Aims

- Toothbrushing reduces plaque levels and minimizes the risk of plaque-associated diseases such as dental caries, gingivitis and periodontitis.1,2
- This in vitro study compared cleaning efficacy at low brushing force of five marketed toothbrushes with a unique handle neck flexibility compared to a control.

Methods

- Five marketed toothbrushes (GSK Consumer Healthcare, Brentford, UK) plus a control were tested using a clinically validated, comparative robot test1 to examine in-vitro brush efficacy.
  - KaVo™ human teeth replicas were used: four incisors, one canine, two premolars, three molars in anatomic positions, coated in clinically validated simulated plaque.
  - Seven runs each of horizontal, seven rotating and seven vertical movements at 2.5 N.
- Evaluation of plaque removal carried out using automated plaque planimetry
  - 30 planimetrical fields per tooth representing buccal, lingual and proximal sites of tooth crowns and exposed tooth roots (Next to Gum line: ABCDF; Interproximal: DF; Crown smooth surface: EGHJ; In-between teeth mesially and distally: XYZ; Root buccally and lingually: W; proximally: W1/W2). Proximal root: W1/W2 encompassing 12 risk areas.
  - Mean simulated plaque reduction was compared to evaluate cleaning efficacy at:
    - All buccal/lingual tooth sites (A–I); at risk fields near gum line and approximally between teeth (ABCDF fields at buccal/lingual sites); all mesial/distal sites (XY fields proximal in-between teeth); root buccally/lingually/mesially/distally; all sites (total, 30 fields per tooth).
  - The Kolmogorov-Smirnov test was applied to test tooth surfaces variables; null hypothesis of normality was rejected, therefore, analysis used non-parametric Wilcoxon-Mann-Whitney-U-testing.

Results

- Plaque removal efficacy (% mean and standard deviation)
  - Horizontal
  - Rotating
  - Vertical

![Image]

- Statistical analysis of cleaning efficacy (% plaque removal)
  - Toothbrush with statistically significantly higher (p<0.05) percentage plaque removal is shown by corresponding colour of brushing movement (Black: Horizontal; Yellow: Rotating; Red: Vertical movements A B C D F)

- Test toothbrushes were statistically superior (p<0.05) to the Reference Jubilee brush:
  - Overall (total) in horizontal movements with 4/5 toothbrushes in rotating and 3/5 toothbrushes in vertical movements.
  - At all mesial and distal sites for all movements.
  - At most buccal and lingual sites for rotating movements only.
  - For all ABCDF buccal sites (exception W1). Tooth root sites: Total mean plaque reduction over all tooth sites; True White: True White; Sens Gum: Sensodyne & Gum; Rap Prot: Repair & Protect; Rep Prot: Repair & Protect; Rap Rel: Repair & Protect; Rapid Rel: Repair & Protect; Reference Jubilee: Reference Jubilee

Conclusions

- Toothbrushing is postulated to differ with different movements due to the ball joint bending being supported by horizontal/rotating brushing flexible movements, with vertical brushing limiting the force transfer from the neck to the head.
- Based on this in vitro model, brushing efficacy of the test toothbrushes with handle neck flexibility can be interpreted as optimal plaque control at all risk areas and their single planimetrical fields, contributing to good oral hygiene.

References