR “diagnosis”[All Fields] OR “diagnosis”[MeSH Terms] AND “assessment”[All Fields] AND (“methods”[Subheading] OR “methods”[All Fields] OR “methods”[MeSH Terms]. Furthermore, alternative and additional terms such as “validity,” “reliability,” “root,” “cervical,” “diagnostic criteria,” and “hypersensitivities,” and the possible combinations of these terms were evaluated. Additional handsearching was performed for the major oral medicine journals not included in PubMed. References of included studies and reviews were checked for further results. No language limitations were imposed. Date of last search was 20th of April 2012.

Criteria for considering studies for this overview

Publication related to the diagnosis of dentin hypersensitivity and different diagnostic procedures and criteria including tactile, thermal, and airblast stimuli, or assessment methodologies relevant for evaluation of patients’ subjective pain were selected.

Results

The actually performed PubMed search reveals that the number of international publications related to the diagnosis of dentin hypersensitivity is rarely available (the last search date was 20th of April 2012, Table 1). However, most of the selected 198 papers from the PubMed search found for diagnosis were related to clinical investigations evaluating the efficacy of different treatment products rather than for diagnosis per se which might be an indication that there are limited data available in the way of diagnosis and management of DHS. Indeed, only seven publications related to different aspects of the diagnosis of dentin hypersensitivity were identified that would

| PubMed search strategy                                                                 | Hits |
|---------------------------------------------------------------------------------------|------|
| “Dentin sensitivity/diagnosis”[MeSH]                                                  | 198  |
| “Dentin sensitivity/diagnosis”[MeSH] AND “Diagnostic Criteria”[All Fields]             | 7    |
| “Dentin sensitivity/diagnosis”[MeSH] AND “Assessment Methods”[All Fields]              | 13   |
| “Dentin sensitivity/etiology”[MeSH]                                                   | 686  |
| “Dentin sensitivity/pathology”[MeSH]                                                  | 76   |
| “Dentin sensitivity/epidemiology”[MeSH]                                               | 51   |
| “Dentin sensitivity/therapy”[MeSH]                                                    | 1,155|
be relevant for the purpose of the present overview [4, 6, 8, 17–19]. Expanding the PubMed search to other aspects of dentin hypersensitivity, further publications could be identified, including several papers relating specifically to diagnosis and diagnostic criteria [7, 12, 13, 20–23]. Regarding the assessment and measurement methods for dentin hypersensitivity, PubMed search identified only 13 relevant papers which could be included [5, 24–35]. Additional information could be found in four further papers dealing with therapeutic aspects and the clinical effect of different materials [13, 23, 36, 37].

Discussion

Typically, dentin hypersensitivity occurs when the external stimulus contacts exposed dentin surfaces with open and patent tubules [20]. The different stimuli trigger a rapid outflow of dentin fluid, and the following pressure change across the dentin activates baroreceptors near the pulp, leading to cause an immediate sharp pain [38]. Tactile, cold, evaporative, and osmotic stimuli trigger the nonphysiological fluid outflow. On the other hand, heat induces a slow retreat of dentin fluid, and the resultant pressure change activates the baroreceptors and nerve fibers in a less dramatic fashion, consistent with the observation that cold and evaporative stimuli are generally more painful to patients than heat [38]. The hydrodynamic theory of dentin hypersensitivity requires that dentin tubules are exposed at the dentin surface and patent to the pulp [39, 40]. Absi et al. demonstrated that the number of tubules in clinically hypersensitive teeth was eight times higher, and the tubules were two times larger in diameter and were mostly open compared with nonsensitive teeth [40, 41]. Furthermore, according to Poiseuille’s law, the fluid flow rate is proportional to the fourth power of the tubule radius, so that the fluid flow in hypersensitive teeth might probably be 16 times greater than that in nonsensitive teeth [2]. It is obvious that this difference in tubule diameter between hypersensitive and nonsensitive teeth might be of clinical relevance [38]. Therefore, a partial or complete tubule occlusion by therapeutic approaches or after physiological sclerosis may have significant effects on fluid flow and the corresponding symptoms and diagnosis [2]. As included in the definition of dentin hypersensitivity, the etiological factors must arise two specific changes in teeth. First, the dentin surface must be exposed and denuded, which requires the loss of enamel or gingival recession combined with loss of cementum. The second condition is the opening of the dentin tubules to allow the sensory mechanisms in the pulpal area following stimulation of the dentin surface [42].

