ORIGINAL RESEARCH PAPER

Dentistry

AN IN-VIVO COMPARISON OF DIFFERENT DESENSITIZING AGENTS IN THE TREATMENT OF DENTINAL HYPERSENSITIVITY IN NON-RESTORED CERVICAL LESION

KEY WORDS: Dentinal Hypersensitivity, HEMA, Tooth mousse, CPP-ACP, cervical lesion, Fluoride

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ABSTRACT

Dentin hypersensitivity involves experiencing sharp and often painful sensations in to certain stimuli such as thermal (hot or cold), evaporative, tactile (touch), osmotic (pressure changes), or chemical triggers. Non carious cervical tooth structure loss are often associated with a subjective symptom of hypersensitivity that needs immediate intervention. **Aim:** Aim of this in vivo clinical study is to evaluate the efficiency of two different commercially available dentin desensitizing agents in terms of reduction in dentinal hypersensitivity in non-restored non-carious cervical tooth lesions. **Materials And Methods:** Thirty patients were selected who had the complaint of sensitivity to hot/cold, sweet and sour food that is associated with non-carious cervical lesion with a greatest depth less than 0.5mm. After performing tactile test, patient responses were recorded in VAS scale. They were divided into two groups and treated with two different types of desensitizing agents (HEMA containing desensitizer and Tooth Mousse containing CPP-ACP). Follow-up was taken after 1st week, 3rd week and 1 month. Statistical analysis was done by one way ANOVA and Tukey Post Hok analysis. **Results:** HEMA desensitizer showed immediate reduction in dentinal hypersensitivity. Whereas Tooth Mousse showed highest overall reduction in dentinal hypersensitivity in follow-up intervals.

INTRODUCTION:

Dentinal hypersensitivity (DH) is a condition characterized by an exaggerated response to stimulation of vital dentin exposed to the oral environment. It manifests as extreme discomfort, presenting as short-term, acute pain of varying intensity. The sensation of pain associated with dentinal hypersensitivity may be localized to a specific tooth or generalized, affecting multiple tooth surfaces. Importantly, the pain typically subsides promptly upon the removal of the triggering stimulus.[1]

Reported prevalence of non-carious cervical lesions, regardless of form and etiology, is shown to vary from 5% to 85%.[2] Those lesions have greatest axial depth of <0.5mm cannot be restored but many a times associated with dentinal hypersensitivity.

The etiology and mechanisms behind the development of dentin hypersensitivity have not been fully elucidated. Several theories have been proposed to explain the generation of pain and transmission of stimuli through dentin, with the Hydrodynamic Theory, introduced by Brännström in 1966, being the most widely accepted. According to the Hydrodynamic Theory, the loss of overlying enamel and/or cementum exposes dentinal tubules to the oral environment. When certain stimuli, such as thermal or tactile factors, are applied, fluids within these tubules undergo displacement. This fluid movement indirectly stimulates the nerve endings in the dental pulp, leading to the sensation of pain. The theory suggests that if the radius of opened dentinal tubules can be reduced, the permeability of the tubules decreases, subsequently reducing sensitivity.[2] Therefore, treatments for hypersensitivity aim to occlude the open dentinal tubules and prevent nerve sensitivity.

Various methods have been employed to address dentin hypersensitivity, including techniques to reduce the radius of opened dentinal tubules. These approaches target different aspects of the Hydrodynamic Theory in an effort to alleviate or eliminate the pain associated with dentin hypersensitivity.[1][3] Therefore, the purpose of this study is to compare the efficiency of two different commercially available dentin desensitizing agents in terms of reduction in dentinal hypersensitivity.

MATERIALS AND METHOD:

This research was conducted after being approved by the Institution's Ethical Committee on Research involving human beings following the principles of Helsinki declaration by the World Medical Association. The patients signed a form of free and informed consent and were informed of the possible events during and after the study.

