

# Evaluation of an 8% Arginine-Calcium Carbonate Tooth Paste Efficacy in Dentin Hypersensitivity

LUCIA MAGDA BARLEAN<sup>1</sup>, CARINA BALCOS<sup>1</sup>, MARIANA ILIE<sup>2</sup>, RAZVAN LEATA<sup>2</sup>, GABRIELA GURAU<sup>2\*</sup>

<sup>1</sup> „Gr. T. Popa” University of Medicine and Pharmacy Iasi, Faculty of Dental Medicine, Department of Surgical Sciences, Discipline of Preventive Dentistry, 16, Universitatii Str., 700115, Iasi, Romania

<sup>2</sup> “Dunarea de Jos” University of Galati, 47 Domneasca Str., 800008, Galati, Romania

*Dentinal hypersensitivity is a painful reaction as response to thermal, mechanical, electrical, osmotic or chemical stimuli. The aim of this study was to assess the effect of a containing 8% arginine-calcium carbonate tooth paste - Colgate Sensitive Pro-Relief - in dentin hypersensitivity. The study involved 103 patients aged 25 to 61 years in 14 private dental offices in Iasi, Romania. The selected patients claiming symptoms from more than 2 teeth free of caries and fillings were asked to specify the characteristics of the pain (intensity, duration, localization, history) and trigger agent. After applying a stream blast of compressed cold air each patient indicated the score of sensitivity using the Visual Analog Scale (VAS) at the first examination, after three days, one week and one month of using a containing 8% arginine-calcium carbonate (Colgate Sensitive Pro-Relief) toothpaste. The Microsoft Excel, and SPSS for Windows 15.0 ( $p < 0.05$ ) were used for data analysis.*

*Keywords: dentinal hypersensitivity, stimuli, arginine-calcium carbonate*

Dentinal hypersensitivity is defined as a painful reaction as response to tooth exposure to different stimuli. [1]. The prevalence of dentin hypersensitivity varies from 3 to 70% with an average value of 15-20% in the general adult population. Dentinal hypersensitivity may occur at any age with a higher frequency between 20 and 40 years. [2]. Regarding gender the prevalence of dentinal sensitivity is reported to be significantly higher in females than in males [3]. About 75%–90% of all hypersensitivities are related to teeth with periodontal disease.

The short, sharp, sudden characteristic pain is most often caused by thermal stimuli (cold and hot) but also by other mechanical-tactile, electrical, osmotic (hypertonic solutions such as sugars or salt) or chemical - acid stimuli (sweet or sugary foods or beverages, gastric secretions during gastro-esophageal reflux). When thermal stimuli are triggers, it is primarily the cold stimulus that causes the pain [4,5].

The symptoms of dentinal hypersensitivity are commonly associated to gingival recession, attachment loss, erosion, abrasion, incorrect teeth brushing technique, use of an inappropriate, hard toothbrush but also to dental procedures like tooth whitening.

## *Mechanism of dentinal hypersensitivity.*

The mechanism involved in tooth sensitivity refers to the exposure of the dentinal tubules through which stimuli gain access to the dental pulp. Over time, various theories regarding the explanation of the dentin hypersensitivity have been cited including the transducer theory, the modulation theory, the “gate” control and vibration theory, and, the most widely accepted, the hydrodynamic theory. This latter theory holds that under the high temperature or physical osmotic changes the movement of the fluids within the dentinal tubules stimulates a nerve receptor leading to the pain transmission [5].

The salivary pH plays a particularly important role in terms of dental tissues resistance to acid attacks. At a pH level lower of 5.5 the demineralization process begins leading to irreplaceable loss of enamel and living the dentin exposed to aggressive factors. The dentin demineralization may start at pH levels as high as 6.5 and the remineralization is very poor and slow. The calcium and phosphate in saliva can block the opened tubules thus reducing dentinal hypersensitivity. That is why hyposalivation and xerostomia are associated with tooth sensitivity and a high risk for dental caries.

## *Diagnosis of dentinal hypersensitivity*

The diagnosis of dentinal hypersensitivity aims to reveal the reason for tubules to be exposed or open. A comprehensive examination should include medical and social history, lifestyle, dietary habits, oral hygiene habits, medication. The patient must be required to identify the trigger stimuli and to describe the type, duration, localization and intensity of pain. The local examination of the sensitive teeth most commonly highlights a gingival recession, tooth abrasion, erosion, or attrition. A thorough examination should also include probing depths, recession measurements, X-rays, percussion testing, thermal tests and occlusion assessment [6,7].

## *Dentinal hypersensitivity treatment*

The treatment options for dentinal hypersensitivity aim to close the dentinal tubules opened to the oral environment and to desensitize the nerve. An individualized approach according to the symptoms intensity and duration and trigger stimuli must be adopted.

