A kinematic investigation of mandibular border movement by means of an electronic measuring system. Part III: Rotational center of lateral movement

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Many theories regarding the rotational center of the mandible have been propounded. Spee, Hall, Monson, Needles and others, formulated theories based on anatomic observations. Gysi reported a theory based on two-dimensional geometric principles, while McCollum and Stuart developed a theory based on their experimentations. Although the rotational center concept of the mandible was discussed, the theories were not proven three dimensionally by means of modern kinematics.

Target orbits 55 mm from the midpoint of the terminal hinge axis were discussed. It was found that the orbits shift straight laterally on the terminal hinge axis and do not show any deviation in the sagittal plane. Based on these findings, it was believed that the Bennett movement was a straight lateral shift of the working condyle along the terminal hinge axis.

If a point 55 mm from the midpoint is considered the kinematic center of the lateral movement of the mandible, it may be defined as the three-dimensional rotational center of the mandible because it is situated on the terminal hinge axis, which is the rotational center of the mandible in the sagittal plane. In other words, the mandible may rotate in three-dimensional space around a specific point during lateral movement and shift in the lateral direction an amount equivalent to the Bennett movement.

The purpose of this study is to explain and illustrate the rotational center of the lateral movement of the mandible by means of an electronic measuring system that measures 6 degrees of free movement.

METHOD

Fifty adults, who ranged from 20 to 50 years of age, were selected. The selection criteria were that the subjects have a normal orthognathic-maxillomandibular relationship and have no discernible temporomandibular joint disorder. An electronic measuring system with an accuracy of ±0.06 mm was used.

Posterior reference points were located on the skin 12 mm anterior to the external auditory meatus on the horizontal reference plane. The transverse axis that connected the right- and left-posterior reference points was used as the terminal hinge axis. The anterior reference point was located 43 mm above the incisal edge of the right maxillary central incisor. The horizontal reference plane consists of the right- and left-posterior reference points, and an anterior reference point.

The upper sensor was placed to these reference points with the face-bow. The upper and lower sensors were fixed rigidly to the maxillary and mandibular arches by custom-made resin clutches. The shape of the central bearing plates was the same as that of the Stuart clutch (C. E. Stuart, Ventura, Calif.).

Right- and left-lateral border movements of the 50 subjects were recorded and the average movement of the field of the intercondylar axis and the targets on the intercondylar axis 65 mm from the midpoint was computed.

RESULTS

Field of motion

Figs. 1 and 2 indicate movement of the intercondylar axis on the horizontal and frontal planes, respectively, during right lateral movement of the mandible. Figs. 3 and 4 show movement of the intercondylar axis on the horizontal and frontal planes, respectively, during left lateral movement of the mandible. A point of intersection of the coordinate XYZ is located at the midpoint of the terminal hinge axis. The upper part of the diagrams illustrates the movement of the intercondylar axis as a whole, while the lower part of the diagrams (surrounded by the rectangular box) illustrates...