COMPARATIVE EVALUATION OF DESENSITIZING EFFECTIVENESS BETWEEN TWO TOOTHPASTES

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ABSTRACT

Many compounds contained in dentifrices have been shown to be effective in the management of dentin hypersensitivity. None of these remedies, however, works predictably. The purpose of this clinical trial was to test the desensitizing effectiveness of two dentifrices over a six-week period. Eighteen subjects, ages 18 to 68 were recruited into the study. Verbal informed consents were obtained.

These subjects were randomly assigned to two experimental groups to use either a strontium chloride dentifrice or a sodium monofluorophosphate dentifrice. Chi-square analysis was used to determine statistical significant difference. The desensitizing effect of sodium monofluorophosphate dentifrice was better, in percentage improvement, than strontium chloride, though not statistically significant.

KEYWORDS: Dentin, Hypersensitivity, Dentifrice, Strontium chloride, Sodium monofluorophosphate

INTRODUCTION

The greatest problem regarding the development of dentin desensitizing agents is that the mechanism of dentin hypersensitivity is not clearly understood. Dentin hypersensitivity remains one of the most painful and least satisfactorily treated chronic problems of the teeth. Basically, there are four theories of sensitivity: The first proposes a direct stimulation of sensory nerve endings in dentin. The second proposes that odontoblasts and their processes in dentinal tubules are sensory cells that receive stimuli. The third theory proposes that nerve impulses are modulated by the release of certain polypeptides during pulp injury while the fourth theory proposes that pulp nerves are stimulated by hydrodynamic mechanism. Evidence for the stimulation of pulp nerve fibres by a hydrodynamic mechanism appears to be the most likely mechanism.

The rationale of desensitization procedures is not fully understood. Some techniques are tubule occluding while some are protein precipitants. Majority of the protein precipitants are obsolete, for example, ammoniacal silver nitrate and formalin. Several empirical treatments have also been used in the past to decrease or eliminate dentin sensitivity. Regrettably, none of these remedies, works as predicted. There have been many conflicting reports ranging from moderately effective to ineffective desensitization concerning treatment with strontium chloride, which is the active ingredient in a commercially available dentifrice specifically for dentinal hypersensitivity. On the other hand, reports from studies, with Sodium monofluorophosphate, a common constituent of most of the commercially available dentifrices, showed that all the subjects found more relief than controls (up to 58.5%).

The purpose of this clinical study was to compare directly, the desensitizing effect of a sodium monofluorophosphate dentifrice that is specifically not known for desensitization to a commercially available strontium chloride dentifrice that is supposed to be specifically known for desensitization.

MATERIALS AND METHODS

The subjects comprised of patients referred to the periodontology clinic of the University College Hospital complaining of dentinal hypersensitivity. The criteria for participant selection were dentinal hypersensitivity to mechanical stimuli, no history of treatment for hypersensitivity for at least 6 months, willingness to participate, no caries, no hairline fractures on the teeth and no essential dental treatment during the examination period. Informed consent was obtained from all the subjects after the procedure had been fully explained to them.

The participants received a thorough clinical examination during which the precise location and number of hypersensitive tooth surfaces were recorded. This was determined by a light stroke of a dental explorer along the occlusal and cervical areas of all teeth present. This procedure is remarkably accurate and reproducible. With this technique, the examiner can return to a precise location in future examinations and can then determine whether that particular surface is still sensitive. The examiner (MOA) applied the same degree of pressure when probing the teeth. Subsequent examinations were conducted in an identical manner by the same examiner.
The subjects were randomly assigned two experimental
groups to use either a strontium chloride dentifrice or a sodium
monofluorophosphate. The subjects were balanced (nine in each
group) with 28 hypersensitive sites in one group and thirty three
hypersensitive sites in the other group. The subjects were given
no specific instructions regarding method or frequency of
toothbrushing, hence, they continued to brush in their usual
manner.

The subjects were examined for hypersensitivity thrice during
the six weeks period of study; First, at the initial examination,
noting the sites and number of hypersensitive surfaces; secondly
at the end of the three weeks, noting the same surfaces and
recording presence or absence of hypersensitivity; and at the
end of six weeks, when the same surfaces were again scored for
the presence or absence of hypersensitivity. For statistical
accuracy, scores for all surfaces were recorded as present or
absent.

The study did not commence at the same time for all the
subjects and the examiner was blinded as to which group a
particular subject belong. Conscious effort was made by the
examiner not to ask the subject which dentifrice he/she was placed
on; and the type of dentifrice was not entered in the casenote.
The subjects names, casenote numbers and groups were recorded in
a separate book.

The components of the two dentifrices are as follows:
Strontium chloride dentifrice - Strontium Chloride, Aqua,
Glycerin, Calcium Carbonate, Sorbitol, Hydroxyethyl cellulose,
Silica, Sodium methyl cocoyl Tairate, Aroma, PEG 40 Stearate,
Sodium Saccharin, Methyl paraben, Propyl paraben, C145430,
C17789.

Sodium monofluorophosphate dentifrice - Sodium
monofluorophosphate, Calcium glycerophosphate, Silica, SCMC,
Trisodium phosphate, Magnesium Sulphate, Glycerine, Sodium,
Laurylsulphate, Sorbitol.

