ASSESSMENT OF THE EFFICACY OF CASEIN VERSUS MILK FOR THE TREATMENT OF DENTINE HYPERSENSITIVITY: A RANDOMIZED CONTROLLED TRIAL

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ABSTRACT

Background:

Dentine hypersensitivity (DH) is a prevalent clinical condition causing sharp pain in response to various stimuli. Casein, a milk-derived protein commercially available as Tooth Mousse, has shown promise in DH treatment. This study compares the efficacy of casein-containing Tooth Mousse with commercially available cow milk in reducing DH.

Methods:

A randomized controlled trial was conducted from July to December 2018 at the Department of Operative Dentistry, Hamdard University Dental Hospital, Karachi. Using non-probability consecutive sampling, 102 patients were enrolled and randomized into two groups. Group A (n=52) used GC Tooth Mousse topically once daily before bedtime, and Group B (n=50) rinsed with 30 ml cow milk five times daily for 15 days. Pain response to thermal stimuli was recorded using a 10-cm Visual Analogue Scale (VAS). Efficacy was defined as a reduction in VAS score

by at least 2 points. Statistical analysis was performed using SPSS version 22.0 with a chi-square test ($p \leq 0.05$).

Results:

Mean age of participants was 55.25 ± 6.92 years, with 63.7% females. Baseline mean VAS scores were 7.52 ± 1.32 for Group A and 7.54 ± 1.34 for Group B. Post-treatment scores were 5.22 and 5.24, respectively. A total of 46 (88.5%) patients in Group A and 44 (88.0%) in Group B reported effective relief. The difference in efficacy between the two groups was statistically insignificant ($p = 0.942$).

Conclusion:

Cow milk demonstrated comparable efficacy to GC Tooth Mousse in reducing dentine hypersensitivity. Given its affordability and accessibility, milk presents a viable home-based alternative for managing DH.

Keywords: Dentine hypersensitivity, Casein, CPP-ACP, Tooth Mousse, Milk rinse

INTRODUCTION:

Dentine hypersensitivity (DH) is defined as a short, sharp pain originating from exposed dentine in response to thermal, tactile, osmotic, or chemical stimuli, in the absence of any other dental pathology. [(1)] Dentine hypersensitivity (DH) is a prevalent clinical condition that can significantly impact an individual's quality of life by causing discomfort during routine activities such as eating, drinking, and oral hygiene practices .[(2)]The global prevalence of DH varies widely, with a study conducted in Pakistan reporting a prevalence of 36.4%, predominantly affecting females and individuals aged between 25 and 34 years.[(3)] Clinically, DH most commonly involves the cervical regions of canines, premolars, and molars, where enamel loss or gingival recession may lead to dentine exposure.[(4)]

The most accepted pathophysiological explanation is Brännström's Hydrodynamic Theory, which suggests that fluid movement within dentinal tubules triggers pain via A-delta nerve fibers.[(5)] Multiple treatment modalities exist, from desensitizing toothpastes to in-office procedures, yet no gold standard has emerged.[(6)]

Various materials have been developed to manage DH, primarily by either occluding the dentinal tubules or by altering the neural response. These include potassium nitrate, which interferes with nerve transmission; stannous fluoride and strontium salts, which aid in tubule occlusion; arginine-calcium carbonate complexes; and bioactive glasses such as NovaMin, which promote remineralization. [(7)] Resin-based bonding agents, varnishes, and lasers are also used in clinical settings for more persistent cases. Despite the variety of available options, their efficacy may vary depending on the severity of sensitivity, patient compliance, and the material's mechanism of action.[(8)]

A novel approach involves the use of casein phosphopeptide-amorphous calcium phosphate (CPP-ACP), commercially known as Tooth Mousse. Casein, the main protein in milk, has been found to stabilize calcium and phosphate ions, promoting enamel remineralization. [(9, 10)]

Milk, a natural and readily available source of casein, presents a potentially affordable and practical alternative for the management of DH. Despite its biochemical similarity to CPP-ACP, limited research has been conducted to compare the clinical efficacy of milk with that of

commercially available casein-based products.[11] Exploring this comparison could offer a cost-effective, natural approach to DH treatment, particularly in populations where access to dental care products is constrained. This study evaluates whether milk, a natural source of casein, can be as effective as Tooth Mousse in treating DH.

