Clinical, Cosmetic and Investigational Dentistry

Dovepress
Taylor & Francis Group

Open Access Full Text Article

ORIGINAL RESEARCH

Effectiveness of Diode Laser Treatment in Managing Dentin Hypersensitivity in Vietnamese Adults: A Six-Month Prospective Study

Hong Loi Nguyen, Nguyet Tu Ha Anh

Odonto-Stomatology Center, Hue Central Hospital, Hue, Vietnam

Correspondence: Hong Loi Nguyen, Odonto-Stomatology Center, Hue Central Hospital, 16 Le Loi Street, Hue, Vietnam, Tel +84913498549, Email drloivietnam@yahoo.com.vn

Background: Dentin hypersensitivity (DH) is a prevalent oral complaint that negatively affects patients' quality of life. Although various desensitising agents exist, their effect is often short-lived. Diode laser irradiation has been proposed as a minimally invasive alternative. This study aims to evaluate the short- and medium-term effectiveness and safety of 810-nm diode laser therapy for cervical DH in Vietnamese adults.

Materials and Methods: This prospective single-arm clinical study included 57 patients contributing 180 hypersensitive teeth with Smith and Knight tooth-wear scores of 1–2. Sensitive teeth were treated with an 810-nm diode laser at 0.5 W in continuous-wave mode using a standardized non-contact protocol. Pain intensity was assessed using a 10-cm visual analogue scale (VAS) at baseline, immediately after treatment, and at 1, 3, and 6 months. Baseline-to-follow-up comparisons were performed using paired analyses.

Results: Mean VAS scores decreased immediately after treatment and remained lower than baseline at all follow-up time points. The reduction was most pronounced at 3 months and remained clinically relevant at 6 months. Greater absolute reductions were observed in teeth with more severe baseline sensitivity. Patient satisfaction exceeded 90%, and no adverse effects were observed during follow-up.

Conclusion: Within the limitations of this single-arm study, 810-nm diode laser treatment was associated with immediate and sustained reduction in dentin hypersensitivity over 6 months. Randomized controlled studies with sham or active comparators are required to confirm efficacy.

Keywords: dentin hypersensitivity, diode laser, photobiomodulation, visual analogue scale

Introduction

Dentinal hypersensitivity is a common dental condition characterized by sharp, transient pain arising from exposed dentin in response to thermal, tactile, osmotic, or chemical stimuli.[1–4] The condition can negatively affect daily comfort, food selection, and oral hygiene practices, thereby impairing quality of life.[3] Current understanding of dentinal hypersensitivity is largely based on the hydrodynamic theory, according to which fluid movement within exposed dentinal tubules activates pulpal mechanoreceptors and produces pain. Exposure of dentinal tubules is most commonly related to enamel loss, cervical wear, abrasion, erosion, attrition, or gingival recession.[5,6]

Conventional management strategies include desensitizing toothpastes, topical fluoride, varnishes, sealants, and other tubule-occluding agents.[6–9] Although these approaches are widely used and may provide relief for many patients, their clinical effect may be variable, they often require repeated application or prolonged use, and symptom control is not always durable. These limitations have encouraged investigation of adjunctive or alternative chairside therapies for patients with persistent symptoms.[10]

Diode lasers, typically operating within the 800–980 nm range, have attracted interest in the management of dentinal hypersensitivity because of their minimally invasive application and their potential biological and thermal effects on exposed dentin and pulpal neural transmission.[11,12] Their photothermal effects can seal exposed dentinal tubules, thereby

https://doi.org/10.2147/CCIDE.S599840
Received: 17 February 2026
Accepted: 21 April 2026
Published: 30 April 2026

reducing sensitivity. Proposed mechanisms include reduction of dentinal fluid movement through tubule sealing, modulation of pulpal nerve activity, and stimulation of reparative dentin formation.[13,14] Previous studies have reported promising short-term and medium-term outcomes with diode laser therapy, but the available evidence remains heterogeneous with respect to wavelength, power settings, treatment protocols, comparator groups, and duration of follow-up.[5,15–18]

Despite growing international interest in laser-assisted treatment for dentinal hypersensitivity, prospective clinical data from Vietnamese routine practice settings remain limited. In addition, the lack of standardization across treatment protocols makes it valuable to report outcomes associated with specific diode laser settings used in real-world practice.