The options of dentinal hypersensitivity treatment include the use of topical agents and dentifrices that contain a desensitizing active ingredient like fluorides, calcium phosphate, oxalate preparations and resin-based material.

\* Tel.: (+40) 0236469100; 0236469850

Fluoride compounds in varnishes, gels, and solutions for oral rinses in different concentrations act as a barrier for dentinal tubules, preventing fluid movement, reducing sensitivity and promoting remineralization. In order to occlude the dentinal tubules Calcium compounds like casein phosphopeptide-amorphous calcium phosphate (CPP-ACP) can be administered in the dental office or at home. The efficacy of the products containing Potassium salts is based on the effect to interfere with the transmission of the stimuli, reducing nerve excitation and the associated pain. Other treatments aim occluding or sclerosing the tubules and reduce flow into the dentin tubules by ingredients like stannous fluoride, strontium chloride, and aluminum, potassium or ferric oxalates and fluorides [5]. As a professional treatment iontophoresis, delivering a charge of sodium fluoride into the dentin and methacrylate polymers, applied as a base or composite restoration can be used [8].

A new anti-sensitivity technology Pro-Argin has as essential component Arginine, an amino acid positively charged at physiologic pH (6.5-7.5) obtained from vegetable sources. This technology aims to reproduce the saliva's natural process of sealing the opened dentin tubules and thus reducing tooth hypersensitivity. The effect of the arginine based anti-sensitivity toothpaste which also contains an insoluble Calcium carbonate is to deposit a dentin-like mineral as a plug which reaches a depth of 2  $\mu\text{m}$  within the dentin tubules and also as a protective layer on the dentin surface. This layer containing high levels of calcium carbonate and phosphate, is resistant to normal pulpal pressures and to acids challenge in oral cavity also acting in reducing dentin fluid flow associated to hypersensitivity. The high efficacy of the arginine-calcium carbonate desensitizing paste in occluding open dentin tubules was confirmed by Confocal Laser Scanning Microscopy (CLSM) and High resolution scanning electron microscopy (SEM) images as demonstrated by researchers in their studies [9,10]. The desensitizing toothpaste containing active agents as potassium salts, sodium citrate, strontium salts are also recommended. The role of the Potassium salts is to interfere with the transmission of the stimuli by depolarizing the nerve surrounding the odontoblasts [11].

Recent treatment options include bioglass, Portland cement, casein phosphopeptide and lasers. The patient education regarding the toothbrushing technique and frequency and diet counseling are also considered important in order to induce the proper preventive attitude towards dentin hypersensitivity.

The aim of this study was to assess the efficacy of a containing 8% arginine-calcium carbonate - Colgate Sensitive Pro-Relief - tooth paste in dentin hypersensitivity.

## Experimental part

### Methods

It was initiated a study involving 103 patients aged 25 to 61 years with tooth hypersensitivity treated in 14 private dental offices in Iasi, Romania. The study was conducted between September 2014 and April 2015. Patients with severe general diseases, pregnant women, patients using complex medical treatment with different drugs as strong analgesics, antihistamines, anticonvulsants, sedatives, tranquilizers, or anti-inflammatory were excluded. The selected patients claiming symptoms from more than 2 teeth free of caries and fillings were asked to specify the history characteristics of the pain (intensity, duration, localization), the trigger agent, and followed treatments.

Clinical examination of the patients was also performed in order to settle the status of the 316 involved teeth. For the hypersensitivity evaluation the air blast hypersensitivity scores were recorded. The examination was performed by the same dentist for each patient. After isolation using the rubber dam the examined tooth was tested with a blast of compressed cold air delivered from the 3-way syringe for 3 seconds from a distance of 1 cm. Each patient indicated the score of sensitivity using the Visual Analog Scale (VAS) with 0 representing "no pain" and 10 representing "extreme pain". The mean air blast hypersensitivity scores were recorded at the first examination and then after 3 days, one week and one month of using a containing 8% arginine-calcium carbonate (Colgate Sensitive Pro-Relief, Colgate-Palmolive Company) toothpaste. The dentist's recommendation consisted in twice a day teeth brushing for 2 minutes by modified BASS technique using a medium hardness bristle toothbrush. No other treatment methods were agreed during the study. Finally, the patient was asked about his satisfaction with the recommended tooth paste and its effects along the study.

Data were analyzed by gender and age. The Microsoft Excel, SPSS for Windows 15.0 (Statistical Package for the Social Sciences, Chicago, IL) were used for data analysis. The level of significance was determined to be  $p < 0.05$ .

