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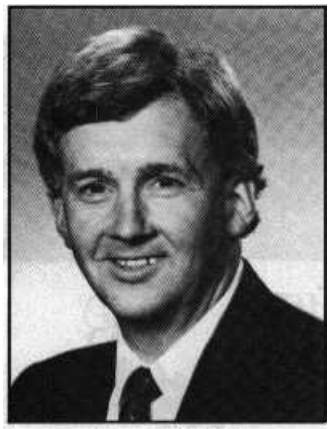
Basic Imaging Requirements For The Temporomandibular Joint



Richard W. Greenan

Basic Imaging Requirements For The Temporomandibular Joint

Much has been written about the various imaging modalities at our disposal for the temporomandibular joint from panoramic radiography all the way up to nuclear bone scans (scmtiscans). In a March 10, 1987 report by the Radiology Section of the American Academy of Dental Radiology, member Denise Kassebaum concluded that "More than half of the dental schools relied on panoramic radiographs for TMJ imaging." The report went on further to state that "Students received little training in TMJ imaging in the radiology curriculum." Although in most instances, the panoramic radiographic affords us our first view of the TMJ (Figure 1), it is of limited benefit and used to merely confirm that the patient does indeed have two TMJ's in addition to a screening for gross osseous changes. Panoramic radiographs are also of benefit for evaluation of elongated stylohyoid processes and its ossified ligaments (Eagle's syndrome), antigonial notching as well as coronoid process hyperplasia and the multitude of dental maladies for which they are commonly used.

Figure 1
Slide of Panoramic Radiograph

To determine the relative position of the mandibular condyle within the glenoid fossa, the panoramic radiograph is fallacious due to the central ray being projected up at an average angle of 150 thereby projecting (or casting the shadow of) the medial pole up at 12 o'clock and the lateral pole superimposed over the ascending ramus at 6 o'clock. Unfortunately for us, the vast majority of the osteoarthritic degeneration found in the TMJ occurs on the lateral pole and opposing fossa surface which supports the validity of the transcranial projection for viewing the lateral pole and explains why the panoramic projection is of little use for evaluation of those subtle degenerative changes.

Figure 2
Slide of Transcranial Radiograph

Unlike the panoramic radiograph, the transcranial projection (Figure 2) is primarily used in screening for "relative" condylar joint position within the glenoid fossa; The questions one must ask are: Are the condyles positioned in the center of their respective fossa; posterior, superior or anterior? Is one condyle positioned further posterior or superior than the other? Do these findings correlate with your clinical evaluation? Dr. Harold Gelb has expanded upon this thesis with a grid to orient condylar position and concludes that the majority of asymptomatic condyles fall within this "4-7" position. Although most of today's leading clinicians feel that the asymptomatic condyle should be either concentrically positioned or in the "4-7" position, the most important determinant is FUNCTION. Does the patient open to a maximum extension of 47-48mm? Does the patient have a lateral excursion left and right of 11-12mm? When internally palpating for condylar position (with the patient par- tially open, insert your small fingers into the external auditory meatus and with an inward and forward motion, instruct the patient to close into CO), does one condyle make

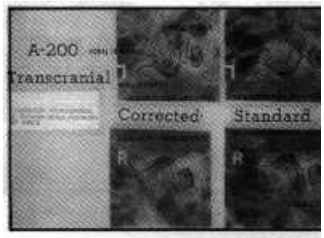
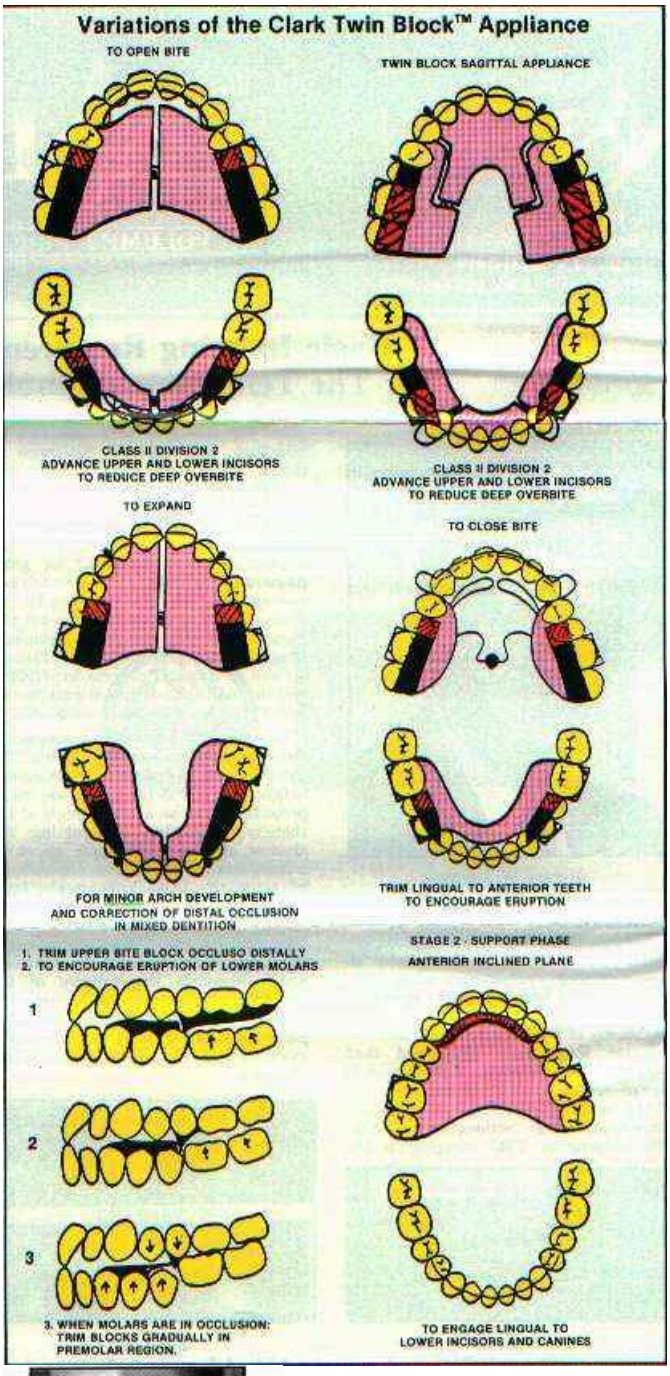


