ORIGINAL ARTICLE

DENTAL HYPERSENSITIVITY IN THE CONTEXT OF TOOTH WEAR

Stănuşi Andreea[1], Stănuşi Adrian Stefan[2], Akarkab Moad[3], Brătoiu Mihaela Roxana[1]

[1] Department of Prosthodontics, University of Medicine and Pharmacy of Craiova, 200349 Craiova, Romania
[2] Department of Oral Health, University of Medicine and Pharmacy of Craiova, 200349 Craiova, Romania
[3] Private Practice, Craiova

All authors contributed equally to this work.

[*] Corresponding author:
Stănuşi Adrian Stefan, Department of Oral Health, University of Medicine and Pharmacy of Craiova, 200349 Craiova, Romania;
Email: *adrian.stefan.stanusi@gmail.com*

Abstract: *Background*: Dentin hypersensitivity (DHS) is one of the most common complaints of patients in dental offices and its pathogenesis remains a subject of debate. The aim of this study was to present the current state of knowledge of DHS among young practitioners and to assess the prevalence of DHS and cervical tooth wear in young patients and also to present modern treatment options. *Methods*: For this study, an electronic questionnaire was created and distributed online. To assess the clinical and therapeutic aspects of DHS in the context of early cervical tooth wear, we examined and treated 20 patients with this condition. *Results*: The questionnaire was completed by 104 participants. To the questions regarding the definition of the symptoms of DHS, over 75% of the participants provided the correct answers. A smaller number of participants (66.3%) answered correctly to the question regarding the association of DHS with early cervical tooth wear. Approximately 90% of participants stated that their oral health was affected. For the present study, 20 patients with DHS were included and divided into 4 study groups. It is noted that for patients who did not receive treatment for DHS, the painful symptoms remained the same or worsened. For the other patients, the painful symptoms experienced a significant reduction. *Conclusions*: The development of DHS in the context of incipient cervical tooth wear is an aspect insufficiently known by dental practitioners. Laser irradiation of the tooth surface for its desensitization represents a modern and effective dental treatment of DHS.

Keywords: dentinal hypersensitivity, tooth wear, cervical wear

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1. Introduction

Dentinal hypersensitivity (DHS) has been defined as a brief, sharp toothache that usually occurs following the action of a physical/chemical/mechanical stimulus applied to the exposed dentinal tubules in the cervical area, and that cannot be attributed to any other dental pathology [1-4].

DHS has been recognized as an important dental condition for more than 50 years, but its pathogenesis remains a subject of debate. DHS is generally considered to be associated with dentin exposure, particularly exposure of open dentinal tubules [4]. The Brännström hydrodynamic theory is the widely accepted explanation for the occurrence of cervical DHS. It states that physical stimuli, applied to the tooth surface, cause fluid displacement in the dentinal tubules, which causes contraction and distension of the odontoblastic processes and stimulation of nerve fibers present at the dentin-pulp interface [5].

The causative etiological factors of DHS are: stress, friction and biocorrosion. Soares and Grippo [2], two specialists in dental wear and DHS, argue that there is a strong relationship between the two pathologies and that both originate from eccentric loading forces on the teeth. These forces subject the periodontium and the cervical region of the tooth to stress and are perceived by the pulp as pain [2].

The concentration of stress in the cervical area has been reported by numerous clinicians and researchers using finite element analysis. This stress causes the loss of the smear layer, cementum and enamel/dentin in the cemento-enamel junction region [6-9]. When the rate of this loss exceeds the rate of remineralization and reformation, the open dentinal tubules reach the nociceptive threshold, that of DHS. Therefore, the presence of DHS is an early sign and symptom of the clinical formation of stress-induced abfraction/non-carious cervical lesion (NCCL) [2].

Dentin hypersensitivity is one of the most common complaints of patients in dental offices. Studies have shown wide variations in the prevalence of DHS, from 2 to 98% [2, 4] and that DHS is more common in patients aged 30 to 40 years [10,11].

Severe DHS can last more than 6 months and can induce psychological and emotional instability, which can trigger the development of neuralgia, requiring treatment as neuropathic pain. Also, the quality of life of patients is related to their oral health and in the case of patients with DHS, it can be improved after DHS has been successfully treated [4].

Although DHS is one of the most common problems encountered by dental professionals, universally accepted guidelines for differential diagnosis and selection of reliable treatment modalities are lacking. The problems associated with the diagnosis and treatment of DHS are further exacerbated by the fact that several dental conditions have symptoms that can mimic DHS at different stages of their progression [4, 12].

