Er:YAG Laser and Desensitizing Effects on Dentin and Dental Cervices

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Purpose: The aim of this clinical study is to compare the desensitizing effects on dentin and dental cervices of different desensitizing gels or liquids with the use of Er:YAG laser.

Materials and Methods: In this split-mouth-design study, 25 patients suffering from hypersensitive dental cervices or dentin were treated with DentinProtector (Vivadent, Liechtenstein) in the first quadrant, in the second quadrant with Er:YAG laser [(KEY III, KaVo, Biberach) at 80 mJ and 3 Hz, Handpiece 2060 with water irrigation, defocused, 2 min per tooth)], in the third quadrant with Duraphat, and the fourth quadrant served as an untreated control group.

Results: Compared to the control group, all three treatment methods showed reduction of discomfort after 6 months.

Conclusion: Desensitizing with Er:YAG laser was effective. In comparison to the use of Duraphat and DentinProtector, the good results persisted longer. It seems that the Er:YAG laser is a suitable tool for treatment of dentin hypersensitivity.

Keywords: Er:YAG laser, hypersensitivity, DentinProtector, Duraphat, desentizising effects, maintenance.

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The aim of this clinical study was to compare the desensitizing effects on dentin and dental cervices of DentinProtector, Duraphat, and Er:YAG laser.

Dentin hypersensitivity presents as an emergency condition requiring that the clinician have an effective means of providing immediate relief at his or her disposal.[1]

In private dental offices, dentin hypersensitivity has for years been a common cause of discomfort in patients. In an average of 10% of patients, dentin hypersensitivity is a severe problem, and also involves moderate cervical pain.[2,3] The reasons for dentin exposure are gingival recession following periodontal disease or periodontal therapy, trauma from tooth brushing,[4] and dietary acids.[5]

Dentine hypersensitivity is a common, painful condition about which relatively little is known. A review of the literature reveals that most research has been concerned with the clinical assessment of therapeutic agents,[6] but a successful reduction of hypersensitivity over long periods has not been reported at all. Furthermore, little is know about the etiology of dentin hypersensitivity.[7]

The most common therapy of hypersensitive dentin is the use of fluoride solutions,[8] and iontophoresis with fluorid paste.[9,10] Of the various in-office treatments,

Table 1 Pain Scale

Degree	Description
1	No discomfort during application of the stimulus
2	Slight discomfort during application of the stimulus
3	Mild discomfort or pain during application of the stimulus
4	Severe discomfort or pain during and continuing for longer than 5 s after application of the stimulus

Duraphat was the most cited choice of varnish/primer options.[11]

Since beginning of the 90s, the use of laser systems has shown good results. In the literature, two different laser methods for treating hypersensitivity are desribed: one, the indirect method is laser combined with stannous fluoride application, and two, the direct application of laser irradiation.[12,13]

There are a number of studies using Nd:YAG laser,[14,15] CO_2 laser,[16] GaAlAs laser,[17-19] and Er:YAG laser[20] to treat hypersensitivity. Few of them were able to show positive long-term results.

MATERIALS AND METHODS

Twenty-five patients (11 females and 14 males, aged between 18 and 46 years, mean age 32 years) participated, bearing a total of 172 contralateral pairs of hypersensitive and caries-free teeth. There were no carious lesions on neighboring or selected teeth, no desentizising therapy during the last 9 months, and no cervical fillings.

Study design

According to the split-mouth design, teeth in the first quadrant were treated with DentinProtector (DP) (Ivoclar-Vivadent; Schaan, Liechtenstein), in the second quadrant with Er:YAG laser (KEY III, KaVo; Biberach, Germany; 80 mJ, 3 Hz, handpiece 2060 with water irrigation, defocused mode, 2 min per tooth), in the third quadrant with Duraphat 5% sodium fluoride varnish (Colgate-Palmolive; Hamburg, Germany), and the fourth quadrant served as an untreated control group.

