Dental treatment of sensitive tooth

Petrescu E. L.[1,2], Novac A. C.[1,2], Al- Hlali H.[1], Ardelean A.[1*], Pop D. M.[1,2], Sinescu C.[1,2], Negruțiu M. L.[1,2], Leretter M.[1,3]

[1]Departement I, Faculty of Dental Medicine, University of Medicine and Pharmacy "Victor Babes", Timisoara
[2]Research Center in Dental Medicine Using Conventional and Alternative Technologies, Department of Prostheses Technology and Dental Materials, Faculty of Dental Medicine, "Victor Babes" University of Medicine and Pharmacy of Timisoara
[3]TADERP Research Center – Advanced and Digital Techniques for Endodontic, Restorative and Prosthetic Treatment, "Victor Babeş" University of Medicine and Pharmacy

Correspondence to:
Name: Ardelean Andra
Address: Piata Eftimie Murgu 2, Timisoara, 300041
Phone: +40 729 537 537
E-mail address: andra.ardelean3@gmail.com

Received: 10 April 2024; Accepted: 10 June 2024; Published: 30 June 2024

Abstract

Introduction: Dentine hypersensitivity (DH) is a significant dental health concern characterized by sharp pain in response to stimuli on exposed dentine. It poses a diagnostic challenge due to its similarity to pain caused by other dental conditions. This condition predominantly affects adults, with canine and premolar teeth being the most commonly involved. **Aim of the Study:** The study aims to elucidate the management strategies for dentin hypersensitivity (DHS), focusing on various therapeutic options tailored to specific patient groups, including those with gingival recession, tooth wear lesions, and undergoing periodontal treatment. **Material and Methods:** For this study twelve patients (8 males and 4 females, aged 23-47 years) were selected after providing informed consent. Sensitivity testing involved exposure to thermal changes in the oral environment. The study design categorized teeth into groups receiving treatments like fluoride varnish, bonding agents to cover root surfaces after periodontal treatment, and a combination of periodontal and endodontic treatments with home care instructions. The effectiveness of these treatments was assessed through clinical examination and patient feedback. **Results and Discussions:** Treatment with fluoride varnish showed significant reductions in discomfort immediately and sustained improvement up to six weeks post-treatment, though effectiveness began to wane towards the end. No significant difference was observed between fluoride varnish and dental bonding in reducing DH. Interestingly, treatments combining periodontal and endodontic care with composite restoration were effective, underscoring the need for a multifaceted approach to DH management. **Conclusions:** The study concludes that various desensitizing agents, including fluoride varnish and dental bonding, are effective in managing dentin hypersensitivity to different extents. The management of DH necessitates a comprehensive understanding of its pathology and a tailored approach to treatment, considering individual patient needs and the specific causes of sensitivity.

Keywords: dentine hypersensitivity, screening procedure, pain management strategies, exposed root surface, gingival recession

INTRODUCTION

Dentine sensitivity (DS) or dentinal hypersensitivity (DH) is recognized as the most prevalent painful disorder affecting teeth. This condition arises in response to stimuli that reach the exposed dentine. Clinically, it is characterized by an excessive reaction to stimuli that are typically not harmful [1] [2].

The phrases "dentine sensitivity" and "dentinal hypersensitivity" are often utilized interchangeably to refer to this identical clinical phenomenon [3].

A significant portion of the research focused on this condition recommends the use of the term "dentine sensitivity", acknowledging that the acute pain experienced is, in fact, a normal reaction of the dental pulp to exposed dentine [4] [5].

However, it is acknowledged that not all exposed dentine is sensitive, and for many years, clinicians have preferred the term "dentinal hypersensitivity". Consequently, both terms are acceptable for describing this clinical situation [6] [7].

The mechanism of dentine hypersensitivity is explained by 3 theories:

1) Neural theory
2) Odontoblastic transduction theory
3) Hydrodynamic theory

The Neural Theory posits that unmediated nerve fibres in the outer layer of root dentine and the presence of potential neurogenic polypeptides reinforce this concept. However, despite its theoretical framework, the lack of substantial evidence to support it remains a challenge. This is particularly evident in the heightened sensitivity of outer dentin compared to inner dentin, and the absence of nerve endings in newly erupted teeth despite their sensitivity [8].

