

Comparison of Vantej and Dente 91 Toothpastes in the Management of Dentin Hypersensitivity: A Randomised Clinical Trial

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ABSTRACT

Introduction: Dentinal hypersensitivity is a prevalent and distressing dental condition characterised by acute, transient pain or discomfort arising from exposed dentin in response to external stimuli, such as variations in temperature, mechanical stimuli, or consumption of acidic or sweet foods. Dentinal Hypersensitivity (DH) impacts daily activities, such as eating, drinking, and oral hygiene practices. Dentifrices are commonly used in the treatment of hypersensitivity, as they relieve sensitivity by obstructing nerve pathways through the formation of compounds.

Aim: The aim of the study is to evaluate and compare the efficacy of two types of desensitising toothpastes, Vantej and Dente 91, in treating DH.

Materials and Methods: A randomised controlled clinical trial was conducted with 40 patients who had a minimum of two hypersensitive teeth. The clinical investigation took place in a dental set-up in Bhubaneswar, Odisha, from July to August 2022. The patients were randomly allocated to two groups (20 in each group) in a 1:1 ratio for the Vantej and Dente 91

groups. Over a four-week period, the patients were instructed to use the prescribed toothpaste twice daily. DH assessment techniques included a Verbal Response Scale (VRS), air blast stimulation, and cold stimulation, both at baseline and after the four-week duration. Statistical analyses were performed using the Mann-Whitney U test and Wilcoxon signed-rank test, with the significance level set at $p < 0.05$.

Results: The fourth-week scores compared to baseline scores for the verbal scale, air blast stimulus, and cold sensitivity methods in both groups showed a reduction in DH. In the inter group comparison, the Dente 91 group exhibited greater effectiveness compared to the Vantej group, with a significant reduction in VRS ($p=0.02$) and air blast stimulus ($p=0.01$), but not in cold sensitivity ($p=0.09$).

Conclusion: Both Vantej and Dente 91 toothpastes significantly reduced dentinal hypersensitivity. However, the percentage reduction was higher in the latter group, suggesting more effective management of DH. Dente 91 could be considered a promising alternative to the existing over-the-counter desensitising toothpastes.

Keywords: Dentin desensitising agents, Lactoferrin, Toothpastes

INTRODUCTION

Dentinal hypersensitivity is characterised by an excruciating response that occurs when the dentinal tubules are exposed to a stimulus. The stimulus may be in the form of thermal, tactile, chemical, evaporative, or osmotic stimuli. It is usually experienced as transient and acute pain but has been found to affect the quality of life [1]. It may or may not be connected to other non-carious dental issues, with the most common ones being hypersensitivity due to the loss of occlusal tooth structure, enamel caries, enamel erosion due to acid reflux or acidic beverage or tobacco consumption habits, bruxism, use of hard bristle toothbrushes, or recent dental treatments such as tooth whitening and crown placement.

The most accepted explanation for DH is the hydrodynamic theory, which was proposed by Brannstrom [2]. The theory proposes that hypersensitivity is the result of fluid movement in the dentinal tubules when subjected to the aforementioned stimuli. Hot stimuli result in an inward flow, while cold causes movement of fluid outwards. Blocking the open tubules in dentin or desensitising the nerves is the practical and preferred treatment option. It can be difficult for a dentist to recommend the best dental product because of the availability of many products in the market [3].

A commercially available toothpaste, Vantej, which costs approximately Rs 350 for 100 gm [4], predominantly contains Calcium Sodium Phosphosilicate (CSPS). It alleviates DH by covering or occluding the exposed dentinal tubules. This causes the release of calcium and phosphate ions, which transform over time into mineral hydroxyl-

carbonate apatite. This layer physically reduces the permeability of the dentin [Table/Fig-1] [5].