This study seeks to bridge that gap by evaluating and comparing the efficacy of milk and Tooth Mousse in reducing dentine hypersensitivity. The findings may open avenues for integrating natural, dietary-based strategies into preventive and therapeutic dental care, promoting sustainable oral health solutions globally.

MATERIALS AND METHODS

Study Design and Setting:

A randomized controlled trial was conducted over six months from July to December 2018 at Hamdard University Dental Hospital, Karachi. Ethical approval was obtained from the institutional review board.

Sample Size and Participants:

Using the WHO sample size calculator (95% confidence interval, 80% power), 102 patients were selected based on inclusion criteria. Participants aged 30–65 years with at least two sensitive teeth (VAS score ≥2) and buccal or cervical lesions (TWI score 2 or 3) were included. Patients with caries, fractures, restorations, pulpitis, allergies, systemic diseases affecting pain perception, or non-consenting individuals were excluded.

Randomization and Interventions:

Participants were randomly assigned into two groups using a computer-generated table:

Group A (Tooth Mousse): Applied GC Tooth Mousse nightly on sensitive teeth using a clean finger.

Group B (Milk): Rinsed with 30 ml cow milk at room temperature, five times daily for 15 days.

Data collection:

Phase I:

At first appointment each patient was given instructions to brush using Bass technique with a soft bristled brush along with a nonmedicated toothpaste. Use of any medicated toothpaste and desensitizing agent was asked to be discontinued and was given a period of 1 week to allow for washout of any desensitizing effects. Each patient received non surgical prophylaxis manual scaling to standardized primary preoperative clinical condition.

Phase II:

Isolation was achieved with cotton rolls and cotton pellets. Scoring of sensitivity was done using a Visual Analog Scale. Ice sticks were used for stimulation and placed on facial surface for 5 seconds or long enough only to generate a response. These scores were recorded for every patient as preoperative sensitivity score.

Phase III:

Members of GA were given written and verbal instruction regarding Tooth Mousse application using clean finger to smear it across labial surface of sensitive teeth each night. [12] Participants of GB were also given instructions to rinse their oral cavity with any commercially available cow milk at room temperature to be done five times per day for 5 minutes till 15 days.[13] Patients were advised to refrain from drinking or eating for 30 minutes after application of products. For record keeping and compliance purpose patients were asked to maintain a chart.

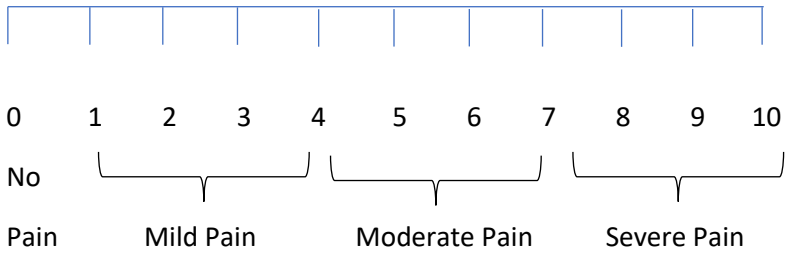
Phase IV:

Follow up was maintained through telephone during study. Postoperative scores on VAS scale was done 15 days later to thermal stimulation and results were recorded in the same manner as

preoperative scores. A reduction in severity of sensitivity by two score was considered to be effective for each group.

Assessment tool:

Visual Analogue Scale [14]



Preoperative and postoperative sensitivity scores were recorded using visual analogue scale which is a 10 cm horizontal line with words describing intensity of pain at each end. Patients were asked to place a mark on this line in response to stimuli. Scores were categorized as mild (1-3), moderate (4-7) and severe (8-10).