Gingival recession and exposure of the underlying dentin could be caused by overzealous tooth brushing and improper tooth brushing technique, or by periodontal disease and its surgical and nonsurgical treatment [38]. Based on recently published studies, it appears that normal tooth brushing cannot cause significant enamel loss [42]. However, erosion from acidic foods and drinks in combination with tooth brushing can result in significant tooth wear on any aspect of the tooth surface, especially in the cervical areas [1, 43]. Investigators have concluded that gingival recession and erosion, rather than cervical enamel loss, may be the most important factor for dentin hypersensitivity [4].

Exposed dentin tubules are loosely occluded by a smear layer. On the basis of in vitro studies, it has been suggested that chemical reactions can remove the smear layer to open the exposed dentin tubules [38]. Further investigations reported that physical forces like tooth brushing alone are not able to remove the smear layer, opening exposed dentin tubules [16]. Dentin hypersensitivity is typically experienced by the middle-aged adult population, age range from 20 to 49 years, with a peak incidence between 30 and 39 years [22]. A slightly higher incidence of dentin hypersensitivity has been observed in females, which may reflect oral hygiene and dietary practices. Dentin hypersensitivity is most commonly observed in the buccal cervical area of permanent teeth, with canine, premolar, and incisor teeth being more frequently affected than molars [38]. Studies of the prevalence of dentin hypersensitivity have reported levels up to 57 % if patients in a general dental practice are evaluated [22, 44]. However, there are further studies suggesting that levels of 10–25 % are typical [45, 46]. The reported wide variations have been attributed to different methods of assessment, self-reported or professional clinical diagnosis, the population base and setting, and behavioral factors, such as oral hygiene habits and intake of acidic foods and drinks [38, 42]. Not surprisingly, levels of dentin hypersensitivity are higher, ranging from 65 to 98 %, in patients following periodontal treatment or surgery [47–49]. All these aspects, presence of denuded dentin surfaces, age, dental history, and the presence of predisposing factors should be considered when dealing with the aspect of dentin hypersensitivity diagnosis in order to allow a valid diagnosis.

General strategy for managing dentin hypersensitivity

Although our knowledge may have been previously incomplete, subsequent advances in our understanding have made a comprehensive approach to dentin hypersensitivity management possible. Specifically, the dental professional is advised to follow six steps with patients suffering from hypersensitivity teeth (Fig. 2) [4]:

- Correct diagnosis of dentin hypersensitivity including a patient’s history screening and a brief clinical examination
- Identification of etiologic and predisposing factors, particularly dietary and oral hygiene habits associated with erosion and abrasion
Differential diagnosis, to exclude all other dental conditions with similar pain symptoms
- If present, treatment of all conditions with symptoms similar to dentin hypersensitivity
- Removal or minimization of etiologic and predisposing factors through dietary advice and improved oral hygiene instruction
- Recommendation or implementation of treatment based upon individual needs (in office and at home)

As mentioned and highlighted above, the exact diagnosis of dentin hypersensitivity is essential to consider successful treatment strategies and long-lasting pain relief for suffering patients. However, the results from the actually performed PubMed search undertaken for the present paper would indicate that there are limited data available in relation to the diagnosis of dentin hypersensitivity per se (Table 1). Unfortunately, even most of the 198 papers found for diagnosis are clinical investigations focusing on the success and comparison of different treatment options. Hence, this might be an indication that the issue of giving a correct and valid diagnosis of dentin hypersensitivity is either an easy or a difficult thing for dental professionals in daily practice. Regarding the definition of dentin hypersensitivity “Dentin hypersensitivity is characterized by a short sharp pain arising from exposed dentin in response to different stimuli and which cannot be ascribed to any other form of dental defect or pathology,” it is obvious that this definition contains two related parts. The first part is the clinical description and most relevant to establish a valid diagnosis. The second part strongly recommends considering numerous differential diagnosis to exclude other causes of dentinal pain to increase the probability for a correct diagnosis (Table 2).

Although for the majority of all these differential conditions, the sensory mechanisms including the stimuli that may produce the patient’s pain may provide a similar outcome, the subsequent clinical management and treatment may be completely different for DHS. Nevertheless, a valid diagnosis of dentin hypersensitivity remains obvious after exclusion of all these dental and periodontal conditions that also might cause pain [4, 5, 12]. A recent Internet survey reported that most of the responding dentists used up to 12 different diagnostic tools in the case of patients suffering from cervical dentin hypersensitivity.

