

# Removal of Simulated Organic Dental Plaque by Different Interdental Brushes

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## Objectives:

Interdental plaque control plays an important role in oral hygiene of adults. Therefore, it was the aim to test *ex-vivo* the cleaning efficacy of (i) an experimental interdental toothbrush in comparison with (ii) two different interdental brushes and (iii) a dental flosser and (iv) a manual toothbrush using organic plaque simulation (Flad et al., 2016) in a planimetric assessment approach.

## Material and Methods:

Plaque removal efficacy at interdental planimetric risk fields by three interdental brushes IDB-A: TePe size 2, parallel (Malmö, Sweden); IDB-B: DenTek Easy Brush ISO-2, conical (Terrytown, USA); IDB-C: experimental, helicoidal; and the Eflseptyl dental flosser IDB-Flosser (Paris, France) and MTB: Dr. Best manual toothbrush (GlaxoSmithKline, Bühl, Germany) was assessed. Eleven typodont teeth in anatomical position with gingival mask (KaVo, Biberach, Germany) were covered with artificial organic plaque exhibiting oral-physiologic parameters similar to natural plaque. Interdental spaces were cleaned with 4 strokes (2 x straight, 1 x 30° mesially, 1 x 30° distally) with interdental brushes and 5 strokes (1x below contact point, 2x mesially, 2x distally) with the dental flosser. Manual toothbrush was tested with horizontal brushing movement. The brushing force was calibrated to 3.5 N. All tests were executed seven times (n=7). The percentage of plaque removal at 24 planimetric crown fields and 6 root fields at 4 sites per tooth was documented by computer-assisted optical planimetry (APP, Fig. 2). Cleaning efficacy at single teeth and selected planimetric fields was statistically compared (t-Test, Wilcoxon-Mann-Whitney-Test).

## Results:

IDB Helix and IDB Dentek exhibit the best cleaning efficacy at all interdental surfaces at incisors, canines, premolars and molars with no statistical differences between the two IDB's.

Both IDB's clean the risk fields next to the gum line better compared to the IDB TePe and to the Flosser.

Because of the brushing action the manual toothbrush removes the most simulated plaque from the risk fields next to gum line. The design of IDB's is decisive for the statistically significant, very significant and highly significant differences in the biophysically brushing action of parallel brush heads, conical brush heads and helicoidal brush heads.

The flossing action is at interdental risk fields less efficient.