Therefore, the present study aimed to prospectively evaluate the short- and medium-term changes in dentinal hypersensitivity after a standardized 810-nm diode laser protocol in Vietnamese adults with cervical dentin wear. The null hypothesis was that diode laser treatment would not produce significant changes in VAS pain scores from baseline across the follow-up period.

Materials and Methods

Study Design

This prospective single-arm clinical study was conducted at the Odonto-Stomatology Center of Hue Central Hospital, Hue, Vietnam, to evaluate the short- and medium-term effectiveness of diode laser treatment for cervical dentin hypersensitivity in routine clinical practice. Participants were recruited by convenience sampling during the study period. The study first assessed cervical dentin wear and dentin hypersensitivity in 67 patients. Of these, 57 patients met the eligibility criteria for treatment evaluation, and 180 hypersensitive teeth from these 57 participants were included in the intervention analysis. Because hypersensitivity was assessed at the treated tooth, the primary treatment analysis was performed at the tooth level rather than at the patient level.

The exploratory single-arm design was chosen to document initial clinical outcomes associated with a standardized diode laser protocol in our setting before undertaking a controlled trial.

The study protocol was reviewed and approved by the Institutional Ethics Committee of Hue Central Hospital, Hue, Vietnam. At the time of approval, the committee documented approval in the institutional review record but did not assign a separate reference number for this study. Written informed consent was obtained from all participants before enrollment. All procedures were performed in accordance with the ethical principles of the Declaration of Helsinki.

Participants

Eligible teeth had cervical dentin wear of grades 1–2, clinical dentin hypersensitivity, and no indication for restorative treatment. Patients with acute medical conditions, pregnancy, use of analgesics, anti-inflammatory agents, or sedatives within 72 hours, history of tooth whitening within the previous 6 months, and endodontically treated or restored teeth were excluded. Teeth with pulp disease, periapical disease, or periodontal disease were also excluded from treatment evaluation.

No formal a priori sample size calculation was performed because this was an exploratory prospective clinical study using convenience sampling.

Intervention

Laser treatment was delivered using an 810-nm diode laser at an output power of 0.5 W in continuous-wave mode. The irradiation protocol consisted of 10 seconds of exposure followed by 10 seconds of rest, with the laser tip positioned approximately 1 mm from the tooth surface. After isolation and cleaning with pumice, the exposed dentin was irradiated using a sweeping non-contact motion to ensure uniform coverage of the sensitive cervical area.

Additional parameters such as spot size and energy density were not available in the archived clinical protocol and therefore could not be calculated reliably for retrospective reporting.

Outcome Measures

The primary outcome measure was change in pain intensity assessed using a visual analogue scale (VAS) from 0 (no pain) to 10 (severe pain). Secondary outcomes included patient-reported satisfaction and any adverse effects observed during or after treatment.

Data Collection and Analysis

Pain intensity was assessed using the visual analogue scale (VAS) at baseline (T0), immediately after treatment (T1), and at 1 month (T2), 3 months (T3), and 6 months (T4). Continuous variables were presented as mean ± standard deviation, whereas categorical variables were summarized as frequencies and percentages. Changes in mean VAS scores over time were analyzed using repeated-measures analysis of variance (repeated-measures ANOVA). When the overall time effect was significant, post hoc pairwise comparisons between baseline and each follow-up time point were performed with Bonferroni adjustment. Subgroup analyses according to baseline pain severity (mild, moderate, and severe) were conducted using the same repeated-measures approach. A two-sided p value < 0.05 was considered statistically significant.

