

# Observer performance in assessment of condylar position in temporomandibular joint radiograms

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The condylar position at centric occlusion has been considered important in diagnosis of the temporomandibular joint. The present study describes inter- and intra-observer variation in radiographic assessment of condylar position. One radiogram obtained by using an individualized lateral oblique transcranial projection and three corrected sagittal tomograms from the lateral, central, and medial parts of the joint were selected from each of 31 patients. In the resulting 124 radiograms three observers assessed the position of the condyle as posterior, central, or anterior on two occasions, 3 months apart. Concordant reports for all three observers were found in 63%. The interobserver agreement two by two ranged between 69% and 79%, whereas the intraobserver agreement ranged between 81% and 90%. The observer variation and limitations of radiographic techniques should be considered when the therapeutic implication of condylar position is discussed. □ *Temporomandibular joint diagnosis; temporomandibular joint syndrome*

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The condylar position at centric occlusion has been considered to be of importance when diagnosing temporomandibular joint disorders (1-9). In interpretation of oblique transcranial radiograms, Farrar (1) found the posterior position of the condyle to be associated with anterior displacement of the disc. Weinberg (7) found posterior condylar displacement to be more frequent than other types of displacements in acute temporomandibular joint-pain dysfunction. Blaschke & Blaschke (10) and Katzberg et al. (8) made area measurements of joint space in sagittal tomograms to determine the posteroanterior position of the condyle. Blaschke & Blaschke (10) concluded that the posteroanterior variation of the condylar positions in asymptomatic temporomandibular joints was wide. Similar findings were made in symptomatic joints by Williams (11). Katzberg et al. (8) found no significant difference between patients with anterior disc displacement without reduction and normal or asymptomatic patients with regard to condylar position.

These controversial opinions on the diagnostic value of condylar position might depend partly on the use of different radiographic techniques. It is known that the transcranial projection in some cases will produce a different appearance of the joint space compared with that resulting from tomography (12, 13). Another possible reason for the controversial opinions may be observer variation, as shown by Blair et al. (14) and Kopp & Rockler (15). We therefore considered it of interest to study observer variation in assessment of condylar position in transcranial radiograms and in corrected sagittal tomograms of the temporomandibular joint.

## Materials and methods

The material consisted of 4 unilateral radiograms from each of 31 randomly selected patients referred to our department for radiographic examination of the temporomandibular joint.