STATISTICAL ANALYSIS:

The data was entered and analysed using SPSS Version22 software. Mean±SD was calculated for age and baseline score. Frequency and percentage were calculated for gender, severity of dentin hypersensitivity, efficacy and diabetes mellitus. Comparison of efficacy on both groups was done by using chi square test with significance level of p-value=<0.05. Effect modifiers age, gender, severity of dentin hypersensitivity and diabetes was controlled through stratification. Post stratification, chi square test was applied by taking p=<0.05 as significant.

RESULTS:

Mean age of patients included was 55.25 years± 6.92 with 63.7% female and 36.3% male. The preoperative assessment of dentine hypersensitivity was scored as mild, moderate and severe. Table 1 illustrates the frequency of each category. The initial mean score of sensitivity experienced

by patients in group A was 7.519±1.320 and mean score of group B was found to be 7.540±1.343. No statistically proven difference was witnessed between these groups.

TABLE I: FREQUENCY AND PERCENTAGE OF PRE

Sensitivity	Mild	Moderate	Severe
Frequency	2	24	76
Percent	2%	23.5%	74.5%

TABLE II: PRE-OPERATIVE SENSITIVITY SCORE ON STIMULATION (VISUAL ANALOGUE SCALE)

Group	Moderate (5)	Moderate (6)	Moderate (7)	Severe (8)	Severe (9)	Severe (10)	Total	Mean	SD
Tooth Mousse (GA)	4	2	29	1	12	4	52	7.519	1.320
Milk (GB)	4	2	27	1	12	4	50	7.540	1.343

After 15 days of product application the mean of VAS score postoperatively was recorded again and any reduction in sensitivity by 2 score was considered effective. The mean of post operative score was found to be 5.22 and 5.24 respectively for Group A and Group B. 46 patients scored the product as effective in group A for Tooth Mousse whereas 44 patients were evaluated to be effective for milk as seen by reduction in score. Summary of pre and post operative VAS score of sensitivity for Group A and Group B and their efficacy is given in Table 1 which was found to be statistically not significant (p value 0.942).

TABLE III: VAS PATIENT RESPONSE AFTER 15 DAYS AND EFFICACY OF THE TWO GROUPS

Group	No pain (0)	Mild (1-3)	Moderate (4-7)	Severe (8-10)	Total	Mean	Efficacy		p value
							Yes	No	
Tooth Mousse (GA)	0	4	47	1	52	5.22	46	6	0.942
Milk(GB)	0	3	47	0	50	5.24	44	6	

Age was stratified as below 55 and above 55 and the p value determined was 0.61 and 1.00 respectively. This showed that no significant difference was found among age groups however hypersensitivity was more prevalent and more severe in elderly. Among males and females, the p value was found to be 0.13 and 0.65 respectively. It was noticed that females were more strictly adherent to the treatment and gender had no effect on treatment outcome. Presence of diabetes mellitus was not found to affect any treatment. Dentine hypersensitivity was stratified into groups of score $\leq$7 and $\geq$7 on VRS scale. No significance was found in these test groups.

DISCUSSION:

Dentin exposure usually results after loss of enamel or cementum at the root surface either after treatment or underlying dental and gingival diseases or physiologic wear and tear of the teeth. Once exposed dentin gets abraded, worn or erode more quickly than enamel[4, 13] Within the dentine, dentinal tubules run from the pulp to the outer dentinal surfaces. Among many theories Brannstrom's Hydrodynamic theory of fluid displacement within the dentinal tubules is the most accepted theory of dentinal hypersensitivity which states that the fluid movement within dentinal tubules stimulates the A-delta fibers resulting in well localized sharp pain perceived as dentine hypersensitivity. [13] [15]

Over the years many inoffice procedures or self-administered treatment modalities for dentine hypersensitivity with varying outcomes have been reported but none provide definite conclusion as to which treatment is superior. [16] Even a large number of published studies are not able to provide a gold standard of treatment or product for treatment of dentinal hypersensitivity. The purpose of this study was to compare the efficacy of tooth mousse versus milk for the treatment of dentine hypersensitivity and clinically evaluate the effectiveness of milk rinse a desensitizing agent. [17]

The mean age in this study was found to be 55.2+ 6.92. There were more females (63.7%) in the study as compared to males (36.3%).