Results

Baseline Characteristics of Patients

A total of 67 patients with cervical dentin wear were initially assessed. After eligibility assessment, 57 patients (30 females and 27 males) were included in the treatment evaluation and contributed 180 hypersensitive teeth to the treatment analysis. Cervical dentin hypersensitivity was present in 86.6% of evaluated teeth, whereas 13.4% showed no sensitivity. According to the Smith and Knight classification, score 2 was the most frequent level of cervical wear (42.1%), followed by score 3 (28.2%), score 1 (27.4%), and score 4 (2.3%) (Table 1).

Before treatment, moderate sensitivity was the most common VAS category (50.4%), followed by mild (25.4%) and severe sensitivity (24.2%) (Table 2). Cold stimulus was the most frequent trigger for dentin hypersensitivity (74.6%), followed by air stimulation (62.7%) and hard food (10.4%) (Figure 1).

Table 1 Frequency of Cervical Dentin Wear Classified Smith and Knight (n = 340 Teeth)

Smith and Knight Score								Total	
Score 1		Score 2		Score 3		Score 4			
n	%	n	%	n	%	n	%	n	%
93	27.4	143	42.1	96	28.2	8	2.3	340	100

Table 2 Distribution of VAS Sensitivity Levels by Age (n = 256 Teeth)

Age	Mild		Moderate		Severe		Total	
	n	%	N	%	n	%	n	%
30–39	0	0	10	3.9	0	0	10	3.9
40–49	2	0.8	10	3.9	3	1.2	15	5.9
≥ 50	63	24.6	109	42.6	59	23	231	90.2
Total	65	25.4	129	50.4	62	24.2	256	100
p-value	p <0.015							

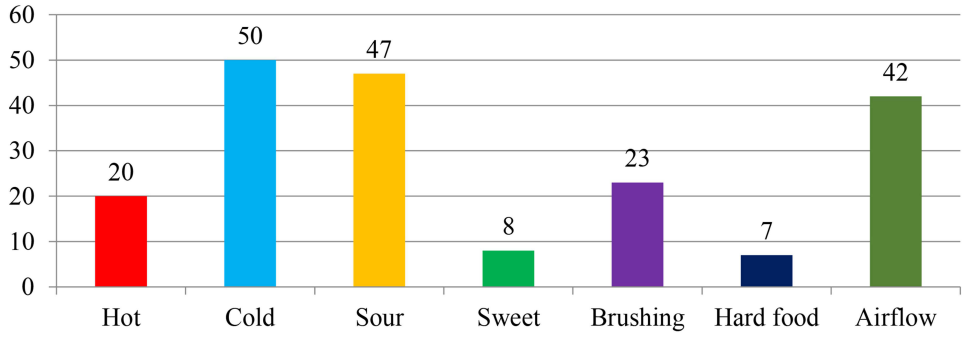

Figure 1 Frequency of triggering stimuli for dentin hypersensitivity.

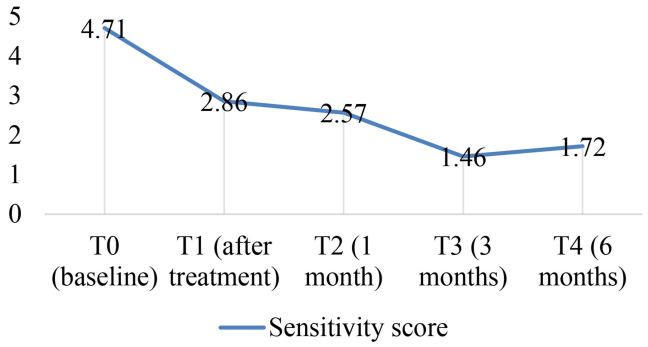

Figure 2 Average dentin hypersensitivity levels over the study period according to VAS score.

