International Journal of Research in Health and Allied Sciences

Journal home page: www.ijrhas.com

Official Publication of "Society for Scientific Research and Studies" [Regd.]

ISSN: 2455-7803

Original Research

Influence of diode laser treatment and casein phosphopeptide-amorphous calcium phosphate paste on eroded root dentin

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ABSTRACT:
Background: DH is an extreme reaction to sensory stimuli that, in most cases, wouldn't cause any problems for a tooth that is healthy and normal. The present study was conducted to assess effect of diode laser treatment and casein phosphopeptide-amorphous calcium phosphate paste on eroded root dentin. **Materials & Methods:** 45 bovine root dentin specimens which were divided into 5 groups. Group I was control group without erosion-sound dentin, group II was control group eroded: specimens were eroded and did not receive any pretreatment, group III was casein phosphopeptide-amorphous calcium phosphate fluoride (CPP-ACP): specimens were pretreated with CPP-ACP, group IV was diode laser: specimens were irradiated with a wavelength of 970 nm, and in group V CPP-ACP + diode laser: specimens were pretreated with CPP-ACP for 5 min and simultaneously irradiated with laser on contact mode. The quantitative bond strength, prevalent fracture mode and the morphology of the dentin surfaces after treatment was recorded. **Results:** The mean shear bond strength in group I was 19.7 MPa, in group II was 14.3 MPa, in group III was 25.9 MPa, group IV was 16.2 MPa, and in group V was 20.7 MPa. The difference was significant (P< 0.05). Fracture type was adhesive at the interface, mixed, cohesive composite resin failure, and cohesive dentin failure in group I seen in 85%, 5%, 4% and 6% respectively. In group II was 82%, 4%, 7% and 7% respectively. In group III was 80%, 7%, 8% and 5%. In group IV was seen in 81%, 10%, 7% and in 2% respectively. The difference was significant (P< 0.05). **Conclusion:** The use of CPP-ACP-containing desensitizers, whether or not they were coupled with a diode laser, strengthened the binding between the eroded root dentin and the etch-and-rinse adhesive system.
Keywords: bond strength, Dentin hypersensitivity, diode laser

Received: 17 January, 2024 Accepted: 20 February, 2024

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This article may be cited as: Nawab A, Talath U, Prithvi MS, Shah P, Kumari M, Bhagat N. Influence of diode laser treatment and casein phosphopeptide-amorphous calcium phosphate paste on eroded root dentin. Int J Res Health Allied Sci 2024; 10(2):1-4.

INTRODUCTION

The vitality of teeth within the oral cavity keeps growing since the number of preventive health dental programs has expanded along with the information about oral care.[1] These days, noncarious cervical lesions are more common due to the decrease in tooth loss. Dentin hypersensitivity (DH), one of the condition's consequences, is a prevalent complaint among adults and is one of the most serious and enduring issues.[2]

DH is an extreme reaction to sensory stimuli that, in most cases, wouldn't cause any problems for a tooth

that is healthy and normal. It is defined as a sharp pain that is acute, nonspontaneous, brief, or persistent that is brought on by the dentin being exposed to various stimuli such as thermal, mechanical, chemical, evaporative, tactile, or osmotic, and that is unrelated to any other dental condition or defect.[3] Due to the exposure of the root surfaces, the prevalence of this condition varies from 8% to 57%. It is significantly more common (72%–98%) in patients with periodontal disease. A product of milk proteins is casein phosphopeptide-amorphous calcium phosphate (CPP-ACP).[4] By obstructing dentinal tubules and generating dentin-like minerals, this complex prevents demineralization of the dental structure, remineralizes dentin by buffering free calcium and phosphate ions on the dentin surface, and mimics natural desensitization processes.[5] The present study was conducted to assess effect of diode laser treatment and casein phosphopeptide-amorphous calcium phosphate paste on eroded root dentin.

MATERIALS & METHODS

The present study consisted of 45 bovine root dentin specimens which were divided into 5 groups. Group I was control group without erosion-sound dentin, group II was control group eroded: specimens were eroded and did not receive any pretreatment, group III was casein phosphopeptide-amorphous calcium phosphate fluoride (CPP-ACP): specimens were pretreated with CPP-ACP, group IV was diode laser: specimens were irradiated with a wavelength of 970 nm, and in group V CPP-ACP + diode laser: specimens were pretreated with CPP-ACP for 5 min and simultaneously irradiated with laser on contact mode. The quantitative variable was bond strength to dentin in megapascals (MPa), obtained from a shear strength test performed in each specimen. The qualitative variables were evaluated by the prevalent fracture mode and the morphology of the dentin surfaces after treatment. Data thus obtained were subjected to statistical analysis. P value < 0.05 was considered significant.