Material	Composition
Vantej	Calcium Sodium, Phosphosilicate, PEG400, Glycerine, Sodium lauryl sulphate, Titanium dioxide, carbomer, Pottasium Acesulfane, flavour
Dente 91	Nanohydroxyapatite, Lactoferrin, Xylitol, Aqua, Sorbitol, Silica, Glycerine, PEG8

[Table/Fig-1]: Desensitising agents used in toothpastes.

Recently, a lactoferrin-based toothpaste called Dente 91, which contains nanohydroxy apatite crystals naturally found in the human body, has been launched. These crystals, the key active ingredient, provide a protective effect [Table/Fig-1]. However, due to wear and tear, the outermost enamel loses these crystals, which can be remineralised by the use of Dente 91, potentially preventing hypersensitivity. Therefore, Dente 91 presents itself as a natural and more affordable alternative, costing around Rs 200 for a 100g pack [6]. Despite these features, the clinical effectiveness of Dente 91 in improving dentine hypersensitivity is poorly understood. In a study conducted by Gudipani RK et al., in 2014, the antimicrobial efficacy of a toothpaste containing lactoferrin, lysozyme, and lactoperoxidase was compared with a 500 ppm fluoride toothpaste and a non-fluoridated toothpaste in children with Severe Early Childhood Caries (S-ECC). The results showed that the toothpaste containing lactoferrin, lysozyme, and lactoperoxidase significantly reduced the salivary levels of mutans Streptococci and *L. acidophilus* in children with S-ECC [5]. While several studies have explored the effects of

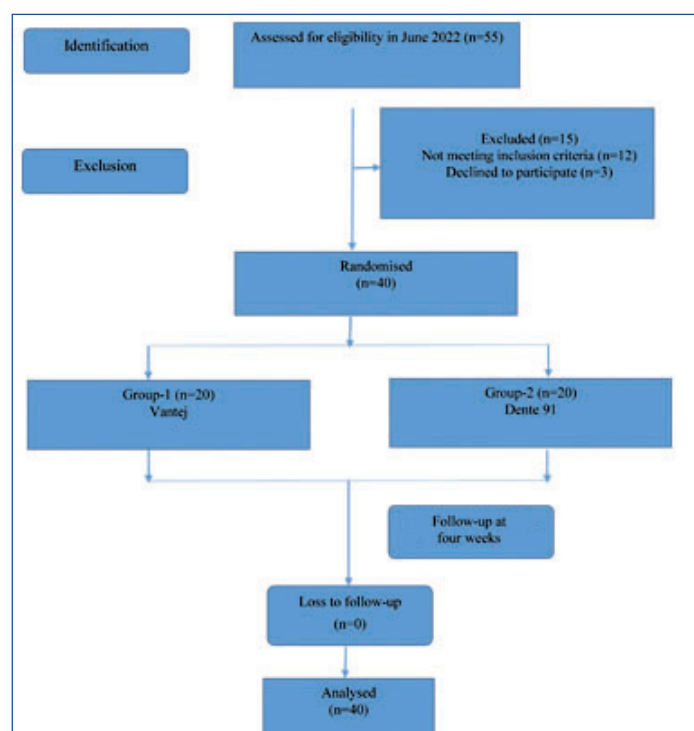
lactoferrin-based interventions on early childhood caries and oral care [7-9], there is a noticeable gap in the literature regarding the impact of lactoferrin on dentinal hypersensitivity in adults. Therefore, this study was conducted to address this research gap and provide insight into the efficacy of two commercially available desensitising toothpaste formulations, Dente 91 and Vantej, in alleviating dentinal hypersensitivity in an adult population.

MATERIALS AND METHODS

This randomised clinical trial was conducted among patients who sought dental treatment in the Outpatient Department (OPD). It utilised a prospective, exploratory, comparative strategy with a follow-up period of four weeks. The clinical investigation took place in a dental set-up in Bhubaneswar, Odisha, from July to August 2022. The researchers evaluating the outcomes were blinded to the intervention. The study protocol was reviewed and approved by the Institutional Ethical Committee (Ref No SOA/IDS/2023/1). Voluntary informed consent was obtained from all study participants, and the study was conducted in conformity with the ethical standards of the 1964 Declaration of Helsinki and its subsequent amendments. Utmost care was taken to maintain the confidentiality of the data.

