Since thousands of years, numerous agents such as potassium oxalate, ammonium hexafluorosilicate, propolis, and dentin bonding agents have been used to treat dentinal hypersensitivity,[3‑5] but no agent or treatment regimen has proved to be a gold standard for effective treatment of dentinal hypersensitivity. Most in‑office desensitizing agents work by tubular occlusion. Earlier, the varnishes that were used Gluma (glutaraldehyde and hydroxyethyl...
methacrylate), Cervitec (thymol and chlorhexidine),

duraphat (Colgate, New York, USA), etc. Now newer
generation varnishes have come into existence such as
Clinpro XT varnish (GC America, Illinois, USA) and
MI varnish (3M ESPE, California, USA).

A sodium fluoride varnish works on the principle
of tubular occlusion and the presence of fluoride is
thought to increase the stability of the dentin surface
thus reducing the solubility of dentin and thereby
shifting the equilibrium at the surface level in favor
of nonsensitivity.[7]

Clinpro XT varnish, which is used for in-office
treatment, acts as a dentin adhesive sealers. It is a
light-cured glass ionomer-based material, which is
available in a liquid/paste system. It also contains
fluorides, calcium, and phosphate which help in
supplementing the remineralization process[8] and
reducing dentinal hypersensitivity.

MI varnish (RECALDENT), which is used for
in-office treatment, acts by plugging the dentinal
tubules and is a calcium phosphate-based varnish.
It is a 5% sodium fluoride-based varnish with
casein phosphopeptides (CPP) which stabilizes the
amorphous calcium phosphate phase to deliver
bioavailable calcium, phosphate, and fluoride ions
to the tooth surface to promote remineralization of
tooth structure[9] and occludes the dentinal tubules
thus reducing dentin sensitivity.

The literature is replete with studies comparing
fluoride varnishes, but very scarce literature is found
on remineralizing varnishes used to treat dentinal
hypersensitivity.[8] Thus, the aim of this study is to
evaluate the efficacy of MI varnish and Clinpro XT
varnish in reducing dentinal hypersensitivity.

MATERIALS AND METHODS

Patients visiting the outpatient department with
cervical dentinal hypersensitivity were selected for
the study. Approval was granted by the Institutional
review board and the procedures conducted were in
accordance with the ethical standards of the Helsinki
Declaration of 1975, as revised in 2000. All the study
subjects were informed in detail about the nature
of the research procedure, and a written consent
was obtained. The sample size was estimated based
on data obtained from published literature.[10] The
pooled standard deviation (S) and mean expected
difference (d) was obtained from the same article. The
probability of Type I error was fixed at 5% (Zα = 1.46).
The probability of Type II error was fixed at 20% (Zβ = 0.84).

The formula used to calculate the sample size is:

\[ n = \frac{(Z_α - Z_{1-β})^2 \times d}{S^2} \]

Substituting the values,

\[ n = \frac{(1.46 + 0.84)^2 \times (1.4)^2 \times 2}{1} = 21 \]

Sample size will be increased by 10% to adjust for
any loss to follow-up. Hence, the final sample size is
23 ± 25 teeth in each group.

The inclusion criteria for patients in the study was that
the teeth should have dentinal hypersensitivity caused
by cervical abrasion/erosion, no dental pathology
which causes pain similar to cervical dentinal
hypersensitivity,[11] should have a preoperative visual
analog scale (VAS) score of ≥2, age in the group of
18–50 years, and a good systemic health.

The exclusion criteria consisted of teeth with caries,
defective restorations, occlusal restorations, chipped
teeth, deep periodontal pockets (probing depth >6 mm),
patients with ulcerative gingivitis and stomatitis and
those who have undergone periodontal surgery within
the previous 3 months, patients with orthodontic
appliances, teeth with cervical defects >2 mm
horizontally,[11] patients who have used desensitizing
toothpaste in the past 3 months. Patients allergic
to ingredients used in the study-CPP are derived
from milk casein. Hence, patients with a proven or
suspected milk protein allergy were excluded.