Reduction in Pain Sensitivity

Mean VAS scores decreased immediately after diode laser treatment and remained lower than baseline throughout follow-up. The average VAS score fell from 4.71 ± 1.89 at baseline to 2.86 ± 1.54 immediately after treatment, corresponding to a 39.5% reduction. The reduction was maintained at 1 month (2.57 ± 1.46; 45.4% reduction), became most pronounced at 3 months (1.46 ± 1.03; 69.0% reduction), and remained clinically improved at 6 months (1.72 ± 1.15; 63.5% reduction) (Figure 2).

When stratified by baseline sensitivity level, larger absolute reductions were observed in teeth with more severe baseline pain. Immediately after treatment, the mean reduction in VAS was 0.46 in the mild group, 1.67 in the moderate group, and 3.28 in the severe group (Table 3). At 1 month, the corresponding reductions were 0.95, 1.79, and 3.72, respectively (Table 4). At 3 months, reductions further increased to 1.26, 2.93, and 5.38 (Table 5). At 6 months, the effect remained substantial, with reductions of 0.97, 2.71, and 5.06 in the mild, moderate, and severe groups, respectively (Table 6). Across all evaluated time points, the reductions from baseline were statistically significant (all $p < 0.001$).

Table 3 Treatment Results Immediately After Treatment According to VAS Score

VAS Score Level of Pain	Pre-Treatment	Post-Treatment	Change After Treatment	p-value
Mild	1.56 ± 0.60	1.10 ± 0.38	0.46 ± 0.60	< 0.001
Moderate	4.52 ± 0.58	2.85 ± 0.61	1.67 ± 0.76	< 0.001
Severe	7.52 ± 0.54	4.24 ± 0.77	3.28 ± 1.01	< 0.001

https://doi.org/10.2147/CCIDE.S599840

Table 4 Treatment Results One Month Post-Treatment According to VAS Score

VAS Score Level of Pain	Pre-Treatment	Post-Treatment	Change After Treatment	p-value
Mild	1.56 ± 0.60	0.62 ± 0.54	0.95 ± 0.69	< 0.001
Moderate	4.52 ± 0.58	2.73 ± 0.58	1.79 ± 0.80	< 0.001
Severe	7.52 ± 0.54	3.8 ± 0.76	3.72 ± 0.83	< 0.001

Table 5 Treatment Results at 3 Months According to VAS Score

VAS Score Level of Pain	Pre-Treatment	Post-Treatment	Change After Treatment	p-value
Mild	1.56 ± 0.60	0.31 ± 0.47	1.26 ± 0.60	< 0.001
Moderate	4.52 ± 0.58	1.58 ± 0.92	2.93 ± 1.07	< 0.001
Severe	7.52 ± 0.54	2.14 ± 0.90	5.38 ± 1.11	< 0.001

Table 6 Treatment Results at 6 Months According to VAS Score

VAS Score Level of Pain	Pre-Treatment	Post-Treatment	Change After Treatment	p-value
Mild	1.56 ± 0.60	0.59 ± 0.50	0.97 ± 0.67	< 0.001
Moderate	4.52 ± 0.58	1.80 ± 0.97	2.71 ± 1.12	< 0.001
Severe	7.52 ± 0.54	2.46 ± 0.93	5.06 ± 1.15	< 0.001

Patient Satisfaction

Over 90% of participants reported high levels of satisfaction with the treatment, citing immediate relief and sustained reduction in sensitivity as key benefits. No significant discomfort or adverse effects were reported during or after the procedure.

Adverse Effects

No adverse effects, such as burns or tissue damage, were observed throughout the study period, underscoring the safety of the diode laser treatment protocol.

Discussion

In this prospective single-arm clinical study, diode laser treatment was associated with an immediate reduction in dentinal hypersensitivity, and the improvement was maintained throughout the 6-month follow-up period. Mean VAS scores decreased substantially immediately after treatment, continued to improve at 1 and 3 months, and remained clearly lower than baseline at 6 months. A slightly higher mean VAS score at 6 months compared with 3 months suggests some attenuation of the treatment effect over time, but overall symptom reduction remained clinically relevant.