The Odontoblastic Transduction Theory posits that peripheral odontoblasts act as receptor cells, transmitting impulses through synaptic junctions to nerve terminals, thereby causing the sensation of pain from nerve endings located at the pulp dentine border [9]. However, a recent study by Thomas (1984) suggests that odontoblastic processes are limited to the inner third of the dentinal tubules. Consequently, it appears that the outer portion of the dentinal tubules lacks cellular elements and is filled only with dentinal fluid [10,11].

The Hydrodynamic Theory is the most widely accepted explanation for dentin hypersensitivity. It was initially proposed by Gysi in 1900 and later validated by Brannstrom. According to Brannstrom (1963), changes in temperature or physical osmotic conditions cause movement in the fluids within dentinal tubules, stimulating nerve receptors sensitive to pressure. This stimulation results in the transmission of stimuli, leading to the sensation of hypersensitivity [12,13].

In the ethology of dentin hypersensitivity, pathological conditions such as gingival recession, coronal destruction, attrition, abrasion, erosion, and abfraction are implicated, as well as periodontal issues. Furthermore, techniques such as dental bleaching can lead to the onset of dentin sensitivity [14].

The treatment of dentin hypersensitivity can be categorized as follows [15]:

A. Patient counselling

Education on oral hygiene practices

Addressing dietary factors

Removing risk factors through education about root caries

B. Interventional treatment

-At-home treatment options:

- Use of anti-sensitivity toothpaste

- Application of fluoride-based gels
- Use of specialized rinses

-In-office treatment options:

(i) Non-invasive:

- Surface applications in-office such as chemical (oxalates) or fluoride treatments
- Utilization of physical agents
- Class V restorations
- Laser therapy
- Iontophoresis

(ii) Invasive:

- Endodontic (root canal) treatment
- Gingival graft surgery
- Tooth extraction

Aim and objectives

The objective of the study was to outline management strategies for dentin hypersensitivity (DHS) and explore various therapeutic options. This study details DHS management strategies tailored to three distinct patient groups:

1) Patients with gingival recession
2) Patients with tooth wear lesions
3) Patients with periodontal disease and those undergoing periodontal treatment

MATERIAL AND METHODS

Patient inclusion

The study was carried out in the prosthodontics department, School of Dentistry at Victor Babeș University of Medicine and Pharmacy in Timișoara, Romania. All participants were verbally briefed, and written consent was obtained for their involvement in the research.

Study group

Twelve patients, consisting of 8 males and 4 females aged between 23 and 47 years (with a mean age of 30±2), were recruited and consented to participate (Fig.1.). Sensitivity testing was performed by exposing them to thermal changes in the oral environment. Each patient had at least two quadrants of their mouth selected, resulting in a total of 73 teeth being included in the study.