Before treatment, patient’s demographic details and a
thorough history of presenting illness were recorded.
Clinical evaluation was performed using visual and
tactile examination, air blast test, and cold water
test.[5]

The teeth to be tested were isolated by cotton rolls and
a suction device. Then, a blast of air was applied at a
0.5 cm distance[11] to the tooth surface, and the score
was measured by VAS in which the patient placed a
pencil mark at a point on scale from 0 to 10 where, 0 is
“no pain” and 10 is the “worst pain possible.” This was
followed by scoring of tooth sensitivity using 0.5 ml of
ice cold water[6] applied to the exposed dentine surface
while neighboring teeth were isolated during testing
using the operator’s fingers and cotton rolls. A period
of at least 5 min was allowed between the two stimuli on each tooth.\[11,12\]

After recording the first scores, the patients were randomly assigned to one of the treatment groups. The randomization process was conducted before the clinical steps. The randomization procedure was carried out using sequentially numbered opaque-sealed envelopes prepared with simple randomization.\[11\]

The desensitizing agents used in the current study were Clinpro XT varnish (GC America, Illinois, USA) and MI Varnish (3M ESPE, California, USA).

The manufacturer’s instructions were followed during the application of the agents [Figures 1 and 2]. Water and saliva contamination were avoided, and a dry field was maintained. The patients were instructed not to consume hard, hot or sticky foods, products-containing alcohol (oral rinses, beverages, etc.) and to avoid tooth brushing and flossing for 4 h.\[11\] Patients were advised to use a soft bristle tooth for brushing twice a day. Patients were directed to refrain from using any other fluoride-containing dentifrice or mouth rinse during the trial but were allowed to continue their normal oral hygiene practices. The sensitivity scores were recorded, immediately and 1 week after the therapy. At each appointment, clinical outcome was evaluated by air blast test and cold water test,\[11\] and scores were evaluated using VAS.\[12\]

**Statistical analysis**

Normality of the data distribution was checked, based on which nonparametric tests were used. Kolmogorov–Smirnov Test was used for determining normality. Mann–Whitney U-test and Wilcoxon-matched pairs test were used for the analysis.

**RESULTS**

Overall, the group for MI Varnish has a statistically significant difference over the group for Clinpro XT Varnish in reducing dentinal hyper sensitivity when comparing the values for Ice test scores [Table 1]. The percentage of change calculated when comparing the two groups for ice test scores is greater in Group 1 than Group 2 [Graph 1].

For cold water test, [Group 1] has a statistically significant difference over Group 2 [Table 2]. The percentage of change for cold water test is approximately double when compared between Group 1 and Group 2 [Graph 2].

**DISCUSSION**

Dentine hypersensitivity is an enigma, being frequently encountered yet less understood.\[13-15\] The basic goal in the treatment of dentinal hypersensitivity is to either seal the dentinal tubules by physical or chemical occlusion or to desensitize the nerves by causing depolarization of the cellular membrane of the nerve terminal and a refractory period with decreased sensitivity.\[16\]

Although subjective, the VAS scale has been shown by studies to be accurate for recording patient responses. Within the present study, an air blast was used as it is considered the best way to illicit a response of the patient. It consists of a short blast from a dental unit triple syringe at 40–65 psi and temperature between...
14°C and 26°C, directed at a distance of 1–3 mm from the exposed buccal cervical root surface. This is a method which has been used in other studies of tooth sensitivity.\textsuperscript{[17,18]} It has been recommended that at least two stimuli should be used, the least severe first followed by the second and there should be little or no interaction between the two stimuli. Thus, a second stimulus has been used in this study in the form of cold water and a time gap of 5 min has been advised in between the two tests.

Discomfort from dentine hypersensitivity is a common finding in the adult population, with the available prevalence data ranging from 8% to 57%. The diversity of reports may be caused by different methods used to diagnose the condition, and it is generally considered that surveys which rely on patient questionnaires alone greatly exaggerate the prevalence figures, thereby yielding misleading data.\textsuperscript{[19‑22]} Indeed, those studies which employed careful patient examinations produced surprisingly similar prevalence figures of around 15%. In periodontal patients, cervical dentinal hypersensitivity was found to be ranging between 72.5% and 98%.\textsuperscript{[23,24]}

![Graph 1: Comparison of Ice Test Scores](image1)