RESULTS

There were nine subjects in each group. Group I subjects
(Strontium chloride) had a total of 28 hypersensitive sites while
Group 2 subjects (Sodium monofluorophosphate) had a total of
thirty three hypersensitive sites.

At the end of three weeks, there was no significant difference
in the responses to the two dentifrices. Only 3 sites (10.7%) in
Group I had relief of symptoms while only 4 (12.1%) in group 2
had relief of symptoms (Table I).

At the end of six weeks, it was possible to differentiate
individual responses to the desensitizing effects of the two
dentifrices, 13 sites (46.4%) of Group I subjects had relief while
23 sites (69.7%) of group 2 subjects had relief of symptoms (Table
2), even though these differences were not statistically
significant.

Comparisons were made using Fisher’s Exact and chi-square
tests on Epi-Info to determine statistical significant difference.
There was however a higher percentage of relief in Group 2
subjects.

The percentages of asymptomatic relief at 3 weeks when
compared to at 6 weeks was also significant. This indicates that
a certain length of time is required for dentifrices to act on

Table 1: Response to Desensitization at 3 weeks

<table>
<thead>
<tr>
<th>Treatment Group</th>
<th>Sensitive Surfaces at Baseline (n)</th>
<th>Sites with Relief (n)</th>
<th>% of Site with Relief</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>28</td>
<td>3</td>
<td>10.7</td>
</tr>
<tr>
<td>2</td>
<td>33</td>
<td>4</td>
<td>12.1</td>
</tr>
</tbody>
</table>

\[ X^2 = 0.05 \]
\[ P = 0.59 \]

Table 2: Response to Desensitization at 6 weeks

<table>
<thead>
<tr>
<th>Treatment Group</th>
<th>Sensitive Surfaces at Baseline (n)</th>
<th>Sites with Relief (n)</th>
<th>% of Site with Relief</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>28</td>
<td>13</td>
<td>46.4</td>
</tr>
<tr>
<td>2</td>
<td>33</td>
<td>23</td>
<td>69.7</td>
</tr>
</tbody>
</table>

\[ X^2 = 2.50 \]
\[ P = 0.114 \]

hypersensitive surfaces.

DISCUSSION

Various treatment modalities have claimed success in
relieving dentinal hypersensitivity, although at present, there
does not appear to be a universally accepted desensitizing agent.
Current opinion based on Brannstrom’s hydrodynamic theory would
suggest that following exposure of the dentin surface
(through attrition, abrasion, erosion or gingival recession),
the presence of open dentinal tubules, patent to the pulp, may be a
prerequisite for dentinal hypersensitivity. Any decrease in the
functional radius of the dentinal tubules should greatly reduce
the rate of fluid flow, thus reducing dentinal hypersensitivity.
Fluid flow through these tubules should obey Poiseuille’s law and
therefore should vary with the fourth power of the radius of the
tubules.

The concept of tubule occlusion as a method of dentin
desensitization, therefore, is a logical conclusion from the
hydrodynamic theory. It has been concluded that many
dentifrices and agents used clinically to desensitize dentin, are
also effective in reducing dentin permeability. This tends to
support the hydrodynamic theory. The mode of action of strontium
chloride is in form of bicoloidal binding and blocking action with
inorganic material of tooth structure with the Strontium ion
stimulating secondary dentin formation. This, leads to a
modification of transmission of neural impulses or stimulation of
recalification.

Sodium monofluorophosphate leads to occlusion of exposed
dentinal tubules by the release of fluoride ions which in turn
replaces the hydroxyl ions of hydroxyapatite crystals in the
dentine to form fluorapatite which occludes the dentinal
tubules. Despite the controversy that surrounds the exact mechanism of transmission, occlusion of the dentinal tubules is definitely indicated.

The two dentifrices used in this study had the ability to reduce the number of sensitive surfaces, though the effect of one was not evident at the end of 3 weeks (Table 1). This shows that the occluding properties of the constituents is a gradual and slow process. The effect was however noticeable at 6 weeks, though not statistically significant. The percentage relief of symptoms was higher in the group with sodium monofluorophosphate. Seventy percent of surfaces had relief in group 2 subjects as compared to 46 percent of subjects in group I. It may be concluded that the occluding properties of sodium monofluorophosphate is better than that of strontium chloride. The toothpaste constituents other than the active ingredients may also have played a part in the occluding properties of the two dentifrices. Constituents like glycerin, calcium glycerophosphate, calcium carbonate, silica, magnesium sulphate and sorbitol along with a modifying effect of saliva may occlude tubules and thus lead to desensitization.

CONCLUSION

In conclusion, a commercially available dentifrice containing sodium monofluorophosphate as its active ingredient demonstrated significant effectiveness in the treatment of dentin hypersensitivity over a 6 week period. A strontium chloride containing dentifrices was also effective though to a lesser degree. When treating dentinal hypersensitivity with a home based dentifrice, a considerable length of time of at least six weeks should be allowed so as to get desired results.

Above all, prevention and treatment of dentinal hypersensitivity require a greater understanding of the aetiology and mechanisms of action of the different treatments. If sensitivity is caused by hydrodynamic fluid movement, then therapeutic agents that decrease dentin permeability should be recommended. In addition, clinicians should be aware of clinical procedures which might result into dentin hypersensitivity.

REFERENCES


