

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 teeth¹. Basically, there are four theories of sensitivity². The first proposes a direct stimulation of sensory nerve endings in dentin^{2,3}. 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^{2,3,4}. Evidence for the stimulation of pulp nerve fibres by a hydrodynamic mechanism appears to be the most likely mechanism⁴.

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^{3,5,6}. Regrettably, none of these remedies, works as predicted^{3,5,6}. There have been many conflicting reports ranging from moderately effective to ineffective desensitization concerning treatment with strontium chloride^{2,3,7}, which is the active ingredient in a commercially available dentifrice specifically for dentinal hypersensitivity. On the other hand, reports from studies^{2,3}, 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%)².

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 reproducible⁷. 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.

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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, C177891.

Sodium monofluorophosphate dentifrice - Sodium monofluorophosphate, Calcium glycerophosphate, Silica, SMC, 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

Treatment Group	Sensitive Surfaces at Baseline (n)	Sites with Relief (n)	% of Site with Relief
1	28	3	10.7
2	33	4	12.1

$$X^2 = 0.05$$

$$P = 0.59$$

Table 2: Response to Desensitization at 6 weeks

Treatment Group	Sensitive Surfaces at Baseline (n)	Sites with Relief (n)	% of Site with Relief
1	28	13	46.4
2	33	23	69.7

$$X^2 = 2.50$$

$$P = 0.114$$

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 agent⁹. Current opinion based on Brannstrom's hydrodynamic theory¹⁰ 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 hypersensitivity⁴. Fluid flow through these tubules should obey Poiseuille's law and therefore should vary with the fourth power of the radius of the tubules⁴.

The concept of tubule occlusion as a method of dentin desensitization, therefore, is a logical conclusion from the hydrodynamic theory⁹. It has been concluded that many dentifrices and agents used clinically to desensitize dentin, are also effective in reducing dentin permeability^{4,9}. This tends to support the hydrodynamic theory. The mode of action of strontium chloride is in form of bicolloidal binding and blocking action with inorganic material of tooth structure with the Strontium ion stimulating secondary dentin formation². This, leads to a modification of transmission of neural impulses or stimulation of recalcification².

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 fluoroapatite which occludes the dentinal

tubules^{2,4}. 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 tubules³ 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.

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