**Graph 1:** Comparison of Ice Test Scores

![Graph 2: Comparison of Air Test Scores](image2)

**Graph 2:** Comparison of Air Test Scores

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### Table 1: Comparison of MI varnish and Clinpro varnish with respect to ice test scores at baseline, immediately after and 1 week by Mann–Whitney U-test

| Time points       | MI varnish | Clinpro varnish | Z    | P     |
|-------------------|------------|-----------------|------|-------|
|                   | Median     | Mean | SD  | Sum of ranks | Median | Mean | SD  | Sum of ranks |       |       |
| BL                | 4.0        | 4.2  | 1.4 | 462.0         | 6.0    | 5.8  | 1.6 | 813.0         | −3.4052 | 0.0007*|
| Immediate after   | 2.0        | 1.6  | 1.2 | 398.5         | 4.0    | 3.4  | 1.1 | 876.5         | −4.6373 | 0.00001*|
| 1 week            | 0.0        | 0.4  | 0.6 | 353.0         | 2.0    | 2.2  | 0.7 | 922.0         | −5.5201 | 0.00001*|
| BL-immediate after| 2.0        | 2.6  | 1.4 | 640.5         | 2.0    | 2.4  | 1.2 | 634.5         | −0.0582 | 0.9536  |
| BL-1 week         | 4.0        | 3.8  | 1.6 | 654.5         | 3.0    | 3.6  | 1.5 | 620.5         | −0.3298 | 0.7415  |
| Immediate after‑1 week | 1.0    | 1.2  | 1.1 | 619.0         | 1.0    | 1.2  | 0.7 | 656.0         | −0.3590 | 0.7196  |

*P<0.05. SD: Standard deviation, BL: Baseline

### Table 2: Comparison of Clinpro and MI varnish with respect to air test scores at baseline, immediately after and 1 week by Mann–Whitney U-test

| Time points       | MI varnish | Clinpro varnish | Z    | P     |
|-------------------|------------|-----------------|------|-------|
|                   | Median     | Mean | SD  | Sum of ranks | Median | Mean | SD  | Sum of ranks |       |       |
| BL                | 4.0        | 3.9  | 1.3 | 444.0         | 5.0    | 5.6  | 1.5 | 831.0         | −3.7545 | 0.0002*|
| Immediate after   | 1.0        | 1.1  | 1.1 | 371.0         | 4.0    | 3.4  | 1.1 | 904.0         | −5.1709 | 0.00001*|
| 1 week            | 0.0        | 0.2  | 0.4 | 342.5         | 2.0    | 2.2  | 0.7 | 932.5         | −5.7238 | 0.00001*|
| BL-immediate after| 3.0        | 2.8  | 1.5 | 707.5         | 2.0    | 2.2  | 1.3 | 567.5         | −1.3582 | 0.1744  |
| BL-1 week         | 4.0        | 3.7  | 1.4 | 673.5         | 3.0    | 3.4  | 1.5 | 601.5         | −0.6985 | 0.4849  |
| Immediate after‑1 week | 1.0    | 0.9  | 0.9 | 562.0         | 1.0    | 1.2  | 0.8 | 713.0         | −1.4649 | 0.1430  |

* significant. SD: Standard deviation, BL: Baseline
the treatments used, with sensitivity returning soon after treatment. Furthermore, the amount of clinical time devoted to the management of this problem is of utmost importance. The cost-effectiveness of materials used here when compared to that of other forms of professional intervention is considerable due to the minimum clinical time required and the comparatively low cost of the material. [25]

The authors recognize that this is a 1-week follow-up study, so studies with a longer term of observation and good design are required to help to determine how often the varnish has to be reapplied. In addition, the authors also recognize that restorative materials still have a role to play in the management of dentinal hypersensitivity particularly in cases where varnishes and desensitizing agents have been ineffective or their benefits are short lived but again further research is needed.

CONCLUSION

Although, both MI and Clinpro Varnish show decrease in dentinal hypersensitivity, going by the statistics, it has to stated here that MI Varnish is a better treatment option when compared to Clinpro XT Varnish.

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Conflicts of interest
There are no conflicts of interest.

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