# Clinical effectiveness of dentin sealer in treating dental root sensitivity following periodontal surgery

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***Key words:*** *dental root sensitivity, periodontal surgery, dentin sealer, desensitizing agents.*

***Summary.*** *Objective. The aim of this study was to evaluate the effectiveness of a commercially available light-cured, resin-based dentin sealer in the treatment of postoperative sensitivity of roots with gingival recession of different extent.*

*Materials and methods. The study was a case control, randomized, blind design. A total of 62 patients with the presence of chronic periodontitis, who required periodontal surgery, participated in this study. All recipients underwent flap operation. After the periodontal surgery 641 teeth were selected for the study. The pain intensity was determined by using visual analogue scale (VAS). The extent of gingival recession was measured using William's periodontal probe.*

*After recording the initial baseline VAS scores, the patients were randomly divided into two groups according to the materials used in the study. The resin-based dentin sealer in the test group was applied following the manufacture's recommendations. Water was used in the control (placebo) group. Hypersensitivity measurements on VAS were repeated 5 minutes, 7 and 30 days after the application of the materials.*

*Results. It was observed that the efficacy of the desensitizing material differed from placebo. The dentin sealer effectively reduced the root sensitivity. The statistically significant ($p<0.001$) decrease in the intensity of root sensitivity after the application of materials was noted in test and control groups. However, the difference in the reduction of pain intensity between the groups was significant and remained such throughout the study period. The root sensitivity on the day 7 and 30 in both groups showed little change compared to the measurements made right after the application of the materials. No significant difference in measurements of pain intensity in the presence of different extent of gingival recession was noted in none of the groups.*

*Conclusion. The results of the study showed that dentin sealer used provided quick and effective reduction in root sensitivity after the surgery and its desensitizing effect lasted beyond 30 days.*

## Introduction

Management of chronic adult periodontitis includes removing of periodontal pockets, scaling, and root planning. This can result in gingival recession, root and dentinal tubules exposure which are directly related to root sensitivity (RS). Pain, arising from exposed root surface, is the most common complaint mentioned by the patients following periodontal treatment, although investigations devoted to the prevalence of RS are rather limited (1, 2). In one of them it has been estimated that RS occurs in half of the patients following subgingival scaling (3). Despite of high prevalence of RS and its clinical significance the cause of this painful condition in teeth with periodontal pathology is still unknown.

It is suggested that the occurrence of sensitivity on denuded root surfaces following periodontal therapy may be a condition distinct from dentine hypersensitivity occurring after hydrodynamic stimulation because of bacterial penetration into dentinal tubules (4–6). Open dentinal tubules are the prime factor that determines occurrence of RS as well as dentine sensitivity (7, 8). Therefore, the main purpose in treating such a clinical condition is to plug the dentinal tubules preventing bacterium invasion and/or fluid flow within tubules (9, 10). Though many treatment methods have been proposed, no universally accepted or highly reliable desensitizing agent or treatment has been identified. The latest generations of adhesives as well as dentin sealers containing methyl methacrylate are hydrophilic and provide better retention of material on dental surface (11). No published studies on the effec-

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tiveness of these materials with fluorides and triclosan in reducing RS following periodontal surgery can be found. This is the reason for selecting dentin sealer as a key agent for this investigation. The purpose of this study was to evaluate the effectiveness of a commercially available light-cured, resin-based dentin sealer in the treatment of postoperative sensitivity of roots with gingival recession of different extent.

**Materials and methods**

The study was a case control, randomized, blind design. The research protocol and informed consent form were approved by the Committee on Bioethics of the Kaunas University of Medicine (protocol number 9/2003).

Patients between 30 and 50 years of age in general good health and with the presence of chronic periodontitis, who required periodontal surgery, were selected at the Department of Dental and Oral Diseases of Kaunas University of Medicine Hospital, Lithuania. Medical histories of the candidates were screened and full oral examination was conducted. All patients received detailed particulars (verbal and written) of the principle of treatment and the purpose of the study and signed appropriate informed consent forms. The professional hygiene procedures and surgical treatment were performed using the same protocol. Three days after flap operation each subject suitable for entry into the study had at least two teeth, from which a painful response was elicited by the first airflow from the air syringe of the dental unit. An air-blast was directed to the root surface for two seconds. The adjacent teeth were protected by the dentist's fingers. Subjects were asked to grade the sensitivity using a visual analogue scale (VAS) labeled ''no pain'' at the zero end and the 100 mm end was marked ''unbearable pain''. A pain score was recorded by measuring the distance between the zero point and the mark in millimeters. Teeth with caries, large or cervical restorations, previous endodontic treatment, enamel cracks, attrition or abrasion defects, nonvital dental pulp and abutment teeth were not included into the study. Presence and extent of gingival recession for teeth with root sensitivity was measured using a William's periodontal probe.

