Evidence-based evaluation of three imaging methods for the temporomandibular disc

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Authors' objectives
To evaluate the evidence for the diagnostic outcome of arthrography, computed tomography (CT) and magnetic resonance imaging (MRI) in the assessment of temporomandibular joint disc position.

Searching
MEDLINE was searched from 1978 to 1994; details of the search strategy were