Thirty patients were selected and two different desensitizing agents were applied in fifteen patients per group. The materials used in them present study are tabulated below:

	DESENSITIZING AGENT USED	MANUFACTURING COMPANY	COMPOSITION [as per manufacturer's information]
Group 1 (n=15)	Tooth Mousse	GC	10 wt% Casein Phosphopeptide (CPP) – Amorphous Calcium Phosphate (ACP)
Group 2 (n=15)	Shield Activ	Prevest DenPro	2-HEMA 45%, Glutaraldehyde 10%, Potassium Nitrate 2.5% and Ethanol

SELECTION OF PATIENTS

Inclusion Criteria:

i) Patient who had non carious cervical lesion of greatest depth <0.5mm
ii) Patient had a history of sensitivity to hot and/or cold, sweet and/or sour food stuffs.
iii) Young adults of second and third decade

Exclusion Criteria:

i) Patients presently on desensitizing treatment
ii) Tooth with detectable carious lesion
iii) Tooth with gingival recession, detectable fracture/crack
iv) Subjects with pre-existing orthodontic appliances or fixed

partial prosthesis that may interfere with the study

Oral prophylaxis was done. A baseline patient's response and follow-up response was noted by scratch test –

The response to tactile stimulus was assessed using a blunt tip probe scratching with a light pressure along the cemento-enamel junction for three seconds. Patient's response evaluation was done by the Visual Analogue Scale (VAS), ranging from 0 (no pain) to 10 (maximum intensity) according to patient reported pain quantification.

Patients were randomly distributed among two test groups according to four commercially available de-sensitizing agent applied –
Group 1- Patients were advised to apply Tooth Mousse twice a day for 3 min with 12 hour interval for a week and asked the patient not to take any water or food or expectorate for next 30 mins.
Group 2- Shield Activ Desensitizer was applied for 3 mins involving the cervical part, left it undisturbed until it dried and asked the patient not to take any water or food or expectorate for next 30 mins.

FOLLOW UP PERIOD:
The patients were examined at 1 week interval (R1), 3 weeks (R2), and 1 month interval (R3).

Improvement was defined as a change in score from higher to lower value, indicating the improvement of the hypersensitive symptoms and disappearance of symptom was indicated when the value to 0.

RESULT
It was observed from VAS score obtained from different patients at baseline and upto 1 month follow-up, HEMA desensitizer showed better immediate action than CPP-ACP containing tooth mousse, but tooth mousse showed highest overall reduction in dentinal hypersensitivity in follow-up intervals.

Statistical Analysis
It was observed that the VAS scores decreased with every consequent follow-up for both the study groups. Inter-group comparisons were carried out using the one-way ANOVA with the *post-hoc* Tukey test.

Table 1: Descriptive Statistics And Comparison Of The VAS Scores Between The Study Groups For All The Follow-up Periods

Periods	Group I(n=15)	Group II(n=15)	P value[§]
T0	5.8 ± 1.38^{a1}	5.67 ± 1.4^{a2}	0.73ns
T1	5.33 ± 1.35^{a1}	4.13 ± 0.743^{b2}	0.0032**
T2	2.67 ± 0.976^{b1}	3.67 ± 0.9^{b2}	0.01*
T3	2.07 ± 0.799^{b1}	2.53 ± 0.915^{c2}	0.24ns
P value[‡]	<0.0001**	<0.0001**	

T0: Baseline; T1:Post-operative 7th Day; T2:Post-operative 21st Day;T3:Post-operative: 1st month

n:sample size per group

[§]:Inter-group comparisons(between the study groups); [‡]: intra-group comparisons(between the time periods within each study group)

1: Tooth Mouse containing CPP-ACP; 2: HEMA+NaF+KF+Ethanol

ns:not significant($P>0.05$), *: statistically significant ($P<0.05$), **:highly statistically significant ($P<0.01$)

Different superscript letters indicate a significant difference between the follow-up period in each study group

It was observed that the VAS scores decreased in both the study groups from the Baseline values. Comparisons were carried out using the two-way ANOVA test and it revealed that both the time and the type of material used significantly influenced the VAS scores ($P<0.001$).