After recording the baseline RS scores, the patients were randomly divided into two groups according to the agents used in the study. The commercially available resin-based dentin sealer in the test group was applied following the manufacture's recommendations. Water was used in the control (placebo) group. Five minutes, 7 and 30 days after the application of the above-mentioned materials the sensitivity tests were repeated as described previously.

The patients were instructed to maintain the same eating and oral hygiene habits.

*Statistical analysis.* Data of the study were processed using SPSS/w 12 (Statistical Package for Social Science) software. Data were analyzed by descriptive statistics with frequency distribution and cross tabs calculation. Student's test was used for comparison of means. Kolmogorov–Smirnov test was performed in order to assess the normality of distribution. The hypotheses were considered statistically significant at the level of $p<0.05$, very significant at the level of $p<0.01$ and especially significant at the level of $p<0.001$.

**Results**

A total of 67 subjects entered the study, out of them 62 (27 male and 35 female) completed all the examination. Four patients in placebo group and one patient in test group withdrew from the study for unknown reasons.

The mean (±standard deviation (SD)) age of the selected patients was 43.23±4.50 with a range of 33 to 50 years. A histogram showing the distribution of individuals with RS according to the age is given in Fig. 1. A significant difference between mean age of patients in placebo group (42.48±5.05 years) and test group (43.56±4.20 years) was not found.

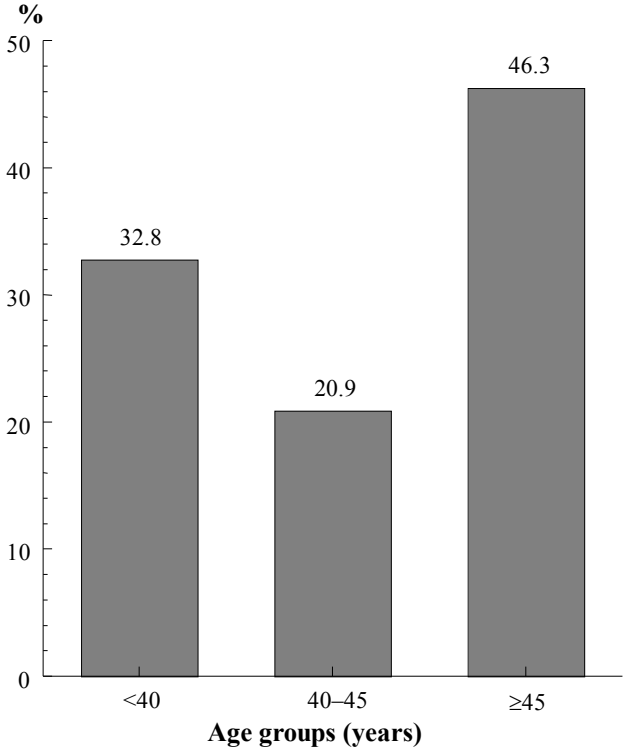


***Fig. 1.*** **The distribution of individuals with hypersensitive teeth according to the age**

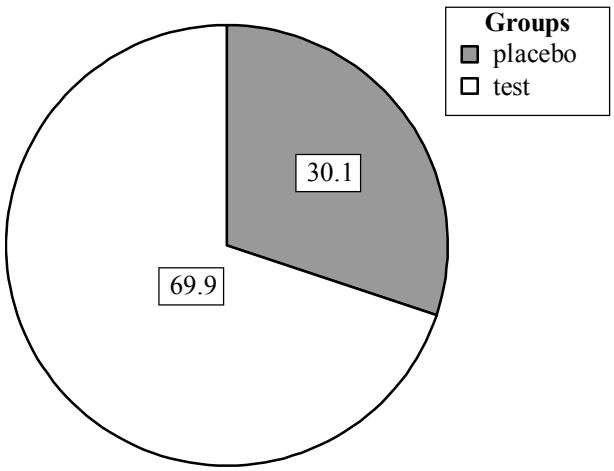


***Fig. 2.*** **Percentage of teeth responding to test stimuli in placebo and test groups**

Of the 641 teeth studied, 193 were in placebo and 448 in test group. Fig. 2 demonstrates the percentage of teeth, which responded to test stimuli in each study group.

Three days after periodontal surgery the mean baseline intensity of RS (VAS 0) in placebo group (42.80±8.18) and in test group (42.72±5.76) was high and the difference in the sensitivity level between the groups was not statistically significant. The mean VAS scores for groups at different study time are shown in Table 1.

Five minutes after application of the materials the RS scores (VAS 1) in both groups decreased significantly ($p<0.001$) when compared to the baseline measurements (VAS 0). However, few times greater reduction of RS was seen in the test group. Also, the similar difference in VAS scores between study groups remained during all study time.

