sciendo

DOI: 10.2478/aoj-1993-0017

AN EVALUATION OF TOMOGRAPHY, CEPHALOMETRICS AND CASTS IN THE TREATMENT OF TEMPOROMANDIBULAR JOINT DISTURBANCE

AUTHOR
Eugene H. Williamson, D.D.S., M.S.

This article summarizes the author's approach to the use of radiography and dental casts in the diagnosis and treatment of temporomandibular joint disturbances. Dr Williamson was the main speaker at the Australian Society of Orthodontists' Congress in Melbourne, in 1985.

Tomography

The measurement of temporomandibular joint spaces on radiographs to determine a correct condylar position has become a popular technique over the years. Ricketts[1] was the first to discuss the procedure in 1950. He took fifty normal subjects and found anterior joint space to average 1.5 mm with a range of 0.5-3.0 mm. Superior joint space averaged 2.44 mm with a range of 1 to 5.5 mm. Since the average anterior and posterior spaces were nearly equal, he suggested that a centred condylar position was ideal as a treatment goal. However, if one looks at the relatively large standard deviations (0.85mm) and the range, it becomes clear that the variation of normal individuals around the mean is quite large. This indicates that many normal or asymptomatic patients may have unequal anterior and posterior joint spaces and hence, an anterior or posterior positioned condyle in the fossa.

In 1970-72, Weinberg[2,3] and in 1972, Farrar[4] published articles using transcranial radiographs to determine condylar position; and advocating a centred condylar position as being ideal and treating to that position. These papers were essentially of poor study design without normal controls and little or no statistical data. Nevertheless, popularity of the centred condylar position determined by radiographs was promulgated by clinicians giving continuing-education courses and displaying anecdotal examples. Frequently, disc displacements were diagnosed from the unequal joint spaces with no basic research used for documentation of technique validity.

In 1978, Williamson[5] found normal individuals to have a wide range of joint spaces on corrected tomograms, but the average was determined to be a centred condyle. Blaschke and Blaschke[6] published similar findings in 1981. Dumas *et al.*[7] also displayed wide ranges in joint space on tomograms for their normal controls in 1984. The latter investigators state that the symptomatic joints of their experimental group were more posterior in the fossa than the asymptomatic ones; but when one peruses the statistical data of the article, there is only 0.15 mm difference in the means of the symptomatic and asymptomatic anterior spaces with a wide range of variability and no statistically significant difference. In 1983, Katzberg and co-workers[8] did a classic prospective study using tomograms obtained prior to arthrograms. There were twenty-seven joints arthrographically shown to have disc displacements without reduction and twenty-three normal joints used as controls. Joint space measurements were determined on the tomograms and the two groups compared. There was no statistically significant difference in joint measurements on tomograms between groups even though the most severe grade of internal derangement was present in one group, i.e. disc displacement without reduction or with perforation.

The overwhelming conclusion of the research available in the current literature is that: the clinician may not measure the joint spaces on a radiograph of his individual patient and compare them to average figures which indicate equal joint spaces. The variation of the normal patients is too great: some having smaller anterior or posterior spaces than others. Hence, the patient presenting in the clinician's office may have asymmetric joint spaces which may very well be normal anatomy for him.

The anatomy and histology of the temporomandibular joints may be one explanation as to why normal joint spaces vary on radiographs. Non-calcified tissue does not appear on routine radiographs, and it is a well-known fact that disc thickness varies as well as the connective tissue thickness covering the eminence and the condyle. Therefore, a patient with a thicker disc may display wider anterior joint spaces on a radiograph which is very normal for him or her.

The question then arises: 'what is the clinical need and effectiveness of tomograms in the everyday practice of diagnosis and treatment of Temporomandibular Joint Disturbance (TMD)?' Considering the research, it seems that joint morphology and potential pathology are the major areas for assessment. The typical morphologic indication of osteoarthrosis is flattening and/or osteophyte formation of the condyle or eminence. When this condition is present radiographically, it is usually the result of soft tissue insult such as internal derangements, i.e. degrees of disc displacements; adhesions or perforations. These conditions, most likely, will have occurred some time prior to the appearance of hard tissue remodelling radiographically. Tomographs may also be used for periodic reassessment and comparison of morphology if the same areas of the anatomy are seen on the films. This requires the use of the submental vertex radiograph so that the operator may be assured that the tomographic slice is made sequentially through the same anatomic location of the condyle and eminence. Indications of pathology, such as neoplasms, may be seen by comparing one joint to the other, i.e. a large bulbous condyle on one side compared to a more normal anatomy on the other. Depending on the history of the chief complaint, this condition may call for more sophisticated imaging and biopsy. Potential unilateral condylar hypertrophy and condylar asymmetry are also diagnostic possibilities. These may be indicated by observing a long, thin condylar neck on one side and more normal morphology on the other. Since condylar position within the fossa, as seen on the film, is of little concern, the use of the tomographic radiograph affects the occlusal treatment in phase two more than phase one therapy for the patient whose chief complaint is pain or limited movement.

Cephalometrics

The lateral cephalogram holds little diagnostic value in pre-phase one therapy, other than to have the reference to mandibular position before treatment and, perhaps, to reference incisor position at that time also. This film allows the clinician to observe any change in mandibulo-maxillary relationship by comparing a second film following phase one therapy and before instituting occlusal treatment, if it is required, in phase two. Unusual morphology may be noted in all craniofacial anatomy, including the cervical vertebra, and appropriate referral made for further diagnosis, if necessary. Since little or no research is available on postural relationships of the cranium and vertebral column, or their association to temporomandibular disorders, this clinician has not used the lateral cephalogram for such diagnostic criteria.