## Conclusions:

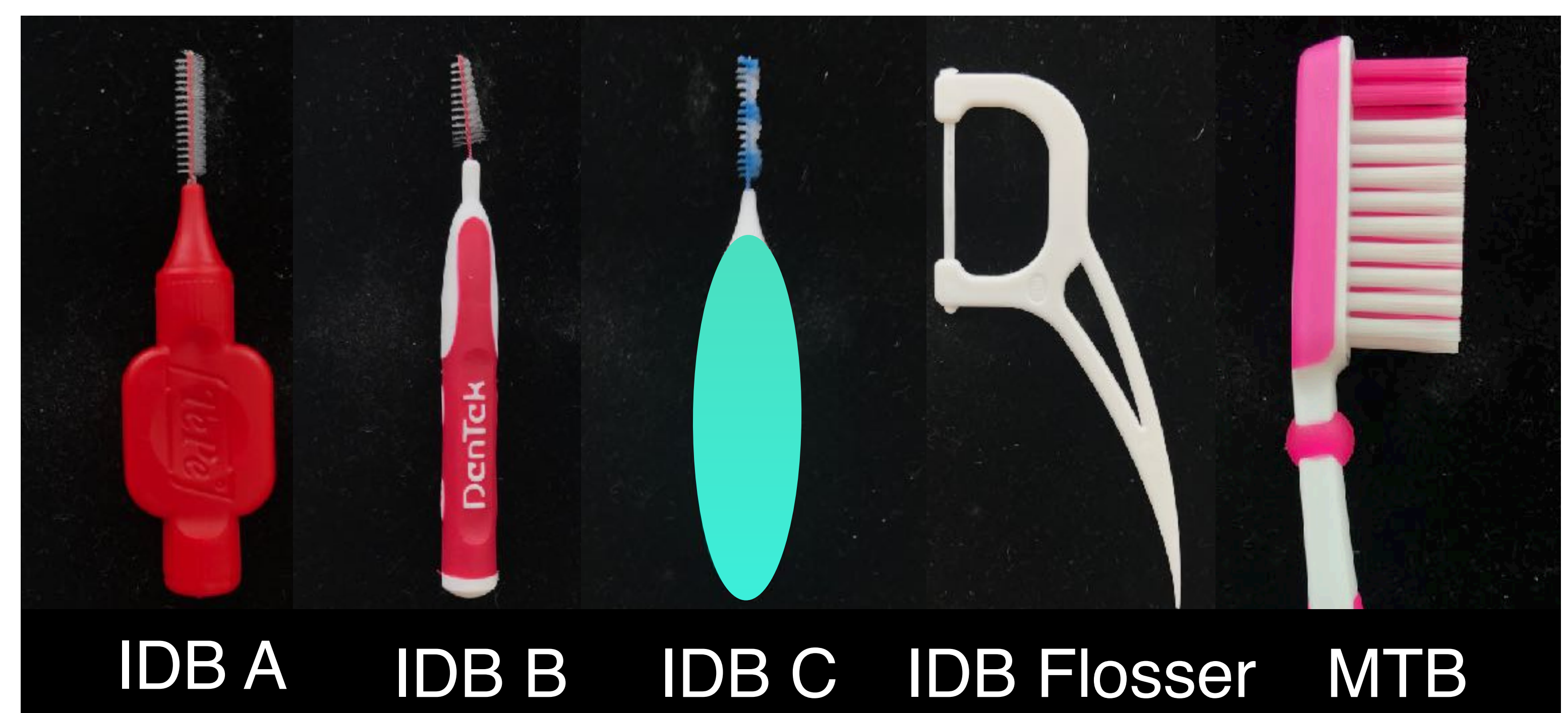
The new *ex-vivo* test methodology of interdental brushes compared to flossing and manual toothbrushing is highly standardized, and the planimetric plaque removal outcome at four sites of teeth in anatomical position results in precise efficacy values.

Different designs of interdental brushes are decisive for their efficacy.