The pain level on the day 7 (VAS 2) slightly increased in both groups, but no significant difference of RS, comparing VAS 1 and VAS 2 measurements, in placebo group as well as in test group was found. On the day 30 the VAS scores (VAS 3) slightly increased in test group and, contrarily, slightly decreased in placebo group. The mean VAS 3 scores significantly ($p<0.001$) differ from the mean VAS 2 scores in both groups.

When comparing the results obtained at the end of the study with those of the baseline, a decrease in RS can be observed in both groups but in the test group it was much greater than in placebo one (Table 1).

All the teeth in this study that exhibited RS also had some degree of gingival recession. The means±SD for the VAS scores of two groups at a different degree of gingival recession are shown in Table 2. The differences in VAS scores among all gingival recession groups were not significant in the test group as well as in the placebo group. Though, higher root sensitivity at all time points in both groups was observed in the presence of 2 mm gingival recession and the lowest – in the presence of 5 mm and 6 mm gingival recessions. The mean VAS 1, VAS 2 and VAS 3 scores associated with different extent of gingival recession in the test group statistically significantly differed from the placebo group.

**Discussion**

Though all the materials used nowadays for curing root sensitivity to greater or lesser extent provide certain desensitizing effect, none of them guarantees absolute pain relief. Most of self-care products, such as mouthwashes, toothpastes, gels containing potassium, strontium, fluoride salts can occlude dentinal tubules or make direct impact on nerve endings of dental pulp, thus obstructing the generation of nerve impulse (12–16). The results of earlier studies have shown that the desensitizing effect of self-care products tends to manifest itself after several days, weeks, or months of regular use (12, 13), and their desensitizing effect might be quickly reduced by the use of acid containing food and beverages (17), as well as due to dental hygiene (18). The direct application of

***Table 1.*** **The mean VAS scores of each treatment group at baseline (VAS 0), 5 min (VAS 1), day 7 (VAS 2) and day 30 (VAS 3) after application of materials**

| Group | VAS 0 mean±SD | VAS 1 mean±SD | VAS 2 mean±SD | VAS 3 mean±SD |
|---|---|---|---|---|
| Placebo | 42.80±8.18 | 36.30±8.01 | 37.33±7.60 | 35.63±7.91 |
| Test | 42.72±5.76 | 16.22±5.40* | 16.27±5.74* | 18.08±5.55* |

SD – standard deviation; VAS – visual analogue scale.

* – a statistically significant difference as compared to placebo group.

***Table 2.*** **The mean VAS scores associated with different extent of gingival recession at baseline (VAS 0), 5 min (VAS 1), day 7 (VAS 2) and day 30 (VAS 3) after application of materials**

| Gingival recession | 2 mm | | 3 mm | | 4 mm | | 5 mm | | 6 mm | |
|---|---|---|---|---|---|---|---|---|---|---|
| Group | placebo mean±SD | test mean±SD | placebo mean±SD | test mean±SD | placebo mean±SD | test mean±SD | placebo mean±SD | test mean±SD | placebo mean±SD | test mean±SD |
| VAS 0 | 46.42±18.84 | 42.78±13.35 | 44.38±7.56 | 44.56±6.35 | 42.60±6.43 | 42.43±4.72 | 40.10±6.89 | 42.16±5.79 | 44.67±10.01 | 42.02±5.63 |
| VAS 1 | 39.67±17.03 | 27.33±11.05* | 37.85±7.13 | 18.72±6.30* | 36.24±6.86 | 15.69±4.60* | 33.51±6.59 | 15.18±4.36* | 36.33±12.85 | 14.19±3.33* |
| VAS 2 | 43.00±14.91 | 25.33±7.75* | 38.62±7.87 | 19.29±6.51* | 37.10±5.70 | 15.51±4.91* | 34.28±6.78 | 15.48±5.15* | 41.00±10.44 | 14.05±4.74* |
| VAS 3 | 42.92±18.85 | 23.33±8.90* | 36.43±6.58 | 21.30±6.37* | 35.47±5.78 | 17.48±4.80* | 32.59±6.61 | 17.16±4.98* | 38.67±13.31 | 15.88±4.46* |

SD – standard deviation; VAS – visual analogue scale.
* – a statistically significant difference as compared to placebo group.

desensitizing materials on a bare dental surface insures faster RS reduction (19–23). For years varnishes containing NaF and $CaF_2$ have been most often used products for this purpose. However, the adhesion of these materials to the surface of the tooth is not strong and they can be readily wiped off of the dental surface by any external mechanical factor. It has been found that resin-based, light-cured, hydrophilic adhesives can penetrate to certain depth of dentinal tubules and make a strong bond with collagen present there (11).

The results of I. Duran and A. Sengun study (21) show that resin-based desensitizing materials decreased the intensity of cervical dentin sensitivity right after their application as well as three months later. Moreover, a number of authors indicate that these substances are also effective in reducing radicular sensitivity (24, 25).

