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Cleaning Efficacy of Triangular Interdental Brushes

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Introduction

Due to the cross-sectional shape of interdental spaces, it was assumed that interdental brushes with triangular heads in cross section will have an improved cleaning efficacy compared to conventional round brushes.

Objectives

The aim of this study was to evaluate the cleaning efficacy of prototypes triangular (TIB) compared to round interdental brushes (RIB) in vitro.

□
Fig. 1: Cross-sectional shape of a RIB and a prototype of TIB.S

Material and Methods

Extracted human teeth were fixed in a socket and matched to pairs in a reversible and reproducible manner, simulating two types of small interdental spaces (isoscele: 1.5mm wide, 1.5mm high, equilateral: 1.5mm each). The proximal tooth surfaces were covered with a dye indicator (Blue Marker, YETI Dentalprodukte GmbH, D-78234 Engen) to simulate plaque. After registering the baseline situation with a digital camera and a highly reproducible geometrical setup the teeth were relocated in their contact position. The interdental spaces were cleaned in a standardized manner followed by digital imaging of the proximal tooth surfaces as described above. The cleaning efficacy was quantified and related to the total proximal tooth surface by digital image subtraction and pixel count of the cleaned area. Four RIB and four prototypes of TIB, which were applicable for small interdental spaces, were tested (n=12).

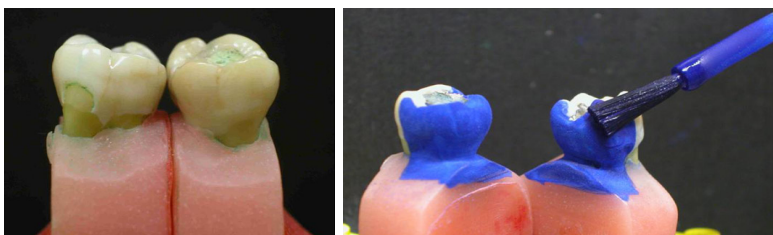


Fig. 2.1.: Split cast model of a simulated interdental space. Fig. 2.2.: Coating of both proximal surfaces with a dye to simulate plaque.



Fig. 2.3.: Repositioning of the teeth and cleaning of the proximal surfaces with interdental brushes. Fig. 2.4.: Separation of teeth.

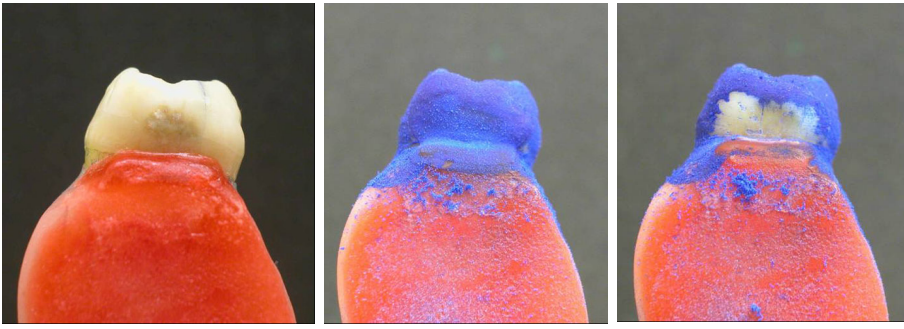


Fig. 3.1.: Baseline digital image of the proximal surface.

Fig. 3.2.: Digital image of the coated proximal surface.

Fig. 3.3.: Digital image of the cleaned proximal surface.

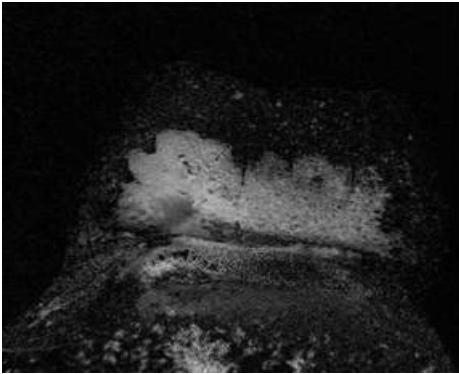


Fig. 3.4.: Digital subtraction (Paint Shop Pro 5.0).



Fig. 3.5.: Conversion of the subtraction image into a black and white bitmap (Scion Image) and pixel count.

Statistical Analysis

Differences between TIB and RIB were analysed by means of the non-parametric Wilcoxon test for paired samples. The significance level was set at $p=0.05$.

□ Tab. 1: Cleaning efficacy and external diameter of the interdental brushes tested in the study.