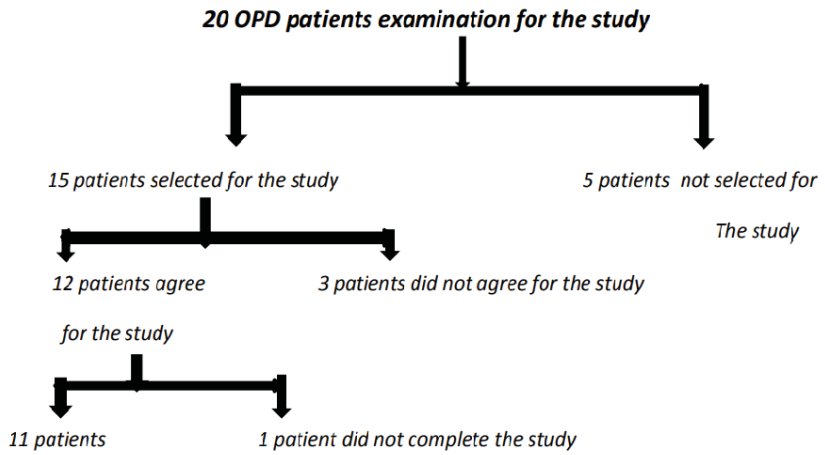

Figure 1. Chart with the recruited patients

Screening procedure

The participants underwent clinical examination and assessment to confirm the presence of dentin hypersensitivity (DH) and were once again screened for inclusion and exclusion criteria. The procedure involved isolating the test and control teeth with cotton rolls and thermally stimulating them with a burst of air from a dental syringe for one second, positioned 10 mm from the buccal tooth surface, to induce a brief, intense pain lasting no more than 30 seconds. After a 10-minute interval, thermal stimulation was halted by placing a small cotton pellet on the buccal tooth surface for one second. To confirm the vitality of the test and control teeth, an electric pulp tester was used with conducting paste, following isolation and drying of the teeth with cotton rolls and air. Assessment of response to various pain stimuli was conducted on both the test and control teeth, as well as adjacent teeth for safety. A thorough screening of medical and dental history, including medical conditions, medications affecting the oral cavity, dietary habits, oral hygiene practices, and substance use, was performed. The included teeth (n=73) were then divided into groups.

Study design

Teeth were categorized into groups as follows:

Group 1 (NaF): Received application of dentin adhesive sealers (fluoride varnish), specifically 5% NaF varnish.

Group 2 (Covering Root Surfaces): After periodontal treatment, received application of a bonding agent to seal the surfaces, thereby preventing exposure.

Group 3: Received periodontal and endodontic treatments, dentin sealer (composite restoration), and home care with dentifrices.

RESULTS

Three patient groups with clinically diagnosed cervical dentin hypersensitive teeth were enrolled and randomly assigned to receive either dentin adhesive sealers (fluoride varnish), a bonding agent, and restoration (endodontic and composite restoration). Pain and discomfort were assessed following an air blast at baseline, immediately after treatment, and during patient visits at weeks 2, 4, and 6.

Treatment with fluoride varnish led to significant reductions in discomfort immediately after treatment and after 1 week. Discomfort decreased by approximately 70% to 85% of baseline scores, followed by a gradual decline. Pain at the 4-week examination was notably lower in the fluoride group compared to other types of treatment. Multiple applications may be required for enhanced efficacy. The benefits stem from the physical blockage of the tubules, although the effectiveness of fluoride varnish began to wane by the end of the sixth week.

The sensitivity level was assessed according to predefined criteria. No statistically significant difference was found between fluoride varnish and dental bonding (dental sealant). When analysed separately, there was no significant difference observed for fluoride varnish across the three examination periods. However, for dental bonding (dental sealant) therapy, a significant difference was noted only between the values obtained before treatment and those recorded weeks after the first application. It can be inferred that both treatments may effectively reduce cervical dentinal hypersensitivity, with improved outcomes observed for teeth with a higher sensitivity level.

Additionally, while treatment in group 3 with endodontic and composite restoration may seem drastic, it proves to be a suitable method for successfully reducing dentinal hypersensitivity (Table.1).

Table 1. Percentage of hypersensitivity reduction for the treatment groups after receiving treatment

Treatment	**Period of treatment**			
group	material	2 weeks	4 weeks	6 weeks
1	fluoride varnish	70-85%	65%	53%
2	Bounding agent	65%	50%	39%
3	Endodontic and Composites restoration	98%	98%	98%

DISCUSSIONS

Dentin hypersensitivity is an exaggerated response to sensory stimuli, typically manifesting as a rapid onset of sharp pain of short duration when exposed dentin is stimulated by various factors such as thermal, evaporative, tactile, osmotic, or chemical stimuli. This response cannot be attributed to any other dental defect or pathology. Various methods and materials are employed for treating dentin hypersensitivity, taking into account the degree of pain, discomfort, and functional complications both before and after treatment.

Treatments aimed at reducing dentin permeability should effectively alleviate dentin sensitivity by occluding dentinal tubules, thereby decreasing the degree of hypersensitivity.

All patients underwent scaling and polishing and received education on the modified Stillman technique. They were instructed to use desensitizing toothpaste and soft-bristle toothbrushes.

After conducting a pre-treatment assessment of hypersensitivity using the cold air blast test following calculus removal (due to improper tooth brushing, scaling, and root planning), it was observed that root planning on sensitive dentin may lead to significant discomfort.

All patients underwent scaling and polishing, along with education on the modified Stillman technique. They were instructed to use desensitizing toothpaste and soft-bristle toothbrushes.