The majority of evaluated teeth with cervical wear were sensitive, and moderate sensitivity represented the most frequent baseline category. Cold stimulation was the most common trigger, which is consistent with the clinical profile described in previous studies of dentinal hypersensitivity.[19–22] The predominance of Smith and Knight grades 1 and 2 in our cohort indicates that many treated teeth had mild-to-moderate cervical wear, a pattern similar to that reported in earlier observational studies.[23–25]

Our findings also suggest that teeth with greater baseline pain experienced larger absolute reductions in VAS score after treatment. This pattern may reflect a greater margin for measurable clinical improvement in severely sensitive teeth, although the absence of a comparator group prevents conclusions about differential efficacy across severity strata. The observed symptom reduction may be explained by several mechanisms proposed in the literature, including partial sealing of exposed dentinal tubules, modulation of nerve transmission, and stimulation of tertiary dentin formation.[21,26–28]

Importantly, the results of the present study should be interpreted with caution because there was no sham-treated or active control group. Accordingly, the observed reduction in pain cannot be attributed exclusively to the diode laser intervention. Placebo response, regression to the mean, behavioral changes after treatment, repeated testing effects, and spontaneous fluctuation in symptoms may also have contributed to the improvement. For this reason, our findings should be viewed as preliminary clinical evidence of an association between diode laser treatment and reduced hypersensitivity rather than definitive proof of efficacy.

We have therefore revised the interpretation of our findings to avoid unsupported comparisons with conventional therapies. Although prior publications have suggested that diode laser therapy may provide rapid symptom relief and sustained improvement in some patients, our study did not include a direct comparator such as fluoride varnish, desensitizing paste, or sham irradiation. No comparative conclusion can therefore be drawn from the present data alone.[5,10,15–18,27–29]

The high level of patient satisfaction and the absence of observed adverse effects support the feasibility and safety of this chairside protocol in routine clinical practice. These findings are clinically relevant because dentinal hypersensitivity is frequently chronic, bothersome, and difficult to manage consistently with home-use products alone. At the same time, patient-reported satisfaction in an uncontrolled study may itself be influenced by expectation and treatment context, and should therefore be interpreted conservatively.

Several limitations should be acknowledged. First, this was an exploratory study based on convenience sampling, and no formal sample size calculation was performed. Second, the analysis was conducted at the tooth level, and because some participants contributed multiple teeth, within-patient clustering was not fully accounted for. Third, although repeated-measures ANOVA was used to assess changes in VAS scores across follow-up time points, more advanced mixed-effects longitudinal models would provide a more robust analytical framework in future studies. Fourth, key technical parameters such as spot size and energy density were not available for retrospective reporting. Fifth, the 6-month follow-up period does not allow conclusions regarding long-term durability. Finally, demographic data were limited, and the study was not designed for subgroup analysis by sex.

Despite these limitations, the study adds prospective follow-up data from a Vietnamese clinical setting and describes outcomes associated with a clearly reported 810-nm diode laser protocol used in daily practice. These findings may help inform the design of future randomized controlled trials with sham or active comparators, longer follow-up, and more rigorous statistical modeling.

Conclusion

Within the limitations of this prospective single-arm study, a single session of 810-nm diode laser treatment was associated with immediate and sustained reduction in dentinal hypersensitivity over 6 months, together with high patient satisfaction and no observed adverse effects. The findings support the potential role of diode laser therapy as a chairside management option for selected patients with cervical dentin hypersensitivity. However, randomized controlled trials with sham or active comparator groups are needed before definitive conclusions regarding efficacy can be made.

Data Sharing Statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Funding

No funding.

Disclosure

The authors declare no conflicts of interest in this work.