Treatment of DHS is a specific treatment that can be performed on an outpatient basis, by local application of desensitizing products, or/and in the dental office using desensitizing agents, laser therapy, and/or surgical treatment [2]. Some specialists have stated that if the painful symptoms do not improve and the depth of the lesion approaches 1 mm, restorative treatment is recommended [13].

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The aim of this study was to present the clinical and therapeutic aspects of HSD, knowing that this condition is associated with early cervical tooth wear. The present study aimed to present the current state of knowledge of DHS among young practitioners. It was also aimed to assess the prevalence of DHS and cervical tooth wear in young patients and to present modern treatment options.

2. Materials and method

The study was approved by the Ethics Committe of the University of Medicine and Pharmacy of Craiova (no. 55/16.02.2023). For this study, an electronic questionnaire was created in Google Forms, consisting of 16 questions (Q1-Q16). This questionnaire was distributed between 05.05.2025-26.05.2025 to dentists and students in the 4th, 5th and 6th years of study from Faculty of Dentistry, University of Medicine and Pharmacy of Craiova.

The questionnaire was sent online, using social networks. By completing the questionnaire, participants expressed their consent to participate in the study and to process their personal data. The results were collected by Google Forms in the form of graphs and a database. The database was processed using Microsoft Excel.

The questions in the created questionnaire are systematized in Table 1 and aimed at classifying the participant according to their level of training and age, their level of knowledge of DHS, self-reporting of this condition and tooth wear. The questions also aimed at participants' appreciation of the role of DHS in affecting the way they consume certain foods and, implicitly, in affecting quality of life.

Also, to assess the clinical and therapeutic aspects of DHS in the context of early cervical tooth wear, we examined and treated 20 patients with this condition. The patients were aged between 20 and 50 years and presented themselves in private dental practice for the treatment of DHS between 03.03.2025 and 30.04.2025. All patients included in this study expressed their written consent to participate.

The patients were divided into 4 study groups:

- group M, the control group, represented by 5 patients with DHS with no treatment for this condition;
- group P, represented by 5 patients with DHS to whom the use of desensitizing tooth pastes was recommended;
- group L, represented by 5 patients with DHS to whom laser desensitization of the affected dental surfaces was done;
- group A, represented by 5 patients with DHS to whom an adhesive system for the treatment of DHS was applied.

At the time of presentation in the dental office, all patients were asked to rate the intensity of pain on a scale from 0 to 10 when a thermal stimulus (cold air jet) was applied. Patients in the control group were asked to return to the office in 2 weeks and to mention a score for the pain they felt. Patients in groups P, L and A were asked, after the treatment, to mention the pain score they felt when a cold air stimulus was applied.

The desensitizing tooth pastes recommended to the patients in group P were the ones based on sodium monofluoro-phosphate (Elmex Sensitive Professional). The laser used in the treatment of patients from group L was a diode laser with a wavelength of 980 nm (Biolase). The laser

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desensitizing protocol involved placing the tip of the laser at a 5 mm distance from the dental surface, activating the laser at a power of 0.5 W, for 90 sec, during which time the laser tip had circular movements and no contact with the dental surface. The adhesive system used in the treatment of patients from group A was a one component light-cured universal adhesive (G-Premio Bond, GC). After etching the dental surface, the adhesive was applied, then the operator waited for 10 seconds, air-dryed the dental surface for 5 seconds and then light cured for 10 seconds.

Table 1. The questions in the questionnaire.

Number	The questions in the questionnaire.	Response possibilities
Q1	Please state your professional degree.	Student/Dentist
Q2	Your gender	Male/Female
Q3	If you are a student, please specify your year of study.	4th year/5th year/6th year
Q4	Your age	20-25/26-30/31-40/41-50/over 50
Q5	DHS is a condition characterized by discomfort/pain that occurs	When applying thermal, chemical or mechanical stimuli to the teeth/Spontaneous/At night
Q6	Discomfort/pain from DHS	It is short-lived (for as long as the stimulus is applied) /It is prolonged, for a few minutes
Q7	DHS is the specific sign of the early stages of cervical tooth wear.	True/False/I don't know
Q8	I believe I have DHS	Yes/No/I don't know
Q9	If the answer to the previous question was yes, I am undergoing treatment for DHS	Yes, I use specific toothpastes/Yes, I went to a dentist for treatment in the dental office/No
Q10	I think I have tooth wear.	No/ Yes, early stage on the occlusal surfaces/Yes, early stage in the cervical area/Yes, advanced stage (more than 1/3 of the coronal height is affected)/I don't know
Q11	If you have/would have DHS, do you think that toothache limits your consumption of certain favorite foods/drinks?	True/False/Don't know
Q12	If you have/would have DHS, do you think that toothache prolongs the time required to consume certain foods/drinks?	True/False/Don't know
Q13	If you have/would have DHS, do you think that toothache prevents you from consuming cold foods?	True/False/Don't know
Q14	If you have/would have DHS, do you think that toothache has caused a change in the way you chew certain foods/drink certain liquids?	True/False/Don't know
Q15	If you have/would have DHS, do you think that in order to avoid toothache, you should be careful how you breathe on a cold day	True/False/Don't know
Q16	If you have/would have DHS, do you think that	Your oral health is affected/Your quality of life is affected/Your oral health is good/Your quality of life is not affected