The analysis of the results of the study has demonstrated that high VAS scores found on the third day of periodontal surgery had been reduced almost by half immediately after the application of the desensitizing material and the achieved RS level had remained throughout all the study. However, after the application of placebo, a slight decrease in VAS scores has been noted in all the stages of the study. According to H. O. Trowbridge and D. R. Silver, the "placebo effect" results from physiological and psychological interactions (26). On the other hand, it is generally accepted that teeth sensitivity may decrease with time due to the natural occlusion of tubules. In our study the dentinal tubules of teeth in the test group were to greater or lesser extent occluded with desensitizing material that is why these processes could influence only results of the placebo group.

Our study has not established any dependency between root sensitivity and extent of gingival recession. Thus, it seems that pain-related factors other than the extent of gingival recession could have influenced the changes in sensitivity. Lower root sensitivity in the presence of 5 and 6 mm gingival recessions can be explained by long-standing periodontal pathology, attachment loss, and bacterial invasion into open dentinal tubules. Following chronic periodontal diseases the bacteria and the low molecular size irritants, such as bacterial toxins, can penetrate into the tubules (6) and cause evident morphological changes in nerve endings of the dental pulp (27). These alterations can be significantly related to decreased RS. And on the contrary, the higher RS with lesser gingival recession could have been related to lesser damage of dental pulp. It seems that the application of dentin sealers may successfully prevent the penetration of microorganisms and their products during blocking of tubules

and prolong vitality of teeth.

It is often assumed that hypersensitive teeth have normal pulps, but there is very little information on this in literature, and this is an area where future research is necessary.

**Conclusions**

This study has demonstrated that:

1. The commercially available resin-based dentin sealer effectively reduces the pain associated with root sensitivity following periodontal surgery.

2. The reduction in sensitivity in teeth treated with desensitizing material at the same level lasted for the study period of 30 days.

3. The extent of gingival recession had no significant influence on the postsurgical root sensitivity.

4. Resin-based dentin sealer can be used successfully in treating postsurgical root sensitivity.

## Klinikinis dentino silerio veiksmingumas esant padidėjusiam dantų šaknų jautrumui po periodonto chirurginio gydymo

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**Raktažodžiai:** dantų šaknų jautrumas, periodonto gydymas, dentino sileriai, jautrumą mažinančios medžiagos.

**Santrauka**. *Darbo tikslas*. Nustatyti *in vivo* dentino silerio veiksmingumą, gydant pooperacinį dantų šaknų jautrumą, esant skirtingam dantenų recesijos dydžiui.

*Medžiaga ir metodai*. Tyrime dalyvavo 62 lėtiniu periodontitu sergantys pacientai, kuriems buvo reikalingas chirurginis gydymas. Po lopo operacijos aklam atvejo ir kontrolės tyrimui atrinktas 641 jautrus dantis ir, naudojant vizualinę analogų skalę (angl. *VAS – Visual Analogue Scale*), nustatytas skausmo intensyvumas. Dantenų recesija matuota William periodontiniu zondu.

Nustačius pradinį dantų jautrumo intensyvumą, atsitiktinumo principu pagrįstais metodais tiriamieji suskirstyti į dvi grupes. Poveikio grupei priskirti dantys buvo padengti dervų pagrindo jautrumą mažinančiąja medžiaga – dentino sileriu. Kontrolinės (placebo) grupės dantims naudotas vanduo.

Dantų jautrumas matuotas trečią dieną po operacijos 5 minutės prieš danties šaknies padengimą dentino sileriu ir iškart po procedūros. Jautrumo matavimai kartoti po septynių ir 30 dienų.

*Rezultatai*. Po operacijos dantų šaknų didelis jautrumas, po padengimo jautrumą mažinančiąja medžiaga, statistiškai reikšmingai ($p<0,001$) sumažėjo poveikio ir kontrolinėje grupėse. Tačiau skausmo intensyvumo sumažėjimo skirtumas pagal VAS tarp grupių buvo didelis ir išliko per visą tyrimo laikotarpį. Septintą ir 30 tyrimo dieną dantų šaknų jautrumas poveikio ir kontrolinėje grupėse mažai skyrėsi nuo matuoto iškart po dantų padengimo jautrumą mažinančiąja medžiaga. Kiekvieno tyrimo etapu skausmo intensyvumo matavimai, esant skirtingam dantenų recesijos dydžiui, statistiškai reikšmingai nesiskyrė nė vienoje tyrimo grupėje.

*Išvados*. Nustatyta, kad tyrime naudotas dentino sileris greitai ir veiksmingai sumažino danties šaknies jautrumą po operacijos ir jo jautrumą mažinantis poveikis išliko ir po 30 dienų.

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