Short-term antibacterial efficacy of a new silver nanoparticle-containing toothbrush

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It is well known that dental plaque is a predominant cause of biofilm-originated periodontal problems and carious lesions.[1] To control the biofilm-associated oral pathogens in the oral flora, mechanical and/or chemical plaque removal methods must be used.[2] Mechanical cleaning has been considered an integral component of plaque removal. For this mechanical cleaning, manual, electrical, and ultrasound toothbrushes have been used with or without chemical components against the biofilm structure to control the plaque accumulation where the bristles access.[2,3] Silver nanoparticles incorporated into the bristles of toothbrushes have been found effective on reducing Mutans streptococci. From that point of view, it is believed that the newly produced Misoka (Yumeshokunin Co., Osaka, Japan) which should be used only with water and without toothpaste for the usage of four weeks due to its mineral/silver-based nanotechnology, could be a good alternative for patients who are disturbed by the taste of toothpaste, mentally/physically disabled patients without a spitting reflex, children 6 months-3 years old at risk of toothpaste swallowing and patients who are at risk for bacterial decontamination problems. Nanosized ions on the bristles of Misokamay inhibit the bacteria on teeth surfaces as similar with the previous finding.[4] To the best of our knowledge, no study has assessed the efficacy of this newly produced silver-containing toothbrush and compared it with other products. Thus, we aimed to compare the short-term antibacterial efficacy of silver nanoparticle-containing toothbrushes with standard toothbrushing with commercially available dentifrices. This study was designed as a prospective randomized blinded short-term clinical study. Individuals who were scheduled to start their dental treatment at the paediatric clinic of the Faculty of Dentistry, University of KTU were included. Forty patients aged 12-15 years who were treated at the paediatric clinic were randomly assigned to two groups. Paediatric dentists utilized oral hygiene training for the parents and children prior to the procedure. In addition, the parents were told not to use any other oral hygiene products during the study period. A paediatric dentist called the parents and children (every second day) to motivate them to ensure valid participation in the trial. The patient brushed daily for 2 minutes. Salivary Mutans streptococci (MS) and Lactobacilli (LB) levels, buffering-capacity (BC), visible-plaque-index (VPI) and gingival-bleeding-index (GBI) were evaluated at the following two different periods (T_0-Baseline: The first samples and measurements were obtained immediately before the procedure/ T_1: Samples and measurements were obtained four weeks after application). The statistical analyses were performed with the statistical package SPSS 17.0 for Windows (SPSS Inc., Chicago, IL, USA). Chi-square, independent sample t-test, Mann-Whitney U and Wilcoxon tests were used for the statistical evaluation ($p<0.05$). No significant differences were found between the groups regarding the demographic properties ($p>0.05$). MS, LB, BC, VPI and GBI scores at either T_0 or T_1 ($p>0.05$). Significantly decreased '1' scores were found at T_1 compared to T_0 for MS, VPI and GBI in group 1 ($p<0.05$) (Table-1). According to our literature search, because we did not find any in vivo study for silver-containing toothbrushes, the three daily instances of toothbrushing in this study showed a decreasing trend for MS, VPI and GBI levels after 4 weeks, and the depletion of silver ions emphasizes the need for evaluating silver-coated toothbrushes in children who have a spitting reflex because of disability, children 6 months-3 years who are at risk of swallowing toothpaste, children at risk of bacterial decontamination problems, and teenagers and for any other uses[1-5] with or without any antibacterial compounds. The short-term results of this study concluded that the silver ion-containing toothbrushes exhibited promising outcomes as an alternative to standard oral hygiene strategies applied with dentifrices in teenagers. The evaluation and recommendation of silver-coated toothbrushes would be beneficial in various age groups of children in

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Table-1: Inter andintragroupcomparisonsforallgroups.

Parameters	Groups	Baseline (T0) Scores (n)	Baseline (T0) Median (Min-Max)	T1 Scores (n)	T1 Median (Min-Max)
MS	1	Score 0=4 Score 1=16	1 (0-1)^{A,a}	Score 0=14 Score 1=6	0 (0-1)^{A,b}
	2	Score 0=6 Score 1=14	1 (0-1)^{A,a}	Score 0=10 Score 1=10	0.5 (0-1)^{A,a}
LB	1	Score 0=8 Score 1=12	1 (0-1)^{A,a}	Score 0=14 Score 1=6	0 (0-1)^{A,a}
	2	Score 0=10 Score 1=10	0.5 (0-1)^{A,a}	Score 0=10 Score 1=10	0.5 (0-1)^{A,a}
GBI	1	Score 0=6 Score 1=14	1 (0-1)^{A,a}	Score 0=16 Score 1=4	0 (0-1)^{A,b}
	2	Score 0=8 Score 1=12	1 (0-1)^{A,a}	Score 0=14 Score 1=6	0 (0-1)^{A,a}
VPI	1	Score 0=4 Score 1=16	1 (0-1)A,a	Score 0=12 Score 1=8	0 (0-1)^{A,b}
	2	Score 0=2 Score 1=18	1 (0-1)^{A,a}	Score 0=10 Score 1=10	0.5 (0-1)^{A,b}
BC	1	Score 1=0 Score 2=14 Score 3=6	2 (2-3)^{A,a}	Score 1=0 Score 2=12 Score 3=8	2 (2-3)^{A,a}
	2	Score 1=0 Score 2=10 Score 3=10	2.5 (2-3)^{A,a}	Score 1=0 Score 2=10 Score 3=10	2.5 (2-3)^{A,a}

*In each column (eachperiod), values with same superscript capital letters indicate no differences p>0.05 regarding MS, LB, GBI, VPI and BC values: Inter-group comparisons.

*In each row (for individual parameters), values with different superscript smallcaps indicate significant differences (p<0.05), whereas same letters indicate no significant differences (p>0.05) between the T0-T1 periods for individual group: Intra-group comparisons.

*Mutansstreptococci (MS), Lactobacilli (LB), Gingival Bleeding Index (GBI), VisiblePlaque Index (VPI) andBufferingCapacity (BC).

larger populations because of its potential effects on oral hygiene procedures, such as eliminating the remaining bacteria on the bristles and/or in an oral environment.

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