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3. Results

3.1 Results of the questionnaire

The questionnaire was completed by 104 participants. Of the 104 participants, 86.5% were final year students at the Faculty of Dentistry, UMF Craiova, and most of them were 6th year students, aged between 20 and 25 years.

To the questions regarding the definition of the symptoms of DHS (Q5 and Q6), over 75% of the participants provided the correct answers.

A smaller number of participants (66.3%) answered correctly to the question regarding the association of DHS with early cervical tooth wear (Q7). Almost 10% of the participants did not know the correct answer to this question.

One question in the questionnaire (Q8) referred to self-reporting of DHS. Most of the participants (68.3%) stated that they did not have this condition.

Among participants with DHS and undergoing treatment for this condition, most mentioned that treatment consisted of using specific toothpastes (26%). Only 10.4% of participants with DHS sought specialized treatment in the dental office.

Another question in the questionnaire (Q10) referred to self-reported tooth wear. Most participants (53.9%) stated that they did not have tooth wear.

Approximately 30% of participants stated that they had incipient tooth wear on the occlusal surfaces. Only 5.9% of participants stated that they had incipient tooth wear in the cervical area.

The following questions focused on the influence of DHS on quality of life. A first question in this section referred to limiting the consumption of certain foods and beverages in the presence of DHS (Q11). Most participants (67.7%) stated that they considered that this condition influences eating behavior (Figure 1).

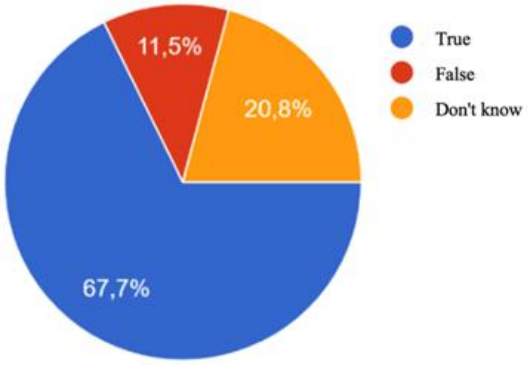

Figure 1. Answers given to Q11.

Participants were then asked whether they considered that the dental pain characteristic of DHS prolongs the time required to consume certain products (Q12). Most participants (66.7%) answered affirmatively and considered the painful symptomatology as a factor increasing the chewing time (Figure 2).

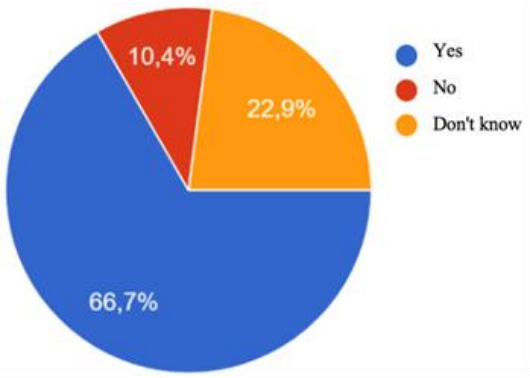

Figure 2. Answers given to Q12.

The next question (Q13) referred strictly to the consumption of cold foods in patients with DHS. Most participants (76%) stated that they were aware that this condition does not allow optimal consumption of foods with a low temperature.

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Another question in this section (Q14) followed the participants' assessment of the masticatory pattern in relation to DHS. Most participants (73.2%) stated that mastication is influenced by the characteristic painful symptomatology (Figure 3).