RESULTS

Table I Comparison of shear bond strength

Groups	Mean (MPa)	P value
Group I	19.7	0.04
Group II	14.3	
Group III	25.9	
Group IV	16.2	
Group V	20.7	

Table I shows that mean shear bond strength in group I was 19.7 MPa, in group II was 14.3 MPa, in group III was 25.9 MPa, group IV was 16.2 MPa, and in group V was 20.7 MPa. The difference was significant (P< 0.05).

Graph I Comparison of shear bond strength

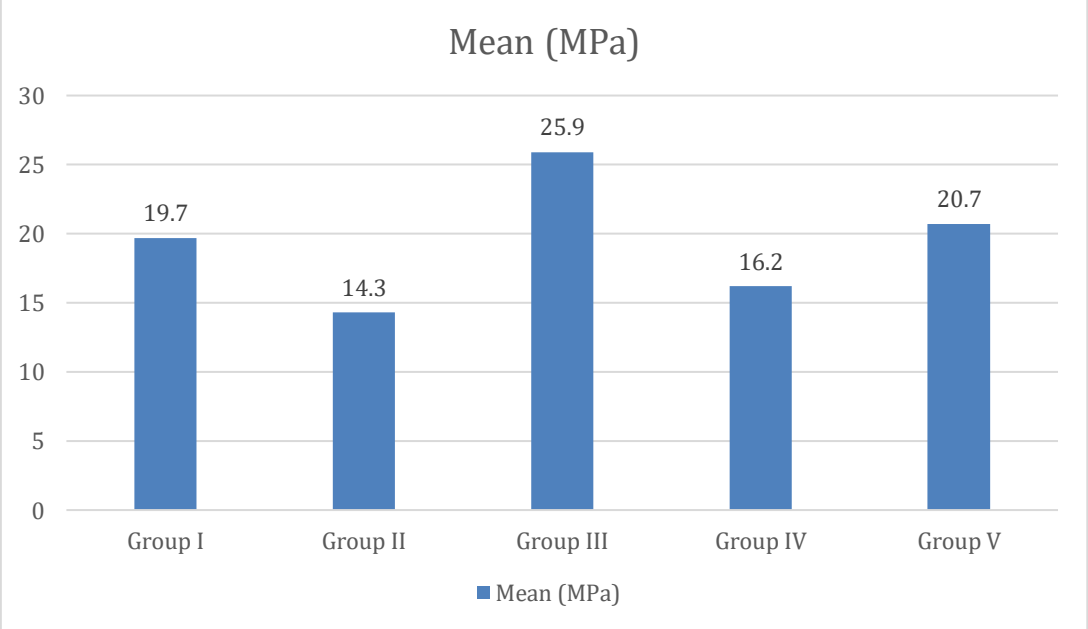


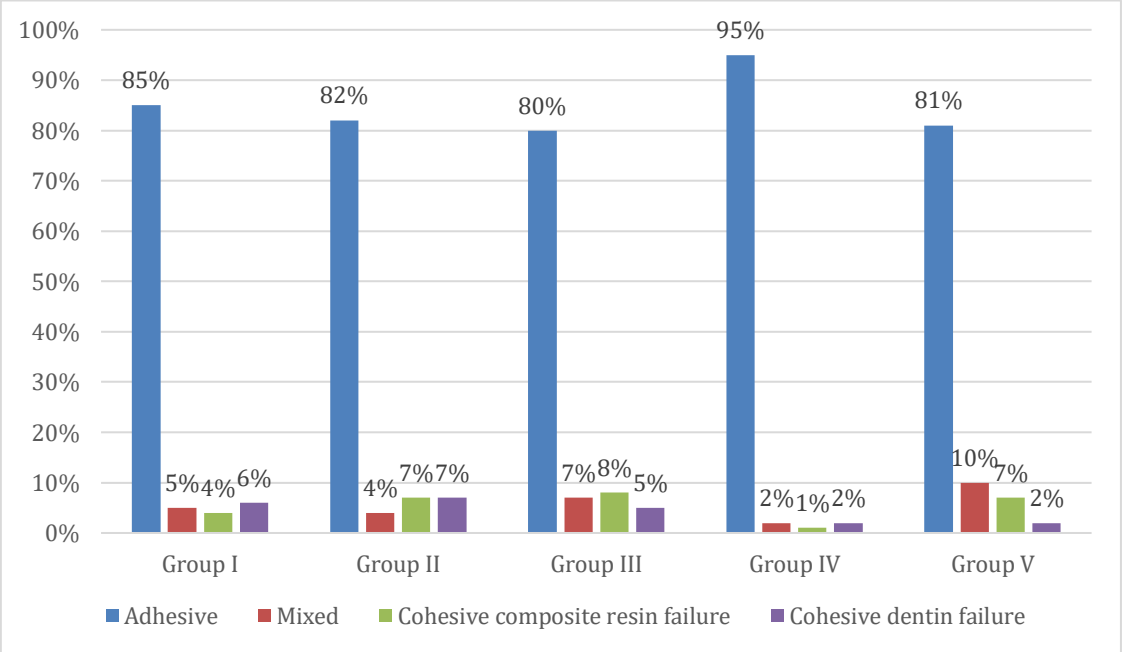
Table II Comparison of fracture mode

Groups	Adhesive	Mixed	Cohesive composite resin failure	Cohesive dentin failure	P value
Group I	85%	5%	4%	6%	0.05
Group II	82%	4%	7%	7%	0.04