Results

In isoclele, equilateral and both types of interdental spaces the round interdental brushes cleaned $37 \pm 3\%$, $33 \pm 3\%$ and $35 \pm 2\%$ (Curaden), $50 \pm 6\%$, $45 \pm 6\%$ and $48 \pm 7\%$ (Tepe), $50 \pm 3\%$, $40 \pm 2\%$ and $45 \pm 3\%$ (Oral B) and $41 \pm 6\%$, $33 \pm 4\%$ and $37 \pm 3\%$ (Butler), respectively. The triangular brushes cleaned $64 \pm 7\%$, $49 \pm 4\%$ and $56 \pm 4\%$ (GABA #4), $67 \pm 4\%$, $54 \pm 5\%$ and $60 \pm 5\%$ (GABA #5), $69 \pm 6\%$, $54 \pm 5\%$ and $61 \pm 5\%$ (GABA #6), and $80 \pm 6\%$, 59 ± 4 and $69 \pm 3\%$ (GABA #7), respectively. The differences between the TIB and RIB groups were statistically significant in any case ($p < 0.001$, multisample Friedman-test).

Conclusion

All types of interdental brushes were effective. In small interdental spaces, triangular brushes have a higher cleaning efficacy compared to round interdental brushes. Additionally, TIBs penetrate the interdental space more easily as a consequence of their cross sectional shape. Compared to RIB bigger sizes of TIB can be used in small interdental spaces.

This Poster was submitted by Dr. Diana Wolff.

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Cleaning Efficacy of Triangular Interdental Brushes

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Introduction

Due to the cross-sectional shape of interdental spaces, it was assumed that interdental brushes with triangular heads in cross section will have an improved cleaning efficacy compared to conventional round brushes. The aim of this study was to evaluate the cleaning efficacy of prototypes triangular (TIB) compared to round interdental brushes (RIB) *in vitro*.



Fig. 1: Cross-sectional shape of a RIB and a prototype of TIB

Methods

Extracted human teeth were fixed in a socket and matched to pairs in a reversible and reproducible manner, simulating two types of small interdental spaces (buccale: 1.5mm wide, 1.5mm high), equilateral: 1.5mm each). The proximal tooth surfaces were covered with a dye indicator (Blue Marker, VETI Dentalprodukte GmbH, D-79201 Friesen) to simulate plaque. After registering the baseline situation with a digital camera and a highly reproducible geometrical setup the teeth were reinserted in their contact position. The interdental spaces were cleaned in a standardized manner followed by digital imaging of the proximal tooth surfaces as described above. The cleaning efficacy was quantified and related to the total proximal tooth surface by digital image subtraction and pixel count of the cleaned area. Four RIB and four prototypes of TIB (Tab. 1), which were applicable for small interdental spaces, were tested (n=12).

Steps of the *in-vitro* investigation:



Fig. 2.1: Split cast model of a simulated interdental space



Fig. 2.2: Coating of both proximal surfaces with a dye to simulate plaque



Fig. 2.3: Repositioning of the teeth and cleaning of the proximal surfaces with interdental brushes



Fig. 2.4: Separation of teeth

Digital imaging and evaluation of the cleaning efficacy:



Fig. 3.1: Baseline digital image of the proximal surface



Fig. 3.2: Digital image of the coated proximal surface



Fig. 3.3: Digital image of the cleaned proximal surface



Fig. 3.4: Digital subtraction of Fig. 3.2 and Fig. 3.3 (Paint Shop Pro 5.0)



Fig. 3.5: Conversion of the subtraction image into a black and white bitmap (color image) and pixel count

Interdental brushes	Diameter [mm] External, internal	Cleaning efficacy in %		
		buccale	Equilateral	Both
GABA 4	4,2	64 ± 7%	49 ± 4%	56 ± 4%
GABA 5	5,3	67 ± 4%	54 ± 4%	60 ± 5%
GABA 6	6,4	69 ± 6%	54 ± 5%	61 ± 5%
GABA 7	7,5	80 ± 6%	59 ± 4%	69 ± 3%
Curaden CPS 11	2	37 ± 3%	33 ± 3%	35 ± 2%
TePe XX-Fine	3	50 ± 6%	45 ± 6%	48 ± 7%
Oral B Ultrafine	3	50 ± 3%	40 ± 2%	45 ± 3%
Butler Picalbrush cylindrical 412	3	41 ± 6%	33 ± 4%	37 ± 4%

Tab. 1: Cleaning efficacy and external diameter of the interdental brushes tested in the study

Statistical Analysis

Differences between TIB and RIB were analysed by means of the non-parametric Wilcoxon test for paired samples. The significance level was set at $p < 0.05$.

Results

In buccale interdental spaces the round interdental brushes cleaned 37±3% (Curaden), 50±6% (TePe), 50±3% (Oral B) and 41±6% (Butler), whereas the triangular brushes cleaned 64±7% (GABA 4), 67±4% (GABA 5), 69±6% (GABA 6), and 80±6% (GABA 7), (Tab. 1). The differences between the TIB and RIB groups were statistically significant in any case ($p < 0.001$, multisample Friedman-test).

Conclusion

All types of interdental brushes were effective. In small interdental spaces, triangular brushes have a higher cleaning efficacy compared to round interdental brushes. Additionally, TIBs penetrate the interdental space more easily as a consequence of their cross sectional shape. Compared to RIB bigger sizes of TIB can be used in small interdental spaces. This study was supported by GABA International AG, Switzerland.

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