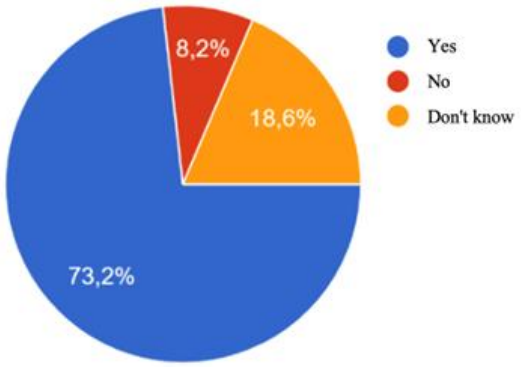

Figure 3. Answers given to Q14.

The next question referred to the correlation of DHS pain with another important patient behavior, unrelated to mastication, namely breathing (Q15). Participants were asked whether they considered that patients with dentin hypersensitivity avoid mouth breathing during a cool day. Approximately half of them (49.5%) answered affirmatively.

The last question in the questionnaire aimed at the direct correlation of DHS with the patient's quality of life (Figure 4). Approximately 90% of participants stated that their oral health was affected. One third of participants stated that this condition decreases their quality of life.

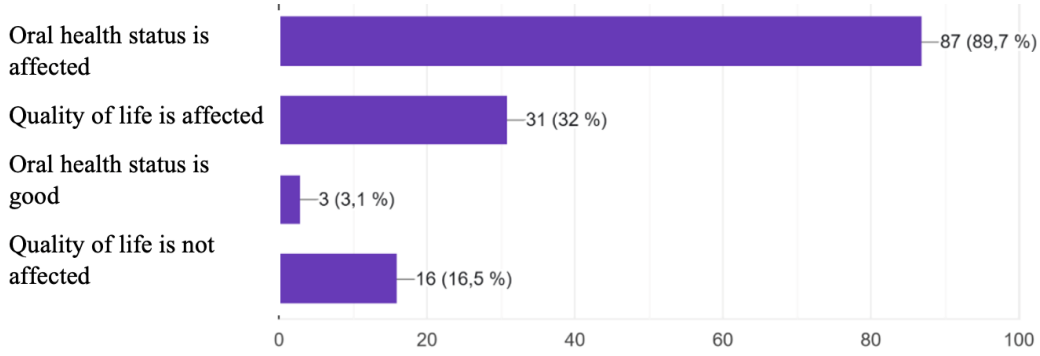

Figure 4. Answers given to Q16.

3.2 Clinical cases

For the present study, 20 patients with DHS were included and divided into 4 study groups. Each patient was assigned a code to protect personal data. The code was composed of: the initial P, the initial of the group, the number within the group (e.g.: P-M-1 represents patient no. 1 in the marker/control group).

For patients in groups P, L and A, DHS treatment was performed using one of the 3 techniques: outpatient use of toothpastes dedicated to this condition (group P), laser treatment of the affected tooth surfaces (group L) and application of an adhesive system on the tooth surface (group A).

Patients were asked to rate the painful symptoms on a scale from 0 to 10 at the time of presentation to the dental office and, respectively, after the treatment of DHS or after 2 weeks. The answers provided by them are shown in Table 2.

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It is noted that for patients who did not receive treatment for DHS, the painful symptoms remained the same or worsened. For the other patients, the painful symptoms experienced a significant reduction.

For the present study, we considered 2 clinical cases to be relevant for the presentation of the clinical picture and treatment options.

Table 2. Pain assessment by patients included in the study.

No.	Patient identification code	Pain score at presentation	Pain score after treatment/2 weeks
1.	P-M-1	7	7
2.	P-M-2	7	8
3.	P-M-3	8	8
4.	P-M-4	6	6
5.	P-M-5	6	7
6.	P-P-1	7	6
7.	P-P-2	6	3
8.	P-P-3	8	6
9.	P-P-4	5	3
10.	P-P-5	7	3
11.	P-L-1	7	1
12.	P-L-2	7	0
13.	P-L-3	6	0
14.	P-L-4	5	1
15.	P-L-5	6	0
16.	P-A-1	6	0
17.	P-A-2	7	0
18.	P-A-3	8	1
19.	P-A-4	8	1
20.	P-A-5	6	0

3.2 Clinical case no. 1

Patient B.F (patient code P-A-2), 31 years old, presented herself to the dental office complaining of localized pain in tooth 4.4. The patient stated that the pain occured when consuming cold foods and drinks and was of high intensity, which decreased within 10-15 seconds.

From the anamnesis, the dentist identified one of the etiological factors of cervical tooth wear and DHS, namely, the consumption of acidic foods and drinks. The patient mentioned that every morning, after brushing her teeth, she consumes a glass of lemonade.