**Table 2** A not necessarily exhaustive list of conditions which may result in similar symptoms to cervical dentin hypersensitivity [2, 7, 11]

### Differential diagnosis

- Cracked tooth syndrome
- Fractured restorations
- Restorations left in traumatic occlusion
- Chipped teeth
- Dental carries, root carries
- Postoperative sensitivity
- Pulpal response to restorative treatment or certain materials
- Marginal leakage of restorations
- Pulpitis, pulpal status
- Gingival inflammation
- Palatogingival grooves
- Vital bleaching procedures
- Atypical odontalgia
from dentin hypersensitivity, for example, air jet, dental explorer, or cold test (Table 3) [10].

Time is needed to make a correct diagnosis; because a thorough patient history screening is required and dentin hypersensitivity is always a diagnosis of exclusion, it is confirmed only after all possible other conditions have been diagnostically eliminated. Unfortunately, a validated screening checklist that contains dentin hypersensitivity-related predisposing, initiating, and perpetuating risk factors identified in clinical or epidemiological studies is currently not available.

Clinical recommendations for valid diagnosis of dentin hypersensitivity

In order to avoid false diagnosis, underdiagnosis and further on an over- or undertreatment screening of patients for terms of dentin hypersensitivity should be routinely done. For every patient, especially patients reporting symptoms and pain, a verbal screening is recommended, during which he/she should be asked if any tooth hurts when eating or drinking hot, iced, cold, or acidic food or beverages. Moreover, the patients should be asked if the symptoms are present during oral hygiene procedures or following restorative procedures. If patients could confirm at least one of these questions, the individual history of the patient should be obtained. Dental professionals should ask for specific pain characteristics like site, character, severity, time, etc. Furthermore, the patient should be asked to identify the pain-related and pain-inducing stimuli. In the next step, dental professionals may ask and look for personal behavior patterns (e.g., extrinsic and intrinsic acids, consumption of high-acid drinks or food, and overzealous dental hygiene) and previous dental therapies (e.g., professional tooth cleaning, scaling, and other periodontal treatment; vital tooth bleaching; and restorative procedures). Afterwards, a clinical examination to confirm clinical signs associated with the definition of dentin hypersensitivity should be undertaken (e.g., dental erosion, gingival recession, and exposed cervical dentin).

| Table 3 | An almost complete list of different tools used for the diagnosis of dentin hypersensitivity [10, 30] |
|---------|--------------------------------------------------------------------------------------------------|
| **Diagnostic tools** |                                                                                                    |
| Air jet |                                                                                                    |
| Cold water jet |                                                                                                    |
| Other thermal tests |                                                                                                    |
| Electrical devices |                                                                                                    |
| Dental explorer |                                                                                                    |
| Periodontal probe |                                                                                                    |
| Radiographs |                                                                                                    |
| Caries diagnostic devices |                                                                                                    |
| Percussion testing |                                                                                                    |
| Assessment of occlusion |                                                                                                    |
| Bite stress tests |                                                                                                    |

In patients with suspected dentin hypersensitivity due to positive findings in the screening and history, the thorough differential diagnosis is very important to eliminate all other forms of orofacial pain, including pulpal inflammation, periodontal pain, cracked tooth syndrome, insufficient margins of restorations, atypical odontalgia, etc. All differential diagnosis (Table 2) must be excluded, before the diagnosis of dentin hypersensitivity is definitely formulated [50].

Furthermore, a specific dentin hypersensitivity-related clinical examination is obligatory in cases with positive results in the first examination steps. It could be suggested to carry out a tactile stimulation with a dental explorer scratching in the mesio-distal direction on the exposed dentin [51, 52]. In addition, it is strongly recommended to use a second stimulus to confirm the diagnosis in every patient [4]. An air syringe delivering a stream of air directly directed towards the affected and exposed dentin surface is one of the most often used stimuli [51, 52]. These tactile and evaporative stimuli should reliably provoke the dentin hypersensitivity-associated pain. If the diagnosis of dentin hypersensitivity could be confirmed in this way, the next step is to eliminate predisposing factors [53] (e.g., acid intake, improve, dietary habits, optimize oral hygiene procedures, etc.) and to start the treatment of the suffering patient either with home use or with in-office desensitizing products [4, 38].

