Structural Pathobiology of Cervical Wear by Robot Simulated 3-year Toothbrushing

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Objectives:
Occlusal wear in omnivorous animals, including man, is a natural phenomenon, the lifetime cervical wear is, in contrast, a risk for dentin hypersensitivity and hard tissue loss. Therefore, an ex-vo study was aimed at (i) enamel and dentin loss, (ii) improvement of cervical conditions contributing to oral health by (iii) comparing ball joint toothbrushing with flexible neck manual toothbrush versus rigid toothbrushing with a conventional manual toothbrush.

Material and Methods:
Following ethical approval EC-LWH-SP-67-2021 random toothbrushing (44 strokes/ tooth horizontally, rotating, vertically. 2x/d) with manual flexible ball-joint test brush vs. control brush with rigid handle and dentifrice Sensodyne Extra-fresh (Haleon/GSK, Weybridge, UK) was performed in an Artificial Oral Cavity with robot force 3.5 N on 14 human extracted teeth. Morphological features were examined by SEM using replication technique (LEO-1450, Zeiss). 3D-SEM analyses were carried out with a 4Q-SE detector (SEM-515, Philips; Point Electronic, Halle).

Results:
Morphological feature coding 0-3 revealed four enamel patterns (abraction marks, perikymata, prismless/prismatic enamel, enamel inclusions), one dentin pattern (open tubules) and three cervical patterns (calculus, enamel infractions), one dentin pattern (open tubules) contributing to oral health by (i) enamel and dentin loss, (ii) improvement of cervical conditions (iii) comparing ball joint toothbrushing vs. control brush with rigid handle and dentifrice Sensodyne Extra-fresh (Haleon/GSK, Weybridge, UK) was performed in an Artificial Oral Cavity with robot force 3.5 N on 14 human extracted teeth. Morphological features were examined by SEM using replication technique (LEO-1450, Zeiss). 3D-SEM analyses were carried out with a 4Q-SE detector (SEM-515, Philips; Point Electronic, Halle).

Conclusions:
Structural pathobiologic follow-up of men-made cervical wear by SEM and 3D-SEM elucidates negative as well as beneficial oral health- contributing micromorphology patterns of simulated 3-year random toothbrushing.

Ball joint flexibility of toothbrushes contributes to less damaging cervical wear compared to rigid toothbrushes.

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Fig. 1: Two dentition models were constructed, each with one human tooth and 10 textures, 1 incisor, 3 premolars, 2 molars, canine, and incisal tooth in anatomical position. The test was made (95% CI 99.0% confidence level): Wash, rinse, remove saliva, repeat 10 times. The test was performed on cervical region with a robotic system (FS 02 N, Point Electronic, Halle).

Fig. 2: Magn. 100x, 400x (see magn. bar).

Fig. 3: Magn. 200x.

Fig. 4: Magn. 30x.

Fig. 5: Magn. 400x.

Fig. 6: Magn. 500x.

Fig. 7: Magn. 100x.

Fig. 8: Magn. 400x.