The clinical dental examination revealed the existence of a enamel fissure on the buccal surface of tooth 4.4 and a localized demineralization in the buccal cervical area (Figure 5). Demineralization in the buccal cervical area was also identified on other teeth, including neighboring teeth. When applying the cold air jet and palpating the buccal cervical area of tooth 4.4 with the probe, the patient complained of painful symptoms, which she rated on a scale from 0 to 10 with a value of 7.

The diagnosis of DHS was established at the level of 4.4. The treatment indication was

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to apply an adhesive system to the identified fissure and demineralization to improve the symptoms characteristic of DHS.

During the treatment session, professional brushing of the dental arches and personalized oral hygiene habbits were delivered.

As a result of the existence of demineralization in the buccal cervical area, the dentist insisted on controlling the etiological factors by limiting the consumption of acidic foods and drinks, but also by brushing the dental cervical third with a soft-bristled toothbrush and fluoride toothpaste.

After professional brushing, the buccal surface of tooth 4.4 was re-examined using the operating microscope and it was noted that after palpation with the probe of this intensely demineralized area, a superficial loss of dental enamel occurred, in the form of NCCL. The specific treatment steps of applying an adhesive system and flowable composite followed. At the end of the treatment session, the painful symptomatology accused by the patient at the level of tooth 4.4 was re-evaluated. When applying the cold air stimulus, the patient mentioned the complete disappearance of pain, giving the value 0.

(a)

(b)

(c)

(d)

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(e) (f)

Figure 5. Clinical case no. 1 - Sequences of the treatment stage: a) pre-operative appearance; b) orthophosphoric acid used; c) demineralization of the interested surface; d) application of the adhesive; e) application of the flowable composite; f) final appearance.

3.2 Clinical case no. 2

Patient A.M (patient code P-L-2), aged 29, presented to the dental office complaining of cold pain, located at the level of tooth 1.4. The patient mentioned that the pain is intense and occurs when brushing teeth, which is why the brushing in that area is avoided. From the anamnesis, the dentist deduced that the patient had used desensitizing toothpastes in the last 3 months, but the painful symptoms had not improved. Following the clinical dental examination, bacterial plaque deposition, gingival retraction on the buccal side of tooth 1.4 and superficial enamel loss in the buccal cervical area, with a depth of less than 1 mm, were identified. The diagnosis of incipient, saucer-shaped NCCL, associated with gingival retraction and DHS at the level of tooth 1.4, was established.

The treatment indication was to perform professional brushing and desensitization of the dental surface by laser irradiation. For this treatment, the Biolase diode laser was used, with a wavelength of 940 nm and a dedicated uninitiated tip (Figure 6). The procedure did not require dental anesthesia.

The patient gave a value of 7 for the pain felt pre-operatively. The patient gave a value of 5 for the pain felt after the first cycle of laser irradiation. The procedure was repeated. Upon re-examination of the painful symptoms, the patient mentioned the complete disappearance of the pain, giving a value of 0 on the VAS scale (Figure 6).

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(a) (b)

Figure 6. Clinical case no. 2 - Sequences of the treatment stage: a) the diode laser used; b) laser irradiation.

4. Discussion

Pain is considered a subjective and complex experience. Dental pain is characterized as discomfort originating from the teeth and supporting tissues and is most often associated with primary and secondary caries, poor restorations, and exposed root surfaces. Pain is the main feature of DHS. Dental pain interferes with daily activities such as brushing teeth, drinking cold liquids, eating ice cream, talking, or inhaling cold air [14].

The starting point in diagnosing DHS is the pain experienced by the patient. The most common clinical signs associated with DHS include the initial non-carious loss of dental hard tissues in the cervical area in the form of erosion/abfraction/abrasion lesions. These non-carious cervical lesions are included in the clinical forms of tooth wear [15].

The objective of our study was to create a questionnaire with a reduced number of questions and to assess, based on the responses provided, the prevalence and impact of self-reported dentin hypersensitivity among final year students at the Faculty of Dentistry, UMF Craiova and among young dentists. We also aimed to investigate the association of DHS with early tooth wear.

The questionnaire constructed for this study included questions regarding self-reporting of DHS and tooth wear, as a result of constructing the study group from specialists in the field of dentistry, final years students and dentists. Their level of training was sufficient to express their appreciation of the existence of these conditions in their own oral cavity.

To the questions aimed at assessing the level of knowledge of the clinical signs of DHS, the participants provided the correct answers in a significantly high percentage. Thus, a high level of knowledge of this dental condition was noted.