Inclusion and exclusion criteria: This study included subjects aged between 20 and 55 years who had atleast two hypersensitive teeth and a minimum score of one on the verbal reaction scale, cold air sensitivity scale, and airblast sensitivity scale [1,10,11]. Patients with deep pockets (PPD >5 mm), dentinal caries, cracked or fractured teeth, teeth with pulpal involvement, patients already receiving desensitising therapy, teeth with congenital enamel/dentin defects, patients allergic to any of the toothpaste ingredients, and patients undergoing orthodontic treatment were excluded from the study.

Sample size and sampling procedure: [Table/Fig-2] presents a graphical representation of the study and the chronology of events. A sample size of 40 patients was determined based on 5% accuracy, an alpha of 0.05 (95% confidence interval), one-sided significance to detect a difference of 0.85, and a power of 80% [12]. A total of 55 patients reporting to the OPD constituted the study sample, of which 40 patients were included based on the inclusion criteria. The final sample size of 40 patients was randomly assigned using a coin toss method into group 1 (n=20): subjects using toothpaste containing lactoferrin and nanohydroxy apatite crystals (Dente 91 Toothpaste),



[Table/Fig-2]: Flow chart (graphical representation) of the selection of study participants.

and group 2 (n=20): subjects using toothpaste containing CSPS (Vantej Toothpaste).

Data collection: Oral prophylaxis was performed on the recruited patients. The severity of DH was measured using the criteria mentioned below at baseline and at the end of four weeks, as most studies have found optimal results within this time frame [1,10,13]. A comparative evaluation was carried out by an investigator who was unaware of the group allocation, both within each group and between groups. The evaluation included the following:

- (i) Verbal Response Scale (VRS)
- (ii) Cold Sensitivity Examination (CS)
- (iii) Air blast sensitivity Examination (AS)

Verbal Response Scale (VRS): The patient's verbal response was measured using an explorer at the affected sites, assigning numerical values from 0 to 4 as mentioned in [Table/Fig-3] [1].

Score	Level of pain intensity
0	No pain
1	Mild pain
2	Moderate pain
3	Severe pain
4	Extremely intense pain

[Table/Fig-3]: Verbal Response Scale (VRS) rating.

Air blast: After recording the VRS, there was a five-minute gap before exposing the tooth surface to air from a typical dental unit air syringe for one second. The response was recorded based on the criteria given by Schiff et al., (1994) [10,11].

- 0- The tooth or individual does not react to the stimulation of air.
- 1- The tooth or subject reacts to an air stimulus, but the subject does not ask for the stimulus to stop.
- 2- The tooth or subject reacts to an air stimulation by requesting that it stop or by moving away from it.
- 3- The tooth or individual reacts to an air stimulus, feels the stimulus to be painful, and asks for the stimulation to stop.

Cold sensitivity examination: This test was performed using a cold stick or frozen syringe to determine the tooth's level of sensitivity. Cotton rolls were used to isolate the tooth, and then a syringe with frozen water was used to inject a few drops of extremely cold water onto the tooth surface. The Schiff Cold Air Sensitivity Scale was used to evaluate the cold stimulus, ranging between 0 to 3 [10].

- 0- The tooth or individual does not react to the stimulation of cold.
- 1- The tooth or subject reacts to a cold stimulus, but the subject does not ask for the stimulus to stop.
- 2- The tooth or subject reacts to cold stimulation by requesting that it stop or by moving away from it.
- 3- The tooth or individual reacts to a cold stimulus, feels the stimulus to be painful, and asks for the stimulation to stop.