One recent option for hypersensitivity is the use of CPP-ACP which was found to be effective among many clinical trials. [18] One such study was conducted in Pakistan where Tooth mousse was applied topically to the exposed dentin of 104 teeth by 16 patients. [12]A significant difference in effectiveness was found between the 4-weeks follow-up and base line levels evaluated for the pain response on VAS. Another research conducted in Multan, Pakistan proved the effectiveness of ACPCPP in treating dentin hypersensitivity against thermal stimuli($p=0.000$). [10]

Milk is a mixture of emulsions, colloids, molecular and ionic solutions. Milk has excellent buffering capacity with a pH of 6.7. It can resist a change in pH on addition of acid or alkali. With the fall of the pH of milk, the charge on the casein also falls and it precipitates.[19]

A study conducted in Jazan University to assess the problem of dentine hypersensitivity after non-surgical periodontal treatment and selection of cases for evaluation of commercially available milk at room temperature as mouth rinse for the treatment of dentinal hypersensitivity. They found a significant reduction of dentine hypersensitivity with probability by unpaired t-test as 0.0007 and 0.0001 at tenth and fifteenth day post periodontal treatment procedures respectively.[17]

The mean value predicts that majority of patients included in the current study had complain of moderate to severe sensitivity. Probability was calculated to be 0.592 ($p<0.05$) at day 15 and at 95% confidence interval which strongly rejected alternate hypothesis and suggested that Tooth mousse and milk both were equally effective in the treatment of DH with milk rinse. Therefore, it is evident from this study that at fifteenth day, the DH has reduced considerably for group B (88.0%) and only 12.0% cases were found to be not effective while at fifteenth day hypersensitivity cases from Group A patients were 88.5% effective and 11.5% were not effective.

Rinsing with milk may provide the rich bioavailability of calcium and phosphate which can aid in remineralization, acid buffer and reduce the acidic effect of plaque on tooth structure.

Milk rinse could be an effective, suitable, cheaper, fast acting, easily available and home use substitute for dentine hypersensitivity. Thus, the results of this study suggested and indicated that for the treatment of dentine hypersensitivity, rinsing with milk is equally effective. This study clearly establishes the desensitizing therapeutic benefit of milk rinsing.[20]

Further studies are required to know the mechanism of milk rinse in prevention and treatment of dentine hypersensitivity. There are no other comparable studies available for milk rinse in the treatment of dentine hypersensitivity.

CONCLUSION:

The effectiveness among both groups to treat hypersensitivity was found to be statistically non significant. Therefore it was safe to conclude that milk can be used as a cheap alternative to tooth mousse for treatment of dentine hypersensitivity.

Ethical Permission: Hamdard University Karachi ERC letter No.

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Data Sharing Statement: The corresponding author can provide the data proving the findings of this study on request. Privacy or ethical restrictions bound us from sharing the data publically.

Author Contributions:

Dr. Shafaq Iqbal Sarim: Study conceptualization and design, Literature review, Statistical analysis, Manuscript drafting and final editing, Supervision of research process

Dr. Masooma Zehra: Study design support, Results compilation and interpretation, Manuscript writing and revision, patient recruitment and data collection

Dr. Fariha Irfan: Methodology development,Literature review and manuscript drafting, Assistance in clinical procedures, Data collection

Dr. Muhammad Hammad : Guidance on clinical protocols ,Contribution to manuscript writing, Patient management and data collection

Dr. Hina Hammad Khan: Preparation of study materials, Manuscript writing and data organization, Support in field data collection

Dr. Syed Abrar Ali: Clinical phase assistance, Patient management, Data collection and documentation

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