## Results and discussions

All 103 subjects completed the one month study. From the investigated patients 64 (62.1%) were females and 39 (37.9%) males. According to age which ranged between 25 and 61 years, the study group was divided into three groups as follows: 25-36 years, 37-48 years and 49-61 years. During the first evaluation as three days, one week and one month later 316 hypersensitive teeth without cavities and fillings were examined. The clinical examination revealed that from the selected teeth 170 (53.7%) showed gingival recession, 89 (28.1%) enamel erosion, 67 (21.2%) loss of attachment and 57 (18.0%) tooth abrasion. As the gingival recession and loss of attachment which expose the tooth cementum and dentine are symptoms of a periodontal disease the results of our study support the finding that condition must be considered as responsible for dentine hypersensitivity. [12, 13]

The considered parameter for dentin hypersensitivity was the pain evaluated by Visual Analog Scale (VAS) at first examination and then after 3 days, one week and one month of an 8% arginine and calcium carbonate containing tooth paste (Colgate Sensitive Pro-Relief) use. The patients answers demonstrate that the pain was caused mainly by cold stimulus (drinks and foods) both for females and males. (80.7% and 78.8% respectively) and for all age groups confirming the results reported by other authors in their studies [14,15,16]. The age group of 37-48 years demonstrated the highest percentage of teeth for which the pain is caused mainly by cold (34%). Other stimuli mentioned by the patients as triggers were toothbrushing (32.7% for women and 24.5% for men), contact with sweets (28.6% for females and 35.5% for males), exposure to chemicals as acids (foods, drinks). (32.2% for females and 23.5% for males), (fig.1)

Regarding the teeth status the gingival recession was associated with 6 to 8 VAS scores while erosion and abrasion were associated with 4 to 6 VAS scores.

All the patients, regardless gender and age, experienced significant and persistent decrease in the mean VAS score after using a 8% arginine and calcium carbonate containing tooth paste until the end of the study. Our results are consistent with those reported by other researchers

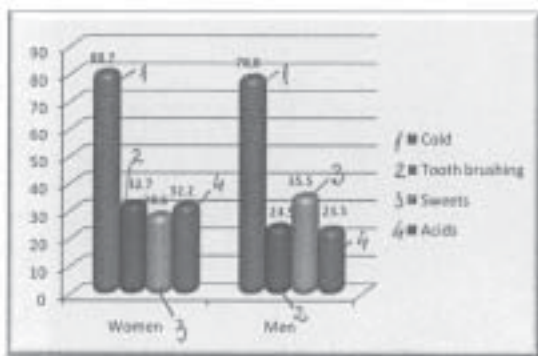


Fig.1. Trigger stimuli for pain by patient gender

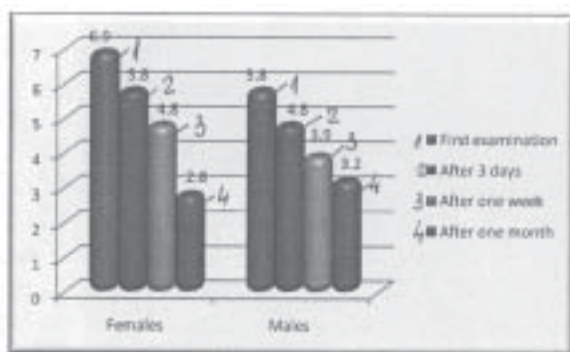


Fig. 2. The mean value of VAS before and after using a 8% arginine and calcium carbonate tooth paste by gender

from Italy, USA, China and Turkey in which the percent reduction in sensitivity ranged between 45% and 60% [17,18,19,20]. In our study the mean value of VAS for females was 6.9 at the beginning of study, 5.8 after 3 days, 4.8 after one week and 2.8 after one month of Colgate Sensitive Pro-Relief toothpaste use. For males the values were: 5.8; 4.8; 3.9 and 3.2 respectively. (fig.2). Statistical analysis of the total sample demonstrated a highly significant difference between before and after one month of daily use of the tooth paste ( $p < 0.05$ ), demonstrating its efficacy in dentin hypersensitivity reduction. The most affected group of age was the 37-48 group with a mean value of VAS of 7.8 at the first examination. The VAS score changes were higher in females (4.1 VAS points) than in males (2.6 VAS points).

The efficacy of the Colgate Sensitive Pro-Relief tooth paste containing 8% arginine and calcium carbonate used twice daily in the treatment of dentine hypersensitivity relief was the subject of a impressive number of clinical trials Our results confirm the outcomes reported in the literature which undoubtedly prove the statistically significant hypersensitivity improvement at all time intervals compared to baseline [2 - 24].

The percentage of patients which expressed their satisfaction after using Colgate Sensitive Pro-Relief toothpaste was 28.1% for females and 20.5% for males after 3 days of use, 67.3% for females and 55.8% for males after one week and 89.3% for females and 86.7% for males at the end of the study (fig.3). 98% of patients would recommend this tooth paste to their family members or friends.