References

1. Parlar Oz O, Karagozoglu I, Kocer I, Demirkol N, Zer Y. The effect of laser therapy for the treatment of dentin hypersensitivity on surface roughness and bacterial adhesion. *Lasers Med Sci*. 2024;39(1):212. doi:10.1007/s10103-024-04166-0
2. Santos PS, Vitali FC, Fonseca-Souza G, et al. Dentin hypersensitivity and toothache among patients diagnosed with Molar-Incisor Hypomineralization: a systematic review and meta-analysis. *J Dent*. 2024;145:104981. doi:10.1016/j.jdent.2024.104981
3. Taques Neto L, Lopez LZ, Dalmolin AC, Pochapski MT, Bortoluzzi MC, Santos FA. Dentin hypersensitivity and quality of life in patients with chronic systemic disease. *Community Dent Health*. 2024;41(4):265–271. doi:10.1922/CDH_00146Santos07
4. West NX, Lussi A, Seong J, Hellwig E. Dentin hypersensitivity: pain mechanisms and aetiology of exposed cervical dentin. *Clin Oral Investig*. 2013;17(Suppl 1):S9–19. doi:10.1007/s00784-012-0887-x
5. Pion LA, Matos LLM, Gimenez T, Palma-Dibb RG, Faraoni JJ. Treatment outcome for dentin hypersensitivity with laser therapy: systematic review and meta-analysis. *Dent Med Probl*. 2023;60(1):153–166. doi:10.17219/dmp/151482
6. Davari A, Ataei E, Assarzadeh H. Dentin hypersensitivity: etiology, diagnosis and treatment; a literature review. *J Dent*. 2013;14(3):136–145.
7. Ramli R, Ghani N, Taib H, Mat-Baharin NH. Successful management of dentin hypersensitivity: a narrative review. *Dent Med Probl*. 2022;59 (3):451–460. doi:10.17219/dmp/143354
8. Liu XX, Tenenbaum HC, Wilder RS, Quock R, Hewlett ER, Ren YF. Pathogenesis, diagnosis and management of dentin hypersensitivity: an evidence-based overview for dental practitioners. *BMC Oral Health*. 2020;20(1):220. doi:10.1186/s12903-020-01199-z
9. Felix J, Ouanounou A. Dentin hypersensitivity: etiology, diagnosis, and management. *Compend Contin Educ Dent*. 2019;40(10):653–657; quiz 658.
10. Mahdian M, Behboodi S, Ogata Y, Natto ZS. Laser therapy for dentinal hypersensitivity. *Cochrane Database Syst Rev*. 2021;7(7):CD009434. doi:10.1002/14651858.CD009434.pub2
11. Parker S, Cronshaw M, Grootveld M, et al. The influence of delivery power losses and full operating parametry on the effectiveness of diode visible-near infra-red (445–1064 nm) laser therapy in dentistry-a multi-centre investigation. *Lasers Med Sci*. 2022;37(4):2249–2257. doi:10.1007/s10103-021-03491-y
12. Seraj B, Ghadimi S, Hakimiha N, Kharazifard MJ, Hosseini Z. Assessment of photobiomodulation therapy by an 8l0-nm diode laser on the reversal of soft tissue local anesthesia in pediatric dentistry: a preliminary randomized clinical trial. *Lasers Med Sci*. 2020;35(2):465–471. doi:10.1007/s10103-019-02850-0
13. Lalli AK, Dhingra S, Lalli AS, Kaur G, Gupta H, Goyal S. Clinical evaluation of diode laser as an adjunct to scaling and root planing in patients with chronic periodontitis and type II diabetes mellitus: a split-mouth study. *Cureus*. 2024;16(2):e54178. doi:10.7759/cureus.54178
14. Rafi S, Budania A, Bhardwaj A, et al. Efficacy and safety of diode laser for facial hair reduction in hirsutism-a clinico-trichoscopic evaluation. *J Cutan Aesthet Surg*. 2024;17(1):19–24. doi:10.4103/JCAS.JCAS_63_23