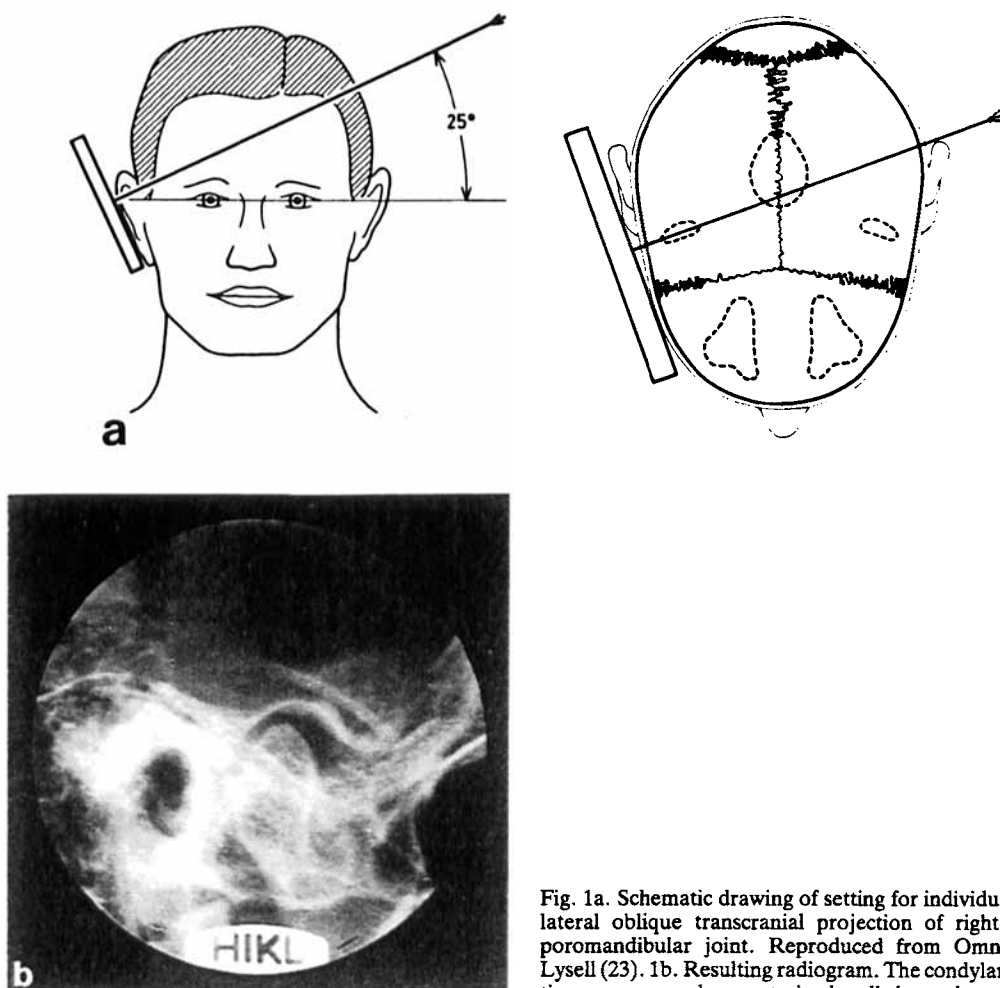


Fig. 1a. Schematic drawing of setting for individualized lateral oblique transcranial projection of right temporomandibular joint. Reproduced from Omnell & Lysell (23). 1b. Resulting radiogram. The condylar position was assessed as posterior by all three observers.

### Radiographic methods

One radiogram at the individualized lateral oblique transcranial projection (13) (Fig. 1) and three corrected sagittal tomograms (13) from the lateral, central, and medial parts of the joint (Fig. 2) were obtained at centric occlusion. During radiography the patient was seated with the head immobilized in a cephalostat (16). The cephalostat was rotatable around its vertical axis, making it possible to orient the horizontal long axis of the condyle in the temporomandibular joint under examination parallel to the central X-ray beam.

For the transcranial projection, an X-ray

tube (Siemens Bi 125/12/50R) and a focus-film distance of 1.15 m was used. Tomography was performed by using hypocycloidal movement in a Philips Polytome U (X-ray tube Siemens Bi 150/30/50R) and a focus-film distance of 1.50 m. A multi-film cassette with three pairs of intensifying screens (Siemens Verstärkerfolien, Simultan) and three films were used. The interspaces between the tomographic sections were 5 mm, covering a total tissue layer of 10 mm. The layers of tomographic sectioning were such that all three tomograms showed the condyle, fossa, and tubercle.

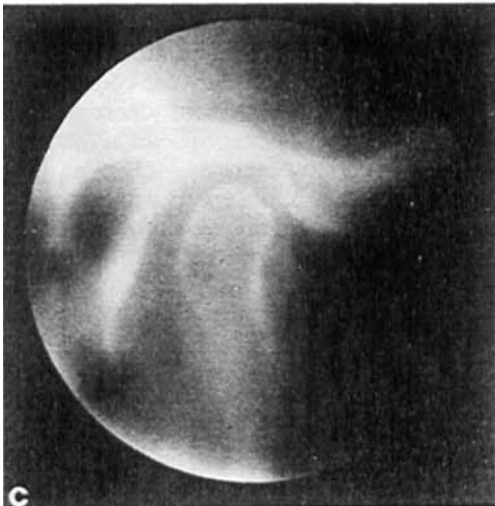
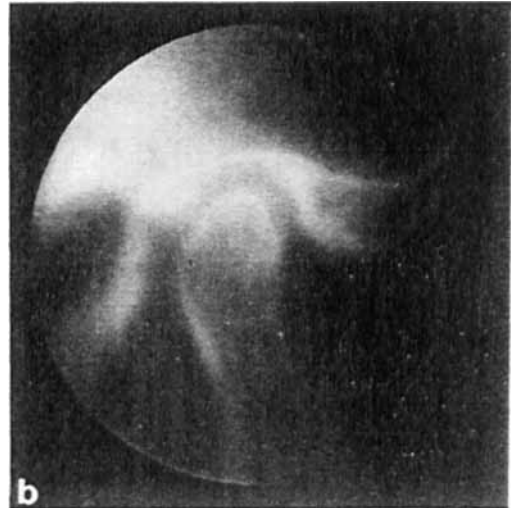


Fig. 2. Corrected sagittal tomograms from lateral (a), central (b), and medial (c) parts of the same joint as shown in Fig. 1b. The condylar position was assessed as central in all three tomograms by all three observers.