Patients were instructed to brush twice a day with the prescribed toothpaste only, refraining from using any other oral hygiene aids until the final follow-up after four weeks. The investigator then repeated the evaluation of all parameters during the recall.

STATISTICAL ANALYSIS

IBM's Statistical Package for Social Sciences (SPSS) version 20 was used to collect and analyse the data. Calculations of percentages, means, and standard deviations were performed as part of the descriptive statistics. The non-parametric distribution was assessed using the Shapiro-Wilk normality test. Intra group comparisons were analysed using the Wilcoxon signed-rank test, and the effectiveness of the two dentrifices was compared using the Mann-Whitney U test. All of the aforementioned statistical tests were conducted with a significance level of p-value set at 5%.

RESULTS

A total of 40 patients (15 men and 25 women) participated in all clinical examinations and were followed-up for a period of four weeks. At baseline, no significant differences were found in DH (Mann-Whitney U test) for both groups, in terms of the three measures (VRS, air blast, and cold sensitivity) employed to measure hypersensitivity ($p>0.05$) [Table/Fig-4].

Outcomes	Dente 91 (Mean±SD)	Vantej (Mean±SD)	p-value
VRS	1.75±0.51	1.85±0.41	0.06
AB	1.65±0.5	1.60±0.4	0.08
CS	1.55±0.5	1.50±0.4	0.09

[Table/Fig-4]: Intergroup comparison between groups at baseline. Mann-Whitney U test; VRS: Verbal response scale; AB: Air blast; CS: Cold sensitivity

The Wilcoxon signed-rank test was performed for each group to compare DH at baseline and after four weeks. The mean scores in both groups were found to decline ($p=0.001$) [Table/Fig-5]. The percentage reduction in sensitivity scores for Dente 91 in the VRS improved by 74.3%, 66.7% for the air blast stimulus, and 64.5% for the cold sensitivity stimulus. For the Vantej group, improvement in verbal scale response was 56.7%, 50% for the air blast stimulus, and 46.6% for the cold stimulus, respectively.

Clinical parameter Dente 91 group	VRS (Mean±SD)	AB (Mean±SD)	CS (Mean±SD)
Baseline	1.75±0.51	1.65±0.5	1.55±0.5
4 weeks	0.45±0.51	0.55±0.6	0.55±0.6
Percentage analysis	74.3%	66.7%	64.5%
p-value	0.001*	0.001*	0.001*
Clinical parameter Vantej group	VRS (Mean±SD)	AB (Mean±SD)	CS (Mean±SD)
Baseline	1.85±0.60	1.60±0.4	1.50±0.4
4 weeks	0.80±0.41	0.80±0.4	0.80±0.4
Percentage analysis	56.7%	50%	46.6%
p-value	0.001*	0.001*	0.001*

[Table/Fig-5]: Comparison of Verbal Response Scale (VRS), air blast and cold sensitivity 349 scores in the two groups.

* $p<0.05$ =statistically significant, Wilcoxon-signed Rank Test

SD: Standard deviation; VRS: Verbal response scale; AB: Air blast; CS: Cold sensitivity

Using the Mann-Whitney U test, an inter group comparison was performed to evaluate the change in scores at the end of four weeks. A statistical difference was observed between the groups at the end of four weeks regarding verbal scale response (p -value=0.02) and Air Blast Stimulus (p -value=0.01). However, there was no significant difference between the groups with respect to the cold stimulus (p -value=0.09) [Table/Fig-6].

Outcomes	Dente 91 (Mean±SD)	Vantej (Mean±SD)	p-value
VRS	0.45±0.51	0.80±0.41	0.02*
AB	0.55±0.6	0.80±0.4	0.01*
CS	0.55±0.6	0.80±0.4	0.09

[Table/Fig-6]: Intergroup comparison between groups at four weeks.

