

Three-dimensional analysis of jaw movements during unilateral gum chewing in healthy subjects and patients with temporomandibular disorders

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In our laboratory, we are currently analyzing three-dimensional mandibular movements during the performance of physiological movements. The aim of the current investigation was to quantitatively compare the three-dimensional jaw movement of healthy subjects and patients with temporomandibular disorders (TMD) performing standardized unilateral gum chewing.

Mandibular movements were non-invasively detected and recorded using an optoelectronic motion analyzer, with a 60 Hz sampling rate. Ten healthy subjects (mean age 32 y, SD 16 y) and ten subjects with mild or moderate TMD signs and symptoms (mean age 27 y, SD 8 y) chewed a gum alternatively on the right (R) and left (L) side of the mouth. Nine passive markers (diameter 5 mm) were used: three created a cranial reference system; three positioned on a stainless steel extraoral frame fixed on the mandibular anterior gingival, provided the mandibular reference system; two individualized the cutaneous projections of the R and L condyles, and one corresponded to the interincisal point. For both the healthy and TMD groups, the three-dimensional pathway of the interincisal reference point was evaluated in 16 chewing cycles on each side of the mouth.

On average, the area covered by the interincisal point was similar (2-way ANOVA, $p > 0.05$) during R and L chewing in both healthy (frontal plane, 21.1 ± 13.5 vs. 22 ± 11.1 mm²; sagittal plane, 9.4 ± 4.8 vs. 9.4 ± 3.8 mm²) and TMD groups (frontal plane, 15.7 ± 9.3 vs. 19.6 ± 10.2 mm²; sagittal plane, 11.3 ± 6.1 vs. 9.3 ± 5.9 mm²). The interincisal point velocity during the closing phase was greater than during the opening phase (3-way ANOVA, $p < 0.001$), regardless of side in both healthy and TMD groups (respectively: R chewing opening, 3.3 ± 1.1 vs. 3.4 ± 0.6 cm/s; R chewing closing 4.5 ± 1.6 vs. 4.6 ± 0.9 cm/s; L chewing opening, 3.5 ± 0.8 vs. 3.5 ± 0.7 cm/s; L chewing closing, 5.0 ± 1.6 vs. 4.5 ± 1.2 cm/s). The morphological analysis of the frontal plane chewing patterns revealed a higher frequency of altered patterns¹ in the TMD group than in the control subjects (Chi-square, $p < 0.01$).

These findings showed that, in TMD patients, the chewing-cycle kinematics is not different from the normal subjects. Anyway the presence of a higher frequency of altered cycles suggests that TMD can influence the masticatory pattern, even in mild or moderate TMD patients.

1. Takeda et al. J Oral Maxillofac Surg. 2009;67:1844-9.