#### *Observers and assessment of radiograms*

Three uncalibrated observers with 4 to 11 years of experience of temporomandibular joint radiography assessed the position of the condyle in the fossa with the naked eye, as posterior, central, or anterior. The radiograms were organized at random, and all patient identifications, including age and sex, were eliminated. The clinical significance of the condylar position was not considered. Assessments were repeated after 3 months. The study of the interobserver agreement was based on the first assessment.

## Results

#### *Interobserver agreement*

Interobserver agreement for assessment of the condylar position at centric occlusion is presented in Fig. 3. The condylar position was assessed concordantly by all 3 observers in 63% of the 124 radiograms. The agreement between the observers two by two were 69%, 78%, and 79%, respectively. Table 1 shows that the proportion of radiograms judged as having a posterior condylar position varied from 28% to 46%. A central

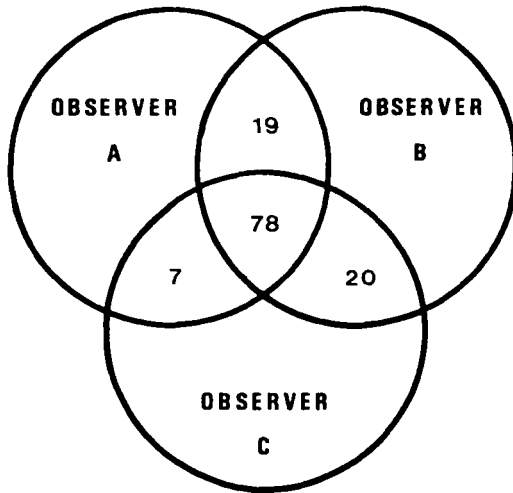


Fig. 3. Number of concordant reports by observers A, B, and C in radiographic assessment of condylar position. Total number of radiograms = 124.

position was reported with a range of 41% to 71%, and an anterior position with a range of 1% to 13%. The disagreement between the observers never exceeded one step; that is, a condylar position assessed as posterior by one observer was never assessed as anterior by any of the two others. Fig. 4 presents the number of radiograms concordantly assessed by two and three observers with respect to the different radiographic techniques and to different condylar positions.

#### *Intraobserver agreement*

The intraobserver agreement for assessing condylar position ranged between 81% and

Table 1. First assessment of three observers for radiographic assessment of condylar position at centric occlusion. One transcranial radiogram and three corrected sagittal tomograms of 31 patients are pooled ( $n = 124$  radiograms)

Observer	Position of condyle in fossa		
	Posterior	Central	Anterior
A	57	51	16
B	47	68	9
C	35	88	1

90% for the whole material (Table 2) and between 71% and 94% for the different radiograms. The intraobserver variation never exceeded one step; that is, a condylar position assessed as posterior at the first reading was never assessed as anterior at the second reading or vice versa.

#### Discussion

In transcranial radiograms of the temporomandibular joint and in sagittal tomograms, which previously have not been studied with regard to observer performance, the interobserver variation was substantial. The interobserver agreement two by two varied between 69% and 79%. The lower figure is comparable to the 67% achieved in a previous study in transcranial radiography of the temporomandibular joint (15). When all three observers in this study are considered, the interobserver agreement decreased to 63%. A decrease of interobserver agreement was also found by Reit & Hollender (17) when the number of observers was increased in a study of radiographic evaluation of endodontic therapy. It is therefore likely that the interobserver agreement in our study would have been lower if more observers were included.

In our study the condylar position was assessed as posterior, central, or anterior, whereas Blair et al. (14) and Kopp & Rockler (15) had two more scores, namely inferior and superior. A larger number of scores is also likely to decrease observer agreement.

To study specifically observer variation, the clinical significance of condylar position was not to be considered in our study. This situation is artificial but necessary to avoid influence of observer attitude. The significance of observer attitude was demonstrated by Goldman et al. (18) and by Gröndahl (19). In clinical work the final diagnosis is based on both clinical and radiological findings. It could be speculated whether this would reduce the observer variation, as discussed by Poulsen et al. (20).