* $p<0.05$ =statistically significant, Mann-Whitney U test

VRS: Verbal response scale; AB: Air blast; CS: Cold sensitivity

DISCUSSION

Dentinal hypersensitivity is one of the most common complaints that patients report to dentists, as it often affects their quality of life. This study compares the efficacy of two types of desensitising toothpastes, Vantej and Dente 91, in treating dentinal hypersensitivity. Both toothpastes were found to improve scores after four weeks ($p=0.001$), with Dente 91 performing better in reducing both VRS and AB but not CS.

Vantej contains CSPS, which plays a crucial role in reducing hypersensitivity. It forms a protective layer similar to hydroxyapatite

on the exposed dentin, occluding the dentinal tubules and blocking external stimuli when exposed to saliva. Additionally, CSPS contributes to the remineralisation process, strengthening the tooth structure and alleviating sensitivity [13-15]. However, these formulations and mechanisms involve chemical procedures.

On the other hand, Dente 91 provides naturally protective oral health benefits as it is made up of natural ingredients. The major constituents are lactoferrin and nanohydroxyapatite crystals, mentioned in [Table/Fig-1]. Dente 91 not only has remineralising properties but also exhibits antifungal and biocompatible properties. Lactoferrin has a high capacity to bind to iron, snatching it away from harmful microorganisms and destroying their structure by depriving them of essential nutrients. This, in turn, prevents the growth of harmful bacteria. Salivary lactoferrin plays a crucial role in protection the enamel and other oral microbes, promoting good oral hygiene [6]. Nanohydroxyapatite has been shown to penetrate dentinal tubules better, thereby reducing dentinal hypersensitivity [15].

A study conducted by Rao A et al., showed that Vantej reduced hypersensitivity after a 15-day trial compared with Colgate [14]. However, in this study, Dente 91 showed better results than Vantej. Dente 91 contains lactoferrin, which, along with hydroxyapatite, provides an added benefit of antimicrobial effect and remineralising properties. Studies examining the effectiveness of commercially available desensitising toothpastes containing Novamin and Pro-Argin in reducing dentin hypersensitivity were undertaken by Penmesta GS et al., and Pradeep AR et al., [16,17]. When compared to a dentifrice with Pro-Argin technology, the desensitising toothpaste with Novamin demonstrated superior reduction in sensitivity. Docimo et al., tested three commercially available toothpastes for their ability to reduce dentin hypersensitivity: Colgate Sensitive Pro-Relief Toothpaste with arginine technology, Sensodyne Rapid Relief Toothpaste with Novamin technology, and Crest Cavity Protection Toothpaste. At the end of eight weeks, it was determined that the toothpaste with arginine technology, used twice daily, significantly lowered dentin hypersensitivity and was more successful in doing so than the toothpaste with Novamin technology and the control [18].

In some studies, it has been observed that the dentinal tubules are either plugged with ionic salts or experience inward diffusion of potassium, which helps reduce nerve excitability and hypersensitivity [19,20]. In other studies, sealing and occlusion of open dentinal tubules have been observed, resulting in reduced hypersensitivity. Hydroxyapatite crystals can efficiently penetrate dentin tubules and obliterate them within 10 minutes, thus regenerating the mineralised layer of dentin [20]. Combining hydroxyapatite and lactoferrin may offer an alternative approach to controlling dentin hypersensitivity and caries; however, further research is required to assess the relative effectiveness of each active ingredient and its role in the outcome.

Limitation(s)

The study did not compare these agents to a placebo; instead, we compared two different dentifrices that claimed to reduce dentine sensitivity. The outcome of the study was dependent on patient compliance. Lastly, as the study was of relatively of short duration (4 weeks), it may restrict the ability to capture long-term effects or observe sustained changes in the outcome.

CONCLUSION(S)

This study demonstrates that Dente 91 can effectively reduce hypersensitivity when compared to the chemical-based composition of Vantej. Hence, it can be used as an alternative to reduce hypersensitivity with minimal to no side effects, as it is comprised of natural ingredients that aid in remineralisation compared to Vantej.

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