All patients were members of the oral hygiene program and received the last professional tooth cleaning 4 weeks before treatment. Immediately prior to treatment, the teeth were cleaned by dental floss and polishing.

A 3-s cool air blast (18-20°C) from a distance of 2 mm was the qualitative stimulation on the site to be tested. The other test sites received an application of DentinProtector or Duraphat according to the respective manufacturer's instructions.

The neighboring teeth were shielded by casting material (Panasil, Kettenbach; Eschenburg, Germany.).

The assessment of hypersensitivity was done according to a pain scale of four degrees (Table 1).

Hypersensitivity was recorded before treatment (baseline; Table 2) , immediately after treatment (Table 3), 1 week (Table 4), 1 month (Table 5), 2 months (Table 6) and 6 months (Table 7) after treatment by a blinded examiner.

Differences in the mean pain scores between the baseline and the 6-month recording were used to determine the reduction in dentin hypersensitivity.

RESULTS

No complications were observed. All treatment forms resulted in reduced discomfort immediately and after one week.

After one month, hypersensitivity examinations showed that the DP group increased up to 56%, the Duraphat group increased up to 57%, and the laser group increased up to 42% of the baseline score (Table 5).

After two months, the hypersensitivity examination showed the DP group had increased up to 64%, the

Table 2 Pretreatment values

Patient	Er:YAG 1st quadrant	Dentin-protector 2nd quadrant	Duraphat 3rd quadrant	Control 4th quadrant
1	4	4	3	4
2	4	4	3	4
3	4	4	4	4
4	4	4	4	4
5	3	4	4	4
6	3	4	4	4
7	3	3	4	3
8	4	3	3	4
9	3	3	4	3
10	4	4	3	4
11	3	4	4	3
12	3	4	3	3
13	3	3	3	3
14	3	3	3	3
15	3	4	4	3
16	3	3	4	4
17	3	4	4	4
18	4	3	4	4
19	4	4	3	3
20	4	3	4	4
21	4	4	4	3
22	4	3	4	4
23	4	4	3	3
24	3	4	4	4
25	4	3	3	4
Results	3.52	3.6	3.6	3.6

Table 3 Results directly after treatment

Patient	Er:YAG 1st quadrant	Dentin-protector 2nd quadrant	Duraphat 3rd quadrant	Control 4th quadrant
1	1	1	1	4
2	1	1	1	4
3	1	1	1	4
4	1	1	1	4
5	2	1	1	4
6	2	2	1	4
7	2	2	1	4
8	1	2	1	4
9	1	1	2	4
10	1	1	2	4
11	2	1	2	3
12	1	2	2	3
13	2	2	2	3
14	1	2	1	3
15	2	2	2	3
16	2	2	2	3
17	1	3	2	3
18	1	2	1	4
19	1	2	2	3
20	1	2	3	4
21	2	2	2	3
22	1	1	2	4
23	1	1	2	3
24	2	1	2	4
25	1	2	2	3
Results	1.36	1.6	1.64	3.56

Duraphat group up to 68%, and the laser group stayed nearly unchanged at 42% of the baseline score (Table 6).

After six months, the hypersensitivity in the DP group increased up to 102%, the Duraphat group increased up to 103%, and the laser group slightly increased up to 55% of the baseline score (Table 7).

The control group showed no decrease in hypersensitivity at any examination over the 6-month observation period.

Compared to the control group, all three treatment methods reduced discomfort at each examination interval over the 6-month observation period (Table 8).

The decrease of the positive effect with Er:YAG laser was observed after 6 months, whereas the decrease of the positive effect of DentinProtector and Duraphat occurred after 2 months.

CONCLUSION

Desensitizing with Er:YAG laser was effective. In comparison to the use of Duraphat and DentinProtector, the reduced hypersensitivity persisted longer.

After 6 months, there was a slight increase in discomfort in the Er:YAG laser group as well. It seems that the Er:YAG laser is a suitable tool for treatment of dentin hypersensitivity.