Because of controversial opinions on the effect of observer calibration (19, 21, 22), we decided to perform this study by uncali-

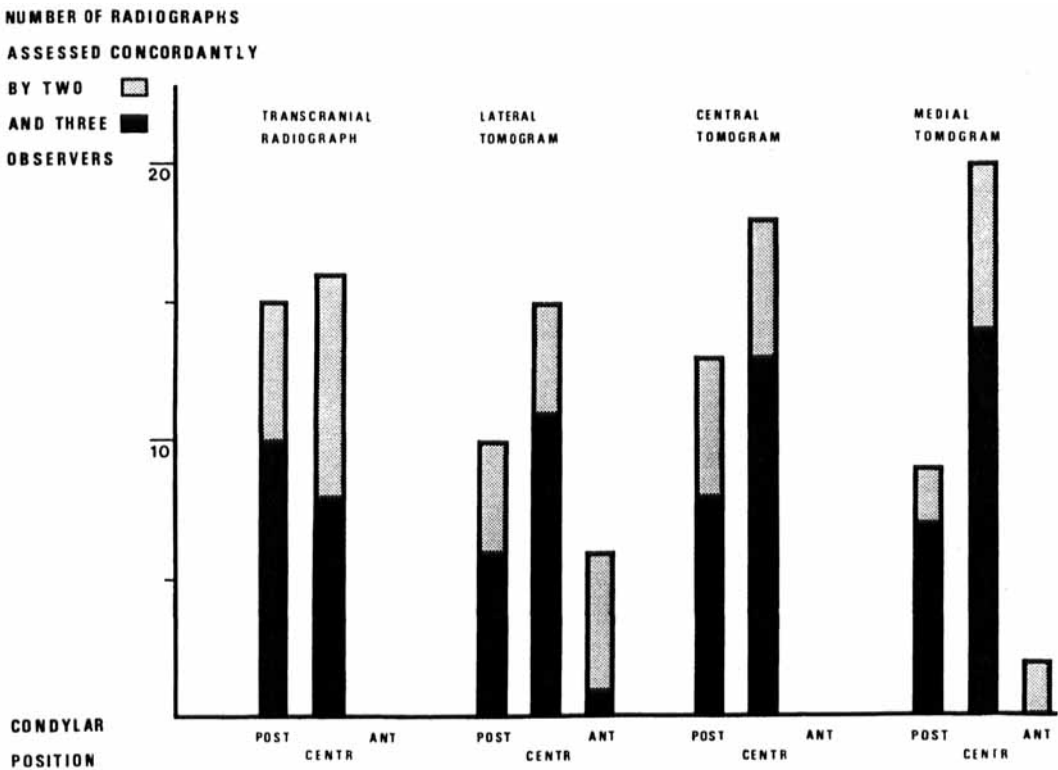


Fig. 4. Interobserver agreement in radiographic assessment of condylar position. Number of radiographs assessed concordantly by two and three observers with regard to the different radiograms and to condylar position.

brated observers. Some degree of calibration, as a result of working at the same department, was, however, unavoidable.

The intraobserver agreement, ranging from 81% to 90%, was higher than the interobserver agreement, which was also found by Blair et al. (14) and by Kopp & Rockler (15). Similar findings have been shown in several other studies of observer performance in radiographic diagnostics (17-19, 22).

We concluded that both inter- and intraobserver variation in radiographic assessment of condylar position must always be expected to a certain extent, even if the radiograms are obtained by standardized procedures. This weakness in the interpretation must be added to the limitation of the radiographic technique in correctly depicting the condylar position. The clinical implications of the condylar position should therefore be dealt with with caution. Fur-

Table 2. Intraobserver agreement in radiographic assessment of condylar position at centric occlusion

Observer	No. of radiograms judged the same at the first and second assessment				
	Transcranial radiogram (n = 31)	Lateral tomogram (n = 31)	Central tomogram (n = 31)	Medial tomogram (n = 31)	Total (n = 124)
A	28	25	29	29	111
B	22	25	29	25	101
C	28	26	27	27	108

thermore, to be able to compare different studies dealing with condylar position and its therapeutic implications, more discriminatory criteria are needed.

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