15. Naghsh N, Hosseini A, Bazmara A, Birang R. Evaluation of three methods for the treatment of dentin hypersensitivity: a randomised clinical trial. *Int Dental J*. 2024;74(5):1016–1023. doi:10.1016/j.identj.2024.03.013
16. Nambiar M, Shetty B, Fazal I, et al. Effectiveness of two wavelengths of diode laser and amorphous calcium phosphate-casein phosphopeptide mousse in the treatment of dentinal hypersensitivity: a randomized clinical study. *Int J Dent*. 2024;2024:1257136. doi:10.1155/ijod/1257136
17. El Mobadder M, Namour A, Namour M, et al. Dentinal hypersensitivity treatment using diode laser 980 nm: in vivo study. *Dent J*. 2019;7(1):5. doi:10.3390/dj7010005
18. Penmetsa G, Vundavalli S, Anusha B, et al. Treatment of dentinal hypersensitivity with diode laser of two different wavelengths - a randomised clinical trial. *J Clin Diagn Res*. 2023;17:ZC25–ZC28. doi:10.7860/JCDR/2023/59983.18073
19. Dhaliwal JS, Palwankar P, Khinda PK, Sodhi SK. Prevalence of dentine hypersensitivity: a cross-sectional study in rural Punjabi Indians. *J Indian Soc Periodontol*. 2012;16(3):426–429. doi:10.4103/0972-124X.100924
20. Naidu GM, Ram KC, Sirisha NR, et al. Prevalence of dentin hypersensitivity and related factors among adult patients visiting a dental school in Andhra Pradesh, southern India. *J Clin Diagn Res*. 2014;8(9):ZC48–51. doi:10.7860/JCDR/2014/9033.4859
21. Umana M, Heysselaer D, Tielemans M, Compere P, Zeinoun T, Nammour S. Dentinal tubules sealing by means of diode lasers (810 and 980 nm): a preliminary in vitro study. *Photomed Laser Surg*. 2013;31(7):307–314. doi:10.1089/pho.2012.3443
22. Zhang Y, Cheng R, Cheng G, Zhang X. Prevalence of dentine hypersensitivity in Chinese rural adults with dental fluorosis. *J Oral Rehabil*. 2014;41 (4):289–295. doi:10.1111/joor.12145
23. Smith BG, Knight JK. An index for measuring the wear of teeth. *Br Dent J*. 1984;156(12):435–438. doi:10.1038/sj.bdj.4805394
24. Borcic J, Anic I, Urek MM, Ferreri S. The prevalence of non-carious cervical lesions in permanent dentition. *J Oral Rehabil*. 2004;31(2):117–123. doi:10.1046/j.0305-182x.2003.01223.x
25. Orchardson R, Gillam DG. Managing dentin hypersensitivity. *J Am Dent Assoc*. 2006;137(7):990–998; quiz 1028–1029. doi:10.14219/jada.archive.2006.0321
26. Rezazadeh F, Dehghanian P, Jafarpour D. Laser effects on the prevention and treatment of dentinal hypersensitivity: a systematic review. *J Lasers Med Sci*. 2019;10(1):1–11. doi:10.15171/jlms.2019.01
27. Jain A, Rao J, Pal N, Singh A. Effectiveness of fluoride varnish, diode laser, and their combination in treatment of dentin hypersensitivity: a randomized split-mouth clinical trial. *J Indian Soc Periodontol*. 2020;24(4):369–374. doi:10.4103/jisp.jisp_494_19
28. Pantuzzo ES, Cunha FA, Abreu LG, Esteves Lima RP. Effectiveness of diode laser and fluoride on dentin hypersensitivity treatment: a randomized single-blinded clinical trial. *J Indian Soc Periodontol*. 2020;24(3):259–263. doi:10.4103/jisp.jisp_478_19
29. Mohammadian M, Jalouti N, Yazdanian M, Keykha E, Hajisadeghi S. Comparison of the effectiveness of diode laser, fluoride varnish, and their combination in treatment of dentin hypersensitivity: a systematic review of randomized clinical trials. *Front Oral Health*. 2025;6:1550127. doi:10.3389/froh.2025.1550127