Moreover, the suffering patients are known to have substantially decreased oral health-related quality of life in comparison with the general population [54]. Therefore, the integration of any kind of questionnaire focusing on the impact of DHS on oral health-related quality of life of these patients in the diagnostic process might be interesting for daily practice [54, 55]. Unfortunately, the two mostly accepted and validated questionnaires used in several clinical studies regarding the impact of DHS—the Oral Health Impact Profile [56] and the Dentin Hypersensitivity Experience Questionnaire [55]—contain at least 48 items. In the daily practice, we could not expect to complete a Quality of Life Questionnaire containing this huge number of items for each patient, but a simple and shortened questionnaire could help to measure the intensity and impact of pain-suffering patients who are experiencing DHS. An accepted and also validated alternative to record clinical oral health status relationships that affect quality of life for daily practice may be using the short form of Oral Health Impact Profile-14 or the 12-item General Oral Health Assessment Index [57–60]. Both questionnaires contain a manageable number of items requiring only a few minutes for suffering patients. Therefore, this might be a practicable alternative for the daily use in dental practice.

Clinical recommendations for valid assessment and monitoring of dentin hypersensitivity

The dental practitioner is confronted—within the daily practice and especially in clinical trials regarding the severity of
symptoms or the efficiency of therapeutic interventions—
with the need to assess and monitor discomfort and pain
associated with dentin hypersensitivity. According to Gillam
et al. the assessment of dentin hypersensitivity in clinical
investigations is always claimed to be subjective and
depends on the individual reaction of the examined patients
to different stimuli [30, 50]. The perception of pain arising
from exposed dentin surfaces is influenced by a number of
different aspects, including the individual parameters of
each patient, psychological factors, cultural aspects, and situ-
tional and emotional factors [50]. It is also described that
patients accommodate to the applied stimuli used in diagnostic
testing. Generally, patients report high values at the beginning
when the pain stimuli is unknown, but once they are aware or
used to the applied stimuli, the response may change signifi-
cantly [50]. Furthermore, there are known interactions be-
tween the use of stimuli, the response may change signifi-
cantly [50]. These aspects might explain the lack of clear and robust
evidence in the dental literature and the sometimes contra-
dictory results of clinical studies focusing on the success of
different treatment options [14, 15]. The ability to quantify
patient sensations to external stimuli on exposed dentin
surfaces should allow record more accurately on the magni-
tude of the condition and could help to evaluate the different
therapeutic strategies in a more objective and evident man-
er. In case of dentin hypersensitivity, two different assess-
ment methodologies are described. Dentin hypersensitivity
might either be evaluated in terms of a stimulus intensity
required to provoke pain (stimulus-based assessment) or as a
subjective evaluation of the pain produced by a defined
stimulus (response-based assessment) [30, 33, 68]. Charac-
teristic for all stimulus-based methods is the measurement of
an individual pain threshold. On the other hand, the
response-based methods assess pain severity after applica-
tion of a standardized, reliable, and reproducible stimulus
[5, 22]. Furthermore, these methods could be judged as
acceptable if the used stimulation method is accepted as
scientifically valid [30]. As mentioned above, several stim-
uli could induce dentinal pain, but not all are suited for
quantifying dentin hypersensitivity in clinical practice [30,
68]. Tactile, cold, and evaporative air stimuli are physiological
and easy controllable. Therefore, these stimuli are mostly used
and widely recommended in various publications [69–71].
The value of other stimulation methods like the use of elec-
trical stimuli is discussed controversially and often needs a
special device with increasing costs [68]. It is important to
address that recorded dentin hypersensitivity may be different
for different stimuli [68, 72]. Therefore, it is recommended
that at least two different hydrodynamic stimuli should be
used [5]. Furthermore, it would appear from the results of a
recently published study that the tactile stimulus using a dental
explorer is less effective than thermal or evaporative stimula-
tion [22]. If several stimuli are applied, the least severe stim-
ulus should be always applied first to avoid a negative impact
on the results of the stimulation [30]. Furthermore, the interval
between stimulus applications should be sufficient to elimi-
nate interactions between both stimuli. Unfortunately, the
correct interval is still unknown and is likely to vary for
different types of stimuli.

In response-based methods, the stimulus is held constant,
and the subject’s response varies. An example of a response-
based method is the use of a timed airblast. Therefore, each
hypersensitive tooth will be isolated from the adjacent teeth
(mesial and distal) by the placement of the examiner’s
fingers over the adjacent teeth. Air will be delivered from
a standard dental unit air syringe at 60 psi (±5 psi) and 70 °F
(±3°F). The air will be directed at the exposed buccal
surface of the hypersensitive tooth for 1 s from a distance
of approximately 1 cm. Directly after stimulation, the sub-
ject response can be quantified by using a visual analog
scale in which the patient places a mark on a 100-mm line
labeled from no pain to worst pain or a validated graphic
pain scale, such as the Faces Pain Scale [73]. This is con-
sidered preferable to a numerical rating scale where the
subject rates pain intensity on a scale comprising several
distinct categories. Another method of quantification is to
use a verbal descriptor scale which uses word descriptors as
a scaling technique to describe variations in pain according
to the patient’s spontaneous report or by the use of a vali-
dated questionnaire [74, 75]. One disadvantage of verbal
descriptor scales is that they could be restrictive because
they may not offer enough descriptions that can be placed in
a continuous and ascending or descending order of severity
of pain. One commonly used scale is the Schiff cold air
sensitivity scale [69, 70, 76–79]. This scale is mainly used to
assess subject response to a stimulus like air or evaporative.

