Discussion: Kinematic Investigation of Anterior Guidance as a Basis for New Gnathological Concepts Authored by Hobo and Takayama

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This in all probability is the most comprehensive study of anterior and condylar guidance that has been completed. The computerized kinematic approach appears to have covered most bases. The article certainly is addressed to the gnathologist. A good basic knowledge of gnathology, geometry and mathematics is required to completely understand this presentation. However, if the presentation is read accepting the above then it is more easily understood.

The definition of anterior guidance “the movement of the mandible through eccentric positions while maintaining contact between the maxillary and mandibular anterior teeth” was taken from The Encyclopedia of Occlusion. The “anterior teeth” include the anterior quadrant, canine to canine. This study of anterior guidance consisted of a control group of patients with normal occlusion and free of temporomandibular problems, a necessary requirement for this study. Normality must be a Class I occlusion, no pathological wear of the teeth, all teeth present, muscles and joint anatomy in a healthy condition.

Most all of the great gnathologists focused on condylar guidance with little discussion on anterior guidance. Dr. Charles Stuart, in his last years, included a discussion on anterior guidance in his lectures. With exceptions noted, very few studies had been completed on anterior guidance.

This kinematic study was based on the calculation of numerous directional angles of the condylar and incisal paths relative to the reference plans. These angles are represent three-dimentional movements of the mandibular triangle formed by each of the condylar poles and a point between the two lower central incisors. This triangle is the base from which all of the angles were calcu-
lated. Thus this three-dimensional analysis is used to accurately reproduce the mandibular movements and to investigate functional harmony between the condylar path and anterior guidance.

This harmony is critical for normality. If the incisal path inclination is steeper than the condylar path inclination, the mandible rotates during protrusive movement. If the paths are parallel the mandible translates without rotation. If the incisal path is flatter than the condylar path the mandible rotates in a reverse direction. This must be pathological because this movement causes muscle irritation. A future study may find a relationship between the reverse rotation and temporomandibular dysfunction. This relationship justifies anterior guidance considerations when treating temporomandibular dysfunction as well as essential criteria for the student of gnathology.

All of the mathematical equations for the mandibular movement are explained as elementary as possible. Again, unless one has the mathematical knowledge and the ability to think in those terms, these data must be accepted as fact. To think in those terms, the basic geometrical figure must be firmly in mind, the O-X-Y-Z coordinate systems and the directional angles of the condylar and incisal paths relative to the reference planes. The equations formed by these angles are the mechanical geometric basis for the border movement calculations. The accuracy of this calculation within 2.4 degrees including measurement error is very significant.

The angles of hinge rotation of the mandible around its axis during eccentric movement along a 2mm condylar path was between 0.15 and 0.47 degrees. If the angle were zero degrees during eccentric movement then the condylar and incisal path are parallel to the sagittal plane. This hinge rotation is a factor which has a direct relationship with the amount of disclusion. The average amount of molar disclusion in the normal person is 1.1mm in protrusive, 0.5mm on the working-side and 1.00mm on the nonworking side. These measurements were taken with 2.0mm of condylar translation. Previous researchers thought that the condylar path was fixed and repeatable, however this study revealed a different path with each tracing. The various paths the condyle takes in translation would indicate the need for more cusp freedom, possibly in conjunction with the buffer space requirement.

The authors defined the buffer space concept as a natural space which acts as a "fail-safe" mechanism. This space produces an optimum condyle position and should not be used to correct clinical mistakes. The average buffer space is 0.2mm in centric relation, 0.3mm in the working condylar path, 0.8mm in the protrusive and nonworking sagittal condylar paths. Each of us
involved in the study of radiographic tomograms of the temporo-
mandibular joint recognize the need for space between the
condyle and the glenoid fossa. The buffer space concept re-
confirms our belief in the need for this joint freedom.

Cusp shape is a factor in the amount of molar discision. All
mandibular movements had their respective amounts of disclu-
sion, but the two most significant findings revealed the cusp
shape component contributes to posterior discision on the non-
working side but not on the working side. The cusp shape com-
ponent for protrusive corresponds to the diameter of a circular
arc 4mm for protrusive movement and 7mm on the non-working
side superimposed on the maxillary lingual cusps in the sectional
view.

The neutral line is a line created by assuming the condyle tran-
lates straight laterally along the terminal hinge axis. A tooth
contact generated working condylar path deviated superiorly
when canine guidance was above the neutral line. The working
condylar path deviated inferiorly when canine guidance was below
the neutral line. This displacement was reduced by one-half when
clutches were used in contrast to canine guided discision.

The authors found significant differences in the condylar path
using the conventional clutch guidance system in contrast with
the tooth guidance system. The results dramatically changed the
working condylar path with little influence on the nonworking
path. The conclusion is that the canine guidance must be arranged
properly or it will significantly influence the working condyle
path.

Immediate sideshift should be a major consideration in restorative
dentistry. The immediate sideshift of the nonworking condyle
is reflected to the incisal point in the same amount of displace-
ment. Instrumentation should be used to accurately reflect the
correct amount of immediate sideshift.

Clinical procedures necessary to utilize these data are complex and
require sophistication of instrumentation including a computer
system and the allied Anteroputer to record and create the neces-
sary information for the gnatologist. Many of the normal gnath-
ological procedures are routine to the informed practitioner, work-
ing cast, a pin system, facebow, etc. The pin system is employed
to be able to remove the anterior teeth to permit waxing the
posters first without anterior interference. The waxing tech-
ique is well explained in the article and is easily followed.

The results of this excellent paper and the advantages made pos-
sible to the progressive gnathologist are difficult to communicate.
The detail and organization of a most complex subject is explained in such a manner that a gnathologist with the basic fundamentals can understand, if close attention is paid to the details. This study will certainly benefit the gnathologist that is interested in high quality restorations that are physiologic.

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