To the question regarding the definition of DHS as a pathognomonic sign of incipient tooth wear in the cervical area, the participants provided the correct answers in a lower percentage. This aspect draws attention to the need to deepen the study of the etiopathogenic mechanisms and symptomatology of tooth wear and, implicitly, of NCCL. Similar results have been obtained in other studies in the literature [6].

Since most participants were young, and tooth wear is a common condition among

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elderly patients, it is not surprising that tooth wear was not self-reported by the participants. The low percentage of participants (approximately 6%) with early tooth wear in the cervical area is correlated with the low percentage of participants with dentin hypersensitivity.

We noted that only half of the participants observed the connection between tooth pain from DHS and mouth breathing during a cold day, although the relationship between atmospheric air quality and tooth pain is known. Atmospheric air during mouth breathing, especially in winter, when low temperatures are recorded, triggers tooth pain [16].

Also, only one third of the participants stated that DHS decreases the quality of life of the patients, although several participants noted changes in eating behavior. This fact denotes the need for additional training of dental professionals in the direction of assessing the patient as a whole. Dentists must appreciate that certain oral conditions change the patient's lifestyle. Oral conditions with painful symptoms influence the way in which the patient masticates, but also the type of food consumed. The reduction in masticatory efficiency and the avoidance of foods with a high consistency and rich in vitamins determine over time a series of gastrointestinal conditions. When the patient develops these conditions, he becomes dependent on certain drug treatments that modify his social life and reduce his financial possibilities [17].

Considering the impact of DHS on the patient's quality of life, multiple treatments have been described in the literature, each with its advantages and disadvantages. Among these, the use of specific pharmaceutical products, the application of adhesive systems and laser irradiation of the affected surface stood out for their ease of application and efficiency, for which we included relevant clinical cases in this dissertation.

In recent years, the attention of specialists has focused on laser treatment of the affected dental surface for its desensitization. Both high/medium power and low power lasers can relieve pain when used with appropriate power settings. These treatments demonstrate an instant pain relief effect upon application and offer long-term benefits [18]. The effectiveness of laser treatment was also noted in patients who benefited from this treatment in our study.

However, there is very limited evidence available to support the advantages of laser therapy over conventional therapy for the treatment of DHS. In addition, there are no widely accepted working protocols regarding which types of lasers or laser parameters (e.g. wavelength, mode, power density) are more effective. Future studies are needed to further investigate the clinical efficacy of lasers, as well as their cost-effectiveness [19].

The widely accepted and widely used treatment option for DHS remains the use of desensitizing pharmaceuticals. Clinical and laboratory studies have demonstrated the beneficial clinical effects of pharmaceuticals containing calcium phosphate on DHS. Regardless of the test used (air jet, tactile, or cold water), calcium phosphate induced a reduction in pain levels by an average of 2.5 on the VAS scale after 4 weeks. These results can be explained by the ability of calcium phosphates to spontaneously form

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hydroxyapatite at physiological pH and to adhere to exposed dentin, forming a layer of calcium phosphate components, which may allow them to seal exposed dentinal tubules and, consequently, be a good candidate for the treatment of DHS [20].

The present study draws attention to the impact of DHS on the quality of life of patients and the need for an individualized and complete treatment that also addresses cervical tooth wear.

One of the limitations of this study is that the results cannot be extrapolated to the general population, since all subjects were of similar ages and backgrounds. Also, the study groups were composed of a small number of participants, and a significant statistical analysis could not be performed.

5. Conclusions

1. Final year dental students and young dentists demonstrated a high level of knowledge of the etiology, symptomatology and treatment of DHS.

2. The development of DHS in the context of incipient cervical tooth wear is an aspect insufficiently known by dental practitioners.

3. The results of the distributed questionnaire demonstrated that DHS has a profound effect on the quality of life of individuals.

4. This study demonstrates the need for further studies on the mechanism of cervical wear for a better understanding among dentists and dental students.

5. Laser irradiation of the tooth surface for its desensitization represents a modern and effective dental treatment of DHS.

6. The use of desensitizing pharmaceutical products implies compliance with the application protocol to improve painful symptoms.

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Data availability statement

Will be provided on request.

Ethics statement

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ORCID

Stănuşi Andreea: https://orcid.org/0000-0003-2520-7967
Stănuşi Adrian Stefan: https://orcid.org/0009-0001-1306-1596
Brătoiu Mihaela Roxana: https://orcid.org/0009-0002-9220-3616

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