This scale is scored as follows:

0 Subject does not respond to air stimulus.
In stimulus-based studies, the subject’s response is held constant at the pain threshold, and the stimulus is varied with increasing and decreasing intensities. An often used stimulus-based method might employ a calibrated probe (XiniX Research, Inc., Portsmouth, NH, USA) where the tactile pressure applied to the tooth with a dental explorer tip can be varied and increased in steps of 10 g using an electronic device [69, 77, 79]. Using this device, teeth can be evaluated for tactile dentin hypersensitivity as follows [69]. The patients were instructed to respond at the point where she/he first experienced pain after stroking the explorer tip with the preset force perpendicular to the tooth. The applied force could be increased by 10 g increments until the patient experienced discomfort. This force will be recorded for further analysis. An alternative could be thermo or electrical devices which have been developed in the past for applying graded thermal or electrical stimuli. However, these devices were discussed contradictory in the literature [34]. In selecting stimulus-based methods, it is important to realize that these have certain drawbacks. Repeated painful stimulation may cause a change in sensitivity. Anticipation of pain by the subject may influence outcome, especially with gradually increasing stimuli. In a recently published study, Ide et al. showed that the reproducibility of evaluation methods for dentin hypersensitivity is difficult to achieve, even when standardized techniques were used [35]. Furthermore, the fact that stimulus-based methods are often time consuming, which limit the number of teeth that can be tested with multiple stimuli in one appointment. Generally, outcome evaluation of dentin hypersensitivity treatment in clinical practice as well as in clinical trials should include at least two different stimuli, and if possible, it is recommended to use both approaches—stimulus- and response-based assessments [5].

**Conclusion**

Today, dentin hypersensitivity is essentially a diagnosis of exclusion. Therefore, the validity and quality of the diagnosis corresponds to the value of the numerous existing differential diagnoses. Finally, at least two different stimuli should be used to assess dentin hypersensitivity. Tactile, cold, and evaporative air stimuli are physiological and easy controllable. Therefore, these stimuli are mostly used and widely recommended for the clinical diagnosis of dentin hypersensitivity in dental practice in various publications [69–71]. Different pain scores could be used to assess the discomfort following any of the above-mentioned stimuli. For dental practice, the use of a continuous 100-mm visual analog scale could be recommended.

Furthermore, monitoring of dentin hypersensitivity is a challenging field. We have some standardized methods, but we should consider that pain negatively influencing the quality of life of suffering patients is still subjective and might be affected by a huge number of individual factors.

As performed in many studies, treatment effects of different therapies or materials could be expressed in terms of the degree of reduction, but in developing further therapeutic strategies, we should always keep in mind that for our patient, the presence or absence of pain is the most important result. The overall dental health impact of dentin hypersensitivity on a particular individual may ultimately correlate with the degree of discomfort and pain experienced [80]. Since it is known that dentin hypersensitivity has an influence on oral health-related quality of life [54], it could be recommended to include this pain-related dimension during the patient’s treatment in daily practice and in clinical trials. Beside several published and validated questionnaires [55, 57, 60], a commonly and widely used instrument for this purpose is the Oral Health Impact Profile-49 [81], which needs to be completed by the patient. In addition to the original version of this questionnaire, validated translations are available in many other languages [82–90]. The evaluation of the impact on the quality of life of patients suffering from dentin hypersensitivity might be a promising aspect in further clinical trials. Certainly, these questionnaires, including 48 and 49 items, were too large for the routine use in daily practice. An acceptable alternative to record clinical oral health status relationships that affect the quality of life for daily practice may be using the short form of Oral Health Impact Profile-14 or the 12-item General Oral Health Assessment Index. Finally, education of both the public and dental professionals should be encouraged to allow that patients affected by and suffering from dentin hypersensitivity receive an adequate treatment.

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**Conflict of interest**

The author declares that he has no conflict of interest.

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