## Conclusions

The use of Colgate Sensitive Pro-Relief tooth paste containing 8% arginine-calcium carbonate, proved to be effective in decreasing dentin hypersensitivity regardless of the gender and age of the patients at all time intervals compared to baseline. Management strategies, considering etiological and predisposing factors, rather than treatment

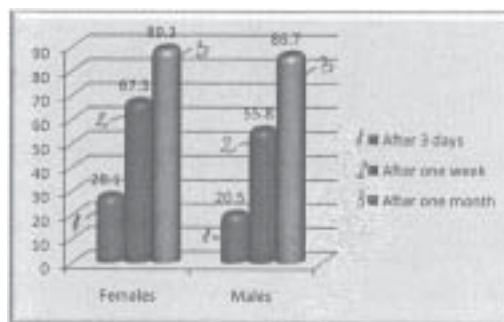


Fig. 3. Patient satisfaction after 8% arginine-calcium carbonate tooth paste use by gender

alone, should be considered in order to control the dentin hypersensitivity.

## References

- KASPER, D., RDH 30, no.6, 2010. <http://www.rdhmag.com/articles/print/volume-30/issue-6/features/hypersensitivity-exposed.html>
- REES, J.S., ADDY, M., Int J Dent Hyg. 2, no.2, 2004, p.64.
- WEST, N.X. . Periodontology 48, no.10, 2008, p. 31
- JACOBSEN, P.L., BRUCE, G. The Journal of Contemporary Dental Practice 2.1 Winter Issue 2001, p.1.
- WALTERS, P The Journal of Contemporary Dental Practice 6.2, 15, 2005, p.110.
- STRASSLER, H., DRISKO, C., ALEXANDER, D. 4, no.6, 2008 , p.2.
- KIELBASSA, A.M. Int Dent J., 52, 2002, p.394.
- BARROW, S.L. The Journal Of Professional Excellence. , Dimensions of Dental Hygiene, 4, no.6, 2006, p. 28. <http://www.dimensionsofdentalhygiene.com/print.asp?id=852>.
- SHALINI S. International Journal of Scientific Study 1, no.3, 2013, p.133.
- STEFANOPOULOS, L.B.. The Journal of Professional Excellence, Dimensions of Dental Hygiene, 5, no.6, 2007, p.24. <http://www.dimensionsofdental-hygiene.com/ddhright.asp?id=1156>.
- DRISKO, C.H.. Int Dent J. 52, 2002, p.385.
- JAGJIT SINGH DHALIWAL, POOJA PALWANKAR, PARAMJIT K. KHINDA, AND SACHINJEET K. SODHI J Indian Soc Periodontol. 16, no.3, 2012, p. 426.
- SALVI, G.E., LAWRENCE, H.P, OFFENBACHER, S., BECK, J.D.. J Periodontol. 14,2000, p.173.
- NIDHAL, A. A., MOHAMMED Q., MAHMOOD,Q. FAHMI, FOUAD, H. AL-BAYATY. Life Science Journal 11, no.9, 2014, p.747.
- ADDY, M., WEST, N.X., BARLOW, A., SMITH, S. Int J Dent Hyg 5, 2007,p.53.
- REES, J.S., ADDY, M., J Clin Periodontol. 29, 2002, p.997.
- DOCIMO, R., PERUGIA, C., BARTOLINO, M., MATURO, P., MONTESANI, L., ZHANG, Y.P, DE VIZIO, W, MATEO, L.R., DIBART, S., J clin Dent, 2, no.4, 2011, p.121.
- HAMLIN, D., WILLIAMS, K.P, DELGADO, E., ZHANG, Y.P, DE VIZIO, W, MATEO, L.R., Am J Dent 22, 2009 (Spec Iss):16A-20A.
- LI R, LI Y, CHEN, J., ZHOU, Z., MORRISON, B.M., Am J Dent. 25, no.4, 2012, p.210.
- BAL, M.V., KESKINER, Y., SEZER, U., AÇIKEL, C., SAYGUN, I. Photomed Laser Surg. 33, no.4, 2015, p.200.
- VLASOVA, N. Patient Survey Program: Russia <http://www.colgate-profesional.com.ve/LeadershipVE/ProfessionalEducation/Articles/Resources/pdf/StudySummaryCSPPRWhitening.pdf>
- CANADIAN ADVISORY BOARD on Dentine Hypersensitivity Consensus-Based Recommendations for the Diagnosis and Management of Dentine Hypersensitivity. J Can Dent Assoc. 69, 2003, p.221.
- AYAD,F, AYAD,N., DELGADO,E, ZHANG,Y.P, DEVIZIO,W, CUMMINS,D., MATEO, L.R., Canada. J Dent.Clin, 20, no.4, 2009, p.115.
- KAPFERER. I., PFLUG, C., KISIELEWSKY, I., GIESINGER, J., BEIER, U.S., DUMFAHRT, H.. Acta Odontol Scand. 71, no. 3-4, 2013, p.994.

Manuscript received: 23.08.2015