Table 4 Results 1 week after therapy

Patient	Er:YAG 1st quadrant	Dentin-protector 2nd quadrant	Duraphat 3rd quadrant	control 4th quadrant
1	1	2	2	4
2	1	2	2	4
3	1	2	2	4
4	1	2	2	4
5	1	2	2	4
6	1	2	2	4
7	1	1	2	3
8	2	1	2	3
9	2	1	3	3
10	2	3	3	4
11	2	2	2	3
12	2	2	2	4
13	2	2	2	3
14	2	2	2	4
15	1	3	2	4
16	1	3	2	4
17	1	3	2	3
18	2	3	3	3
19	2	2	2	3
20	2	2	2	3
21	2	2	2	3
22	1	2	3	4
23	1	1	2	3
24	1	1	3	4
25	2	1	1	3
Result	1.48	1.96	2.16	3.52

Table 5 Results 1 month after therapy

Patient	Er:YAG 1st quadrant	Dentin-protector 2nd quadrant	Duraphat 3rd quadrant	Control 4th quadrant
1	1	2	2	3
2	2	2	3	4
3	2	1	3	4
4	1	1	2	4
5	2	1	2	4
6	1	1	2	3
7	2	2	2	3
8	2	3	2	3
9	1	2	2	3
10	1	3	2	4
11	1	2	3	3
12	1	2	3	4
13	1	2	3	3
14	1	3	2	3
15	1	3	2	4
16	2	3	2	4
17	2	1	1	4
18	2	2	1	3
19	2	2	1	3
20	1	1	1	3
21	2	2	3	3
22	2	3	3	3
23	2	2	1	3
24	2	3	2	3
25	1	2	2	3
Result	1.52	2.04	2.08	3.36

Further studies are needed over a longer time period to evaluate the long-term stability of the positive results.

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Table 6 Results 2 months after therapy

Patient	Er:YAG 1st quadrant	Dentin-protector 2nd quadrant	Duraphat 3rd quadrant	Control 4th quadrant
1	1	2	2	3
2	1	2	1	3
3	1	2	2	3
4	1	2	2	3
5	2	2	3	3
6	2	3	2	3
7	2	2	3	3
8	3	3	2	4
9	2	2	3	4
10	3	3	2	4
11	2	2	3	3
12	2	3	2	4
13	1	2	3	3
14	1	3	2	4
15	1	2	3	3
16	2	3	3	4
17	1	2	3	4
18	1	2	3	3
19	1	3	3	4
20	2	3	3	3
21	1	2	2	4
22	1	2	2	4
23	2	2	3	4
24	1	2	3	4
25	1	2	2	4
Result	1.52	2.32	2.48	3.52

Table 7 Results 6 months after therapy

Patient	Er:YAG 1st quadrant quadrant	Dentin-protector 2nd quadrant	Duraphat 3rd quadrant	Control 4th quadrant
1	3	2	4	4
2	3	4	4	3
3	2	4	4	3
4	2	3	4	3
5	2	4	3	4
6	2	3	4	3
7	2	4	4	4
8	2	4	3	3
9	2	4	4	3
10	2	4	3	3
11	2	4		4
12	3	3	3	4
13	3	3	4	4
14	3	4	4	4
15	1	4	4	4
16	1	4	4	4
17	1	3	4	4
18	1	3	4	4
19	1	4	4	4
20	1	4	4	4
21	2	4	3	4
22	2	4	4	4
23	2	4	3	4
24	2	4	3	4
25	2	4	4	3
Result	1.96	3.68	3.70833333	3.68

Table 8 Summary of results

	before	immediately after	1 week	1 month	2 months	6 months	differences
Er:YAG Laser	3.52	1.36	1.48	1.52	1.52	1.96	1.56
Dentin Protector	3.6	1.6	1.96	2.04	2.32	3.68	-0.08
Duraphat	3.6	1.64	2.16	2.08	2.48	3.71	-0.11
Control	3.6	3.56	3.52	3.36	3.52	3.68	-0.08

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