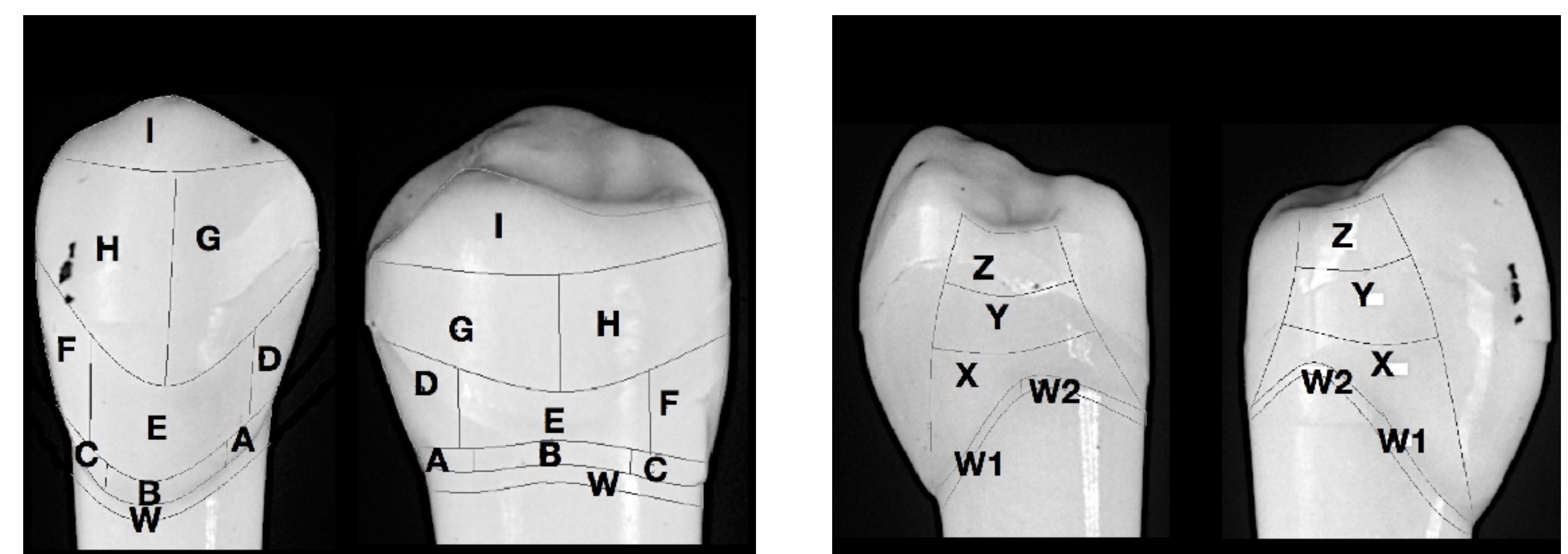
Flossing is less effective in interdental plaque removal compared to conical and helicoidal brushes.

The superior plaque removal at risk fields next to the gum line by manual toothbrushing is supporting combined usage with interdental brushes.

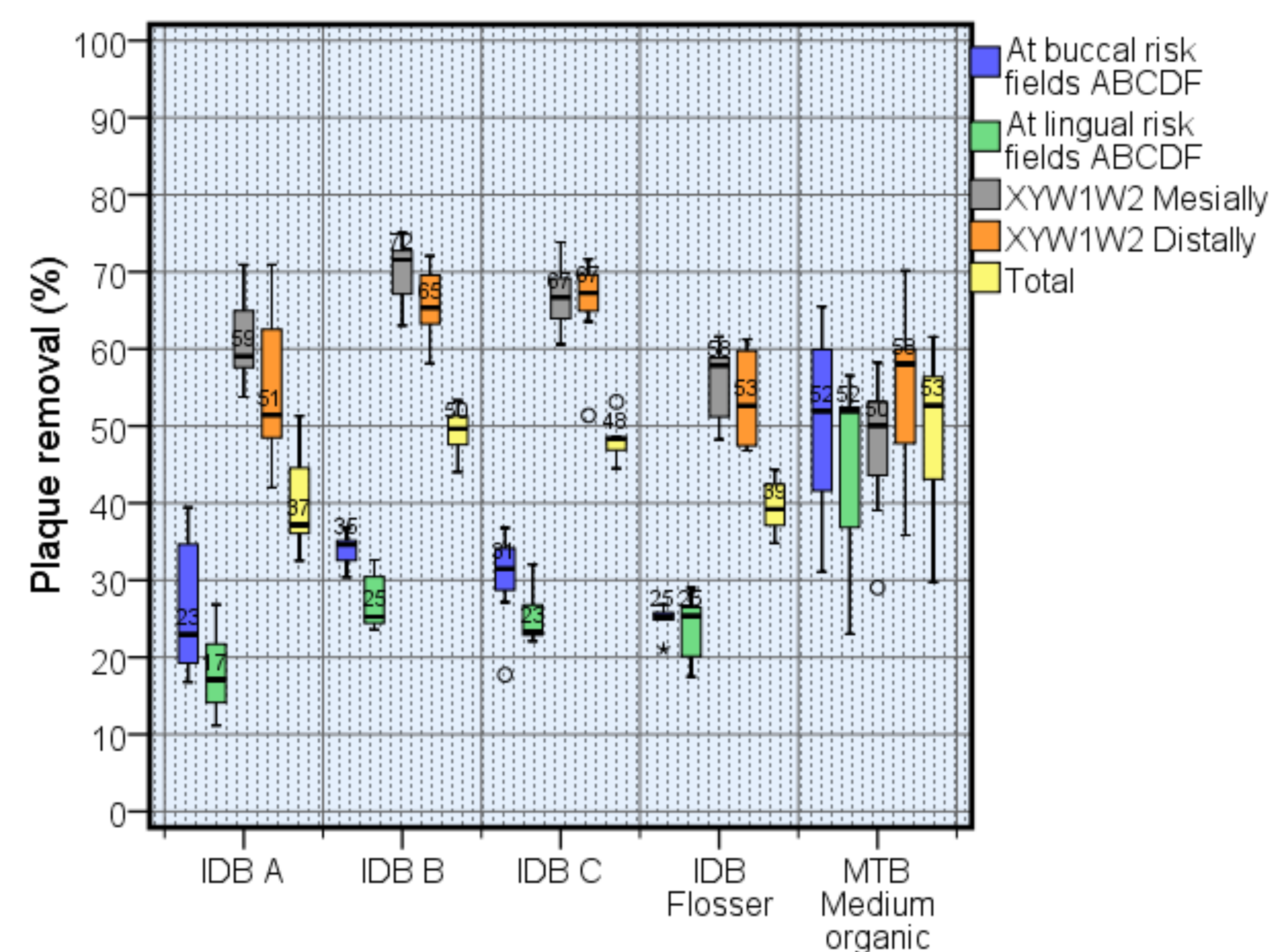
Prevention of gum diseases and root caries needs further research of the best brush designs, whereas flossing could be avoided.



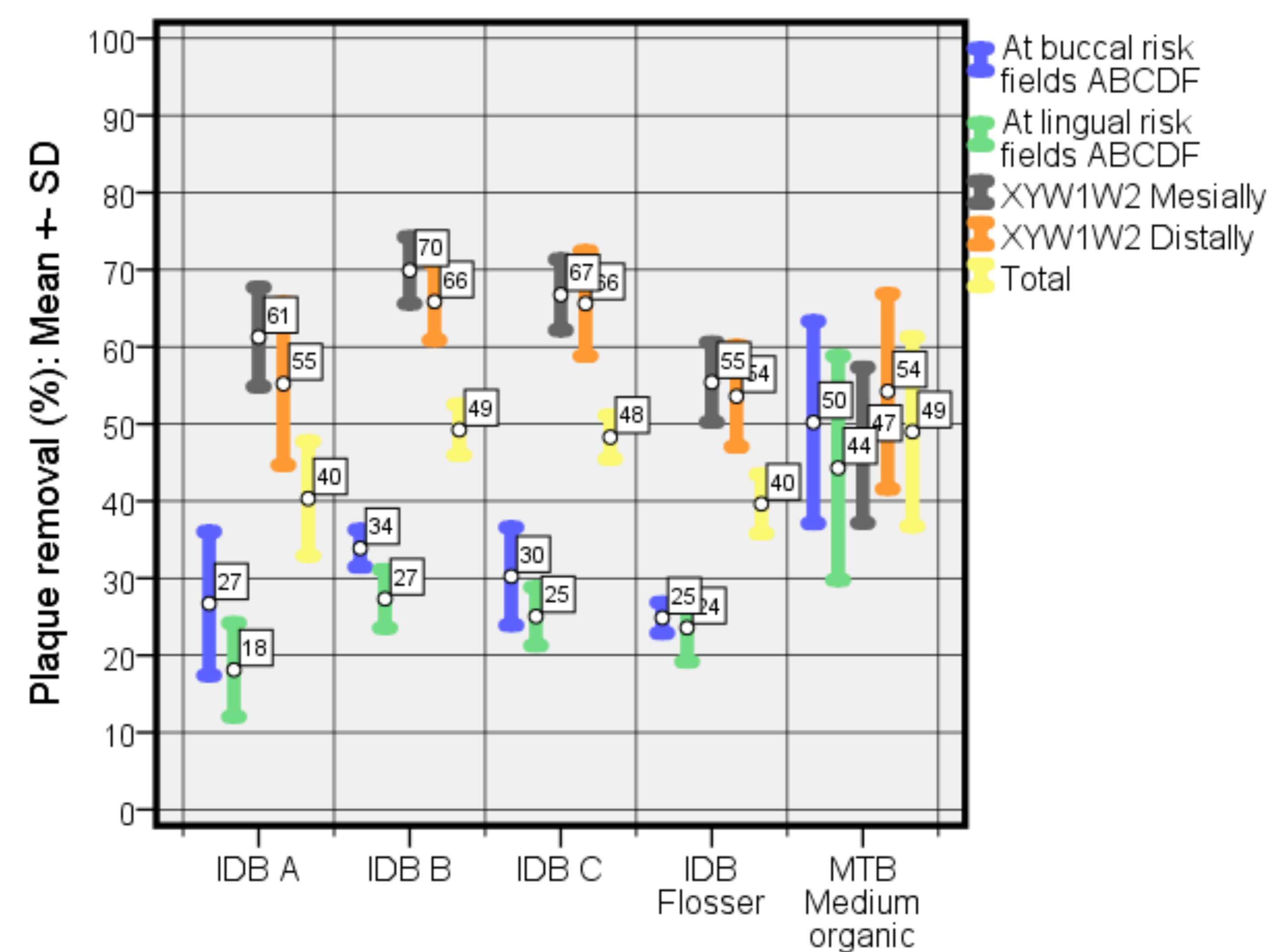
**Fig. 1:** IDB A: Interdental brush A - TePe size 2; IDB B: Interdental brush B - DenTek Easy Brush ISO 2; IDB C: Interdental brush C - helicoidal experimental brush; IDB Flosser: Dental Flosser - Eflseptyl Oral Care Porte Ruban Dentaire, MTB: Manual toothbrush Dr. Best Full Head, Flat Trim, Medium.



**Fig. 2:** Planimetric fields at tooth crowns and roots of smooth surfaces (left) and mesially and distally in-between the teeth (right) for plaque assessment in percent per field, per risk area or per tooth site with automated plaque planimetry APP according to the Planimetric Plaque Index PPI (Lang et al., 2011).



**Fig. 3 :** Box plots of median percentage of plaque removal at buccal and lingual risk fields ABCDF (next to the gum line), XYW1W2 mesially and distally (in-between regions) and total for the five tested toothbrushes



**Fig. 4 :** Error bars of mean percentage of plaque removal at buccal and lingual risk fields ABCDF (next to the gum line), XYW1W2 mesially and distally (in-between regions) and total for the five tested toothbrushes.

Toothbrush	Mesial	Distal
IDB Dentek	69.92 %*	65.87 %*
IDB Helix	66.75 %*	65.62 %*
IDB TePe	61.27 %	55.20 %
Flosser	55.40 %	53.60 %
MTB	47.24 %	54.22 %

**Tab. 1:** Comparison of mean values of mesial and distal interproximal plaque removal. (\*) significant superior plaque removal (p ≤ 0.05).

Toothbrush	ABCDF buccally	ABCDF lingually
IDB Dentek	33.87 %	27.32 %
IDB Helix	30.24 %	25.05 %
IDB TePe	26.72 %	18.11 %
Flosser	24.87 %	23.58 %
MTB	50.21 %*	44.29 %*

**Tab. 2:** Comparison of mean values of plaque removal at buccal and lingual risk fields next to the gum line. (\*) significant superior plaque removal (p ≤ 0.05).