The frontal or anterior-posterior radiograph is primarily to assess asymmetry in condylar height and, therefore, maxillo-mandibular midline discrepancies. Again, this has no bearing on phase one of treatment other than on assessment for other unusual morphology or pathology of the cranio-facial region.

The submental vertex (SMV) radiograph gives a unique view of the mandibular condyles from lateral to medial pole, as well as noting any asymmetry in mandibular corpus length. It is a useful tool in observing unusual morphology of the deep cranial structures which may indicate pathology such as neoplasms that can cause distortion of adjacent bony anatomy. Such findings may call for more sophisticated imaging and referral. This film is extremely useful on condylar fracture cases. Another good use of the SMV is to monitor condylar rotations pre- and post-orthognathic surgery in phase two treatment.

Casts

The only way to assess the occlusion of a patient is to mount models by means of a facebow transfer and interocclusal record on a semi-adjustable articulator. Since the skeletal relationship of the mandible to the cranium may change with treatment in phase one therapy, it is most essential to record the existing skeletal condition as the patient enters a practice. The interocclusal record should be made in the best possible seated position of the mandible, just prior to the first tooth contact. This may be difficult if the patient is in pain due to internal derangement; in such cases, it may be necessary to mount the lower model at the intercuspal relationship to be used as the original occlusion prior to treatment. Otherwise, the recording should be made with a manipulated wax interocclusal registration or a leaf gauge and material such as zinc oxide eugenol.

Little diagnostic information can be obtained from the models at this time, other than to assess the degree of malocclusion. Since it has been an axiom of this clinician not to change the occlusion of the patient by means of equilibration, orthodontics or restorative dentistry during phase one therapy, occlusal analysis is rarely required until a diagnosis is made in phase two.

The mounted models are first used in diagnosis during splint therapy. Since anterior repositioning is most often used to reduce the internal derangement and is followed by superior repositioning to allow mandibular seating, the models are used to assess stability when there appears to be no further condylar seating.

Continual occlusal adjustments are required with the wearing of a superior repositioning splint as the mandible seats muscularly into a superior-anterior position. When there seems to be no more mandibular change, two interocclusal records are made a few weeks apart and models mounted on the articulator. The two records may then be utilized with a mandibular position indicator, or a Veracheck type instrument, to determine the stability of condylar position in the glenoid fossa. If the two sequential interocclusal records indicate the condylar positions to be within one millimeter of each other, the models may be used at that time for planning phase two treatment, if it is required.

The mounted models become an integral and very important part of treatment in the case of orthodontic therapy. The superior repositioning splint is often used in conjunction with fixed appliance treatment in the transition to phase two. The goals of treatment are:

1. retain the muscular seated condylar position;
2. intercuspation of the posterior teeth to coincide with the seated condylar position. This means at least one cusp of each two opposing posterior teeth in a fossa acts as a centric stop and supports mandibular closure;
3. overbite and overjet of the anterior teeth, i.e. coupling of the anteriors as best possible; and
4. separation of the posterior teeth by means of some anterior teeth in eccentric jaw movements.

The attainment of these goals is assessed by means of sequentially mounted models during active orthodontic treatment. It has been this clinician's experience that the first two goals are the most important to keep the patient pain free while in therapy. The splint satisfies these goals until teeth are in contact to replace it. Areas of the splint may be removed, and groups of teeth moved, until enough posterior teeth are intercuspating to satisfy goal number two. Splint coverage of the second molars and the anterior teeth is maintained to meet the goals during this transition. At that time, a new mounting may be made and the models equilibrated so that the operator is assured that premolars and first molars are stable in occlusion. This procedure is completed in the patient's mouth. The splint may then be discarded and the remaining teeth positioned to satisfy the goals of treatment. Goals may be evaluated and decisions concerning the biomechanics and the actual moving of teeth to achieve those goals, may be made only through the continuous use of sequentially mounted models. The use of equilibration determined from the models made during orthodontics, is a major advantage to efficient and time-saving phase two treatment.

In the evolution of this clinician's practice, the use of properly mounted models is the most critical and important diagnostic tool available. Phase two treatment should be the least invasive, if at all. The ascending order of invasiveness, following phase one treatment for TMD, is considered to be the following:

1. no further treatment if the patient can function without splint use during the day;
2. equilibration to achieve the four goals;
3. orthodontics or restorative dentistry to achieve the four goals; and
4. orthodontics and orthognathic surgery to achieve the four goals.

Only with properly mounted models can these decisions be made.

Bibliography

1. Ricketts RM. Variations of the temporomandibular joint as revealed by cephalometric laminagraphy. Am J Orthod 1950; 36: 874.
2. Weinberg LA. An evaluation of the duplicability of temporomandibular joint radiographs. J Prosthet Dent 1970; 28: 512.
3. Weinberg LA. Correlation of temporomandibular dysfunction with radiographic findings. J Prosthet Dent 1970; 24: 512.
4. Farrar WB. Differentiation of temporomandibular joint dysfunction to simplify treatment. J Prosthet Dent 1972; 28: 629.
5. Williamson EH. A laminagraphic study of mandibular condyle position when recording centric relation. J Prosthet Dent 1978; 39: 561.
6. Blaschke DD, Blaschke TJ. Normal TMJ bony relationships in centric occlusion. J Dent Res 1981; 60: 98.
7. Dumas AL, Moaddab MB, Wilis HB, *et al.* A tomographic study of the condyle/fossa relationship in patients with TMJ dysfunction. J Craniomandib Prac 1984; 2: 316.

Address for Correspondence:

Dr E.H. Williamson
P.O. Box 569
4250 Washington Road, Evans
Georgia 30809 U.S.A.