The initial therapy involved the use of fluoride varnishes, which resulted in a significant reduction in dentinal hypersensitivity and a gradual decrease after air stimulation at 2, 4, and 6 weeks. This can be explained by the mechanism of action of fluoride deposition on the tooth surface, leading to the formation of Fluor-apatite. Fluor-apatite has the ability to completely seal dental tubules and promote the formation of secondary dentin surfaces. It can also form stable crystals that are deposited deep inside the dentinal tubules. However, a single application of varnish may not effectively occlude the dentinal tubules and may require multiple applications, as the effects diminish from 2 to 6 weeks during tooth brushing.

Furthermore, fluoride varnish provides additional protection against tooth decay and treatment of dentine hypersensitivity when used in conjunction with brushing.

CONCLUSIONS

Based on the findings of this study, we conclude that all desensitizing agents are capable of reducing dentin hypersensitivity, with varying degrees of effectiveness showing a decrease in dentin hypersensitivity from the first to the second week.

Treatment for dentin hypersensitivity requires a thorough understanding of the condition's complexity and available treatment options.

Management of dental hypersensitivity should involve regular treatment, starting with at-home therapy and then complementing with additional treatments as needed.

Patients who undergo periodontal therapy are more prone to developing hypersensitivity due to gingival recession and exposed root surfaces resulting from the disease and its associated therapy. This exposes dentin tubules to the oral environment.

Reducing the frequency of consumption of acidic foods and drinks and, in some cases, modifying toothbrushing practices may also be advisable.

Patients should be encouraged to seek medical advice if the primary cause of tooth wear is environmental or medical.

However, it is evident that a single strategy may not be suitable for all patients.

REFERENCES

1. Addy M. Dentine hypersensitivity: Definition, prevalence distribution and aetiology. In: Addy M, Embery G, Edgar WM, Orchardson R, editors. Tooth wear and sensitivity: Clinical advances in restorative dentistry London: Martin Dunitz; 2000. p. 239-48
2. Addy M. Etiology and clinical implications of dentine hypersensitivity. Dent Clin North Amer 1990;34:503-14.
3. Trowbridge HO. Mechanism of pain induction in hypersensitive teeth. In: Rowe NH, editor. Hypersensitive dentine: Origin and management. Ann Arbor, USA: University of Michigan; 1985. p. 1-1
4. Gillam DG, Orchardson R. Advances in the treatment of root dentin sensitivity: Mechanisms and treatment principles. Endod Topics 2001;13:13-33
5. Clayton DR, McCarthy D, Gillam DG. A study of the prevalence and distribution of dentine sensitivity in a population of 17-58-year-old Serving personnel on an RAF base in the Midlands. J Oral Reha 2002;29:14-23.
6. Absi EG, Addy M, Adams D. Dentine hypersensitivity: A study of the patency of dentinal tubules in sensitive and non sensitive cervical dentine. J Clin Periodontol 1987;14:280-4.
7. Rimondini L, Baron C, Carrassi A. Ultrastructure of hypersensitive and non-sensitive dentine. J Clin Periodontol 1995;22:899-902.
8. Berman LH, Hargreaves KM. Cohen's Pathways of the Pulp: Cohen's Pathways of the Pulp - E-Book. Elsevier Health Sciences. 2020 Cap 1: 24-26.
9. Bleicher F. Experimental Cell Research:Odontoblast physiology. J Clin Diagn Res.2014;65-71
10. Song M, Yu B, Kim S, et al. Clinical and molecular perspectives of reparative dentin formation: Lessons learned from pulp-capping materials and the emerging roles of calcium. Dent Clin North Am. 2017;61:93–110.
11. Dou L, Yan Q, Yang D. Effect of five dental pulp capping agents on cell proliferation, viability, apoptosis and mineralization of human dental pulp cells. Exp Ther Med. 2020;19:2377–2383.
12. Jafarzadeh H, Abbott PV: Review of pulp sensibility tests. Part I: general information and thermal tests, Int Endod J. 2010; 43:738
13. Komabayashi T, Zhu Q, Eberhart R,et al. Current status of direct pulp-capping materials for permanent teeth. Dental Materials Journal.2016;35(1):27-30.
14. Berman LH, Hargreaves KM. Cohen's Pathways of the Pulp: Cohen's Pathways of the Pulp - E-Book. Elsevier Health Sciences. 2020 Cap 24: 928-929
15. Berman LH, Hargreaves KM. Cohen's Pathways of the Pulp: Cohen's Pathways of the Pulp - E-Book. Elsevier Health Sciences. 2020 Cap 12: 255-262.