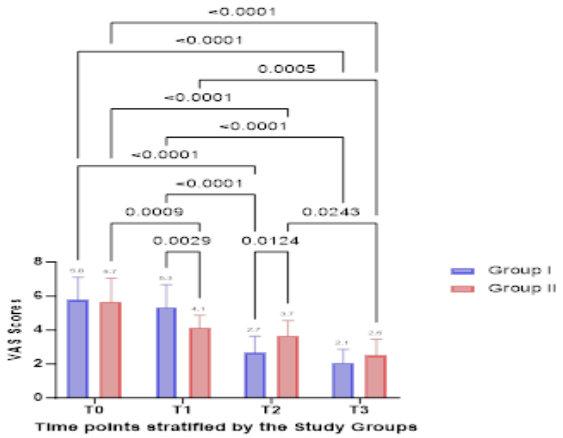
Tukeys HSD test was carried out to assess the actual differences within the groups and between the groups and the following was inferred:

Within-Group comparisons:
In **Group I**, the VAS scores decreased gradually with every subsequent follow-up: T0(5.67±1.4)> T1(4.13±0.743)> T2(3.67±0.9)> T3(2.53±0.915).

Comparisons indicated that there was a significant difference between the VAS scores of all the follow-up periods except between the baseline & T1 and also between T2 and T3.

In **Group II**, the VAS scores decreased gradually with every subsequent follow-up: T0(5.8±1.38)> T1(5.33±1.35)> T2(2.67±0.976)>T3(2.07±0.799)

Comparisons indicated that there was a significant difference between the VAS scores of all the follow-up periods except between T1 and T2.



Between-Group comparisons:
- At **T0**, comparisons of the VAS scores between the study groups were found to be not significant ($P=0.73$), implying that the baseline scores were matched for both groups.
- At **T1**, it was observed that the VAS scores were significantly lesser in Group II than in Group I ($P=0.0032$)
- At **T2**, it was observed that the VAS scores were significantly lesser in Group I than in Group II ($P=0.01$)
- At **T3**, it was observed that the VAS scores were only indicatively lesser in Group I than in Group II, but the difference was not statistically significant ($P=0.24$)

DISCUSSION
The exposed patent dentinal tubule is considered the morphological etiology of dentin hypersensitivity. Various studies [4][5][6] have revealed that "hypersensitive" dentin has more widely open tubules compared to "non-sensitive" dentin. The wider exposed dentinal tubules, such in non-carious cervical tooth lesion, lead to increased fluid movement, consequently increasing the pain or sensitivity response [7][8]

Agents that occlude dental tubules create a barrier by precipitating proteins and calcium/phosphate ions on the surface or within the tubule orifice. The degree of desensitizing activity increases with the depth of penetration. When penetration is shallow, there is a risk of removal of deposits by brushing or dietary acids. However, deeper penetration within the dentinal tubule makes it more resistant to removal by brushing or dietary acids, resulting in better

occlusion of the tubule and a more effective desensitizing effect.[9]

ACP was developed by Tung et al in 2003. CPP containing **phosphoseryl sequences** can be helpful in attaching and stabilization of ACP and forms nano-complexes with ACP at the tooth surface thereby providing a reservoir of calcium and phosphate ions which favors mineralization. CPP also buffers the pH of plaque, depresses demineralization and enhances remineralization which also results in the anticariogenic property of CPP-ACP.[10]

Hydroxy-ethyl-methacrylate (HEMA) with glutaraldehyde resulting in its desensitizing effect by **precipitation of plasma proteins** in the dentinal tubules which reduces **dentinal permeability** and occludes the peripheral tubules. The presence of glutaraldehyde causes protein coagulation within dentinal tubules. [11]

In the present study, it was observed that CPP-ACP contacting tooth mousse and HEMA desensitizer showed marked reduction in dentinal hypersensitivity within 3 weeks of application period.

Better immediate and long standing action of HEMA containing desensitizer can be explained by the fact that, greater depth of penetration (66.28 – 139.88μm) within the dentinal tubules. CPP-ACP containing tooth mousse (which reduces the diameter of open dentinal tubules) showed equally good result but that requires multiple application for stabilization of amorphous calcium phosphate at the entrance of dentinal tubules thereby reducing the fluid movement.

CONCLUSION

HEMA desensitizer showed better immediate action than CPP-ACP containing tooth mousse, but tooth mousse showed highest overall reduction in dentinal hypersensitivity in follow-up intervals.

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