Figure 3
Slide of Corrected
Transcranial Radiograph

contact earlier than the other? Does one condyle displace laterally or medially upon contact? Your clinical findings should correlate with your transcranial radiographic analysis in 80-90% of the cases. Although the literature supports a correlation between the joint space as measured on transcranials and corrected tomograms in 60% of the cases, subjective analysis of "relative" condylar position does heed a considerably higher correlation. Hence, the literature does not support the accuracy of a transcranial for anything other than a screening for "relative" condylar joint position and possible osseous changes of the lateral pole and opposing glenoid fossa. There has also been a great deal of recent discussion regarding "Corrected" versus "Uncorrected" Transcranial radiographs (Figure 3).



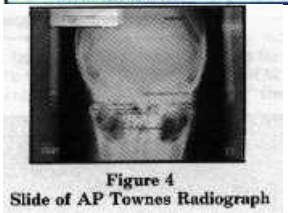


Figure 4
Slide of AP Townes Radiograph

An Uncorrected Transcranial does not take into consideration the patient's true condylar horizontal angle and consequently, every patient is positioned into a generic headholder alike. The horizontal angle of the headholder may or may not coincide with that of the patients respective condyle.

A 'true Corrected Transcranial radiograph is based on transferring the horizontal angle from the submental vertex radiograph directly to the transcranial headholder. Although there are a few headholders on the market that will accept the transfer of these angles, any angle greater than 250 has the effect of rotating the subject TMJ further away from the cassette hence losing the important object-to-film relationship It is necessary to have the subject TMJ pressed tightly up against the cassette with all transcranial techniques (regardless of condylar angle!) and a rotation in the horizontal plane in excess of 25 0 with most patients, will pull the TMJ away from the cassette, negating any advantage gained with proper angulation.

Having the subject TMJ pressed tightly up against the cassette with the patient's midsagittal plane rotated in towards the cassette (in what Farrar referred to as his 3 point stabilization -TMJ, zygoma and chin), will in most instances, position the subject condyle at the desired 20~250 incident to the central ray. Such angulation will, in of itself, usually "correct" the radiograph. Figure 3 demonstrates the two extremes between a 00 (standard) and a 250 (corrected) patient angulation with just a .5mm difference in posterior joint space. A ± 100 variation (ie. 150350) in the horizontal plane from the above patient positioning recommendation will not adversely affect fossa position and is within acceptable tolerances for the transcranial technique.

Although we now have some idea of relative condylar position and gross

symmetry, we still do not have a view of condylar morphology. In other words, are the condyles the same size and shape? Is one condyle "worn" down as compared to the other? Is the lateral pole smaller on one side than the other? Does the smaller side correlate with increased antigonial notching as seen on the panoramic projection? These questions will affect your treatment and can easily be answered with the AP Townes projection (Figure 4).

The anterior-posterior Townes projection is an excellent plain radiographic technique for visualization of true condylar morphology from a frontal perspective. Both the medial and lateral poles of the condylar heads are clearly seen in addition to the anterior and posterior aspect of the condylar articulating surface. Along with the transcranial projection, the Townes affords essentially a 3D view of the ternporomandibular joint. Not only providing you with excellent documentation, but more importantly, allowing you to "see" the total patient and demonstrate the relationship of the muscles and their function. Such a definitive history on your patient can only compliment your treatment plan for more predictable results.

For one excellent reference on radiographic interpretation covering the myriad of those techniques available to today's practicing clinician in orthodontics/orthopedics and TMJ, I wish to refer you to "A Practical Atlas of TMJ and Cephalometric Radiology" by Richard W. Greenan (Figure 5). The "Atlas" is comprised of sixty actual radiographs including a tracing and narrative on each one demonstrating norms in addition to the typical anomalies as seen on cephalograms, panoramics, transcranials, Townes, PA skulls, tomograms etc. For information on the various patient positioning techniques, such as the Townes, and the respective exposure parameters, I wish to refer you to "A Practical Guide to TMJ and Cephalometric Radiology". Both the "Atlas" and "Guide" are available through North American Orthodontic Labs.

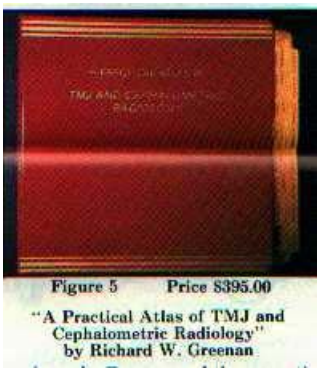


Figure 5 Price $395.00

"A Practical Atlas of TMJ and Cephalometric Radiology" by Richard W. Greenan

In review, panoramic, transcranial and AP Townes radiography are in fact viable imaging modalities when used in conjunction with a comprehensive patient history and thorough clinical exam.