Group III	80%	7%	8%	5%	0.03
Group IV	95%	2%	1%	2%	0.01
Group V	81%	10%	7%	2%	0.02

Table II, graph I shows that fracture type was adhesive at the interface, mixed, cohesive composite resin failure, and cohesive dentin failure in group I seen in 85%, 5%, 4% and 6% respectively. In group II was 82%, 4%, 7% and 7% respectively. In group III was 80%, 7%, 8% and 5%. In group IV was seen in 81%, 10%, 7% and in 2% respectively. The difference was significant (P< 0.05).

Graph II Comparison of fracture mode



DISCUSSION

Lasers, whether low- or high-power, have emerged as a viable DH treatment substitute. Dentin exposed to diode laser radiation produces low-energy emission with minimal temperature rise, boosting cellular activity and circulation while encouraging favorable reactions like analgesic, anti-inflammatory, vascular, and tissue healing.[6] Patients with DH typically have dental wear, and occasionally, a straightforward desensitizing procedure is not enough to meet the patient's demands.[7] In order to prevent discomfort and the progression of the noncarious cervical lesion, an aesthetic restorative procedure using composite resin is carried out when the desensitizing treatment proves insufficient.[8] The present study was conducted to assess effect of diode laser treatment and casein phosphopeptide-amorphous calcium phosphate paste on eroded root dentin.

We found that mean shear bond strength in group I was 19.7 MPa, in group II was 14.3 MPa, in group III was 25.9 MPa, group IV was 16.2 MPa, and in group V was 20.7 MPa. Quero et al[9] in their study seventy-five bovine root specimens were randomly divided into five experimental groups (n = 15). Samples were eroded by six cycles of immersion in hydrochloric acid solution (0.01M; pH = 1.2) for 20 s each, at 45 min intervals, and treated with: G2 – no treatment, G3 – CPP-ACP, G4 – diode laser (970 nm), and G5 – CPP-ACP + Diode laser. The fracture mode of each group was evaluated after restoration with composite resins in the treated area. G3 showed the highest values for shear bond strength; there was no significant difference among G1, G3, and G5 (P > 0.05). The adhesive fracture was predominant for all groups.

We found that fracture type was adhesive at the interface, mixed, cohesive composite resin failure, and cohesive dentin failure in group I seen in 85%, 5%, 4% and 6% respectively. In group II was 82%, 4%, 7% and 7% respectively. In group III was 80%, 7%, 8% and 5%. In group IV was seen in 81%, 10%, 7% and in 2% respectively. Faraoni et al[10] evaluated how casein phosphopeptide-amorphous calcium phosphate (CPP-ACP) associated with Nd:YAG or Diode laser affects dentin exposed to hydrochloric acid (HCl) with or without tooth brushing. One hundred and sixty human root dentin blocks were selected after they were initially eroded with liquid HCl (pH 1.2) 3x for one day. The blocks were divided into the following groups: G1– liquid HCl (HCl-l), G2– HCl-l + brushing, G3– gaseous HCl (HCl-g), and G4– HCl-g + brushing. Each group was randomly assigned to the following treatments (n = 10): A) Control (no treatment), B) CPP-ACP, C) CPP-ACP associated with Nd:YAG laser (λ = 1064 nm) (40 mJ, 10 Hz, 0.4 W, 15 s), and D) CPP-ACP associated with Diode laser (λ = 980 nm) (0.5 W, 200 µs, 15 s). The treatment with CPP-ACP (G2, G3 and G4) was applied on the

dentine surface for 5 min. Erosion (6x/day/20 s) and erosion (6x/day/20 s) with abrasion (2x/10 s) were performed for five days. Dentin volume loss was determined by 3D confocal laser microscopy. G1 - CPP-ACP (10.77 ± 1.66) and CPP-ACP associated with Diode laser (9.98 ± 0.89) showed lower volume loss in relation Control group (12.86 ± 0.63) ($p < 0.05$). G2 - CPP-ACP associated with Diode laser (12.41 ± 1.08) elicited lower volume loss as compared to the Control (14.42 ± 1.24) ($p < 0.05$). As for G3 and G4, all treatments showed similar volume loss.

CONCLUSION

Authors found that the use of CPP-ACP-containing desensitizers, whether or not they were coupled with a diode laser, strengthened the binding between the eroded root dentin and the etch-and-rinse adhesive system.

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