Objectives:
The best plaque control in elderly/ periodontitis patients is still disputed. Therefore, it was the aim of the study (i) to compare plaque removal efficacy in a complex clinically validated robot programme (Lang et al. 2014) including manual, powered and interdental toothbrushes, (ii) to differentiate crown versus root plaque control, and (iii) to compare single toothbrush use with hybrid powered toothbrush plus interdental toothbrush.

Material and Methods:
The robot was programmed simulating 2 min brushing, force 3.5 N, movement rotating on replicated human teeth in anatomic position. Synthetic plaque simulation was used. Automated Planimetrical Plaque Assessment (Gaengler et al. 2013) was executed at 24 crown and 6 root fields per tooth. The test of manual toothbrush (MTB) Inava15/100 (Pierre Fabre, France) was compared to Curaprox 1560 (Curaden, Switzerland), and powered toothbrush (PTB) Inava Hybrid was compared to PTB Inava Hybrid plus gauge-adapted interdental toothbrushes (IDBs) (Pierre Fabre, France). All four tests were performed 7 times. Kolmogorov-Smirnov-test was applied to test 11 variables for normal distribution, H0 was rejected. Therefore, Wilcoxon-Mann-Whitney-test was used.

Results:
Brushing programmes were strictly identical. No statistical differences could be detected in plaque control at buccal and lingual smooth surfaces. Mesially and distally, next to gum line and at all root fields Inava was clearly superior to Curaprox, however, inferior to combined brushing with Inava Hybrid followed by the IDBs Blue/Yellow. Consequently, this combination was statistically significantly better than Curaprox at all risk fields/areas except next to gum line lingually. Most hidden areas distally of tooth roots showed plaque removal from incisors to second molars of 75.2-99.4% in analysis of single teeth. Range of total brushing efficiency of MTB Inava 71.5% and MTB Curaprox 57.3%, PTB Inava Hybrid 66.4% and PTB+IDB 81.6% Plaque control by soft brushes depends on toothbrushing actions. All single tooth data represent an outcome of the study, and a close number of multiple contrasts of the toothbrushes is consequence a number of 7 significances / significant differences have to be ignored (see ‘~’ markings in tables).

Conclusions:
Complex plaque control by powered vibrating/rotating toothbrushing followed by adapted interdental brushing of exposed root areas is highly efficient. Clinically validated robot testing and planimetric plaque assessment at 4 sites of all teeth demonstrates standardized biophysical brushing actions. All single tooth data represent an optimal plaque control outcome with prevention ability. Adult patients with gum recession, gingivitis, periodontitis progression and root caries risks have the best home care with a high evidence level by Hybrid PLUS Interculular Brush.

References:

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Fig. 1: Tested toothbrushes: Manual toothbrush (MTB) Inava 15/100 (Inava), MTB Curaprox 1560 (Curaprox), powered toothbrush (PTB) Inava Hybrid (Inava) and PTB + IDB Hybrid Inava (Inava) combined with gauge-adapted interdental toothbrushes (IDBs) (Hybrid IDB).

Fig. 2: Planimetric fields at tooth crown and roots of smooth surfaces (left) and at buccal and lingual smooth surfaces (right) for plaque assessment in percent. Fig. 3: Error bars of plaque removal (MTB) Inava Hybrid versus PTB Inava Hybrid. Number of observations per toothbrush: n=7.

Fig. 3: Error bars of plaque removal individually (towards the crown). Lignally towards the lingual, mesially (antero)mesially towards the buccal, distally (antero)distally in-between the teeth and at buccal and lingual risk fields (MSID) next to the gum line for the tested toothbrushes. Number of observations per toothbrush: n=7.

Fig. 4: Error bars of plaque removal on root fields (in-between the teeth), mesially (antero)mesially in-between the teeth, distally (antero)distally in-between the teeth for the tested toothbrushes. Number of observations per toothbrush: n=7.

Tab. 1: Mann-Whitney-Test of cleaning efficiency (% plaque removal) tests of significance contrasts of the toothbrushes.

MTB Inava (1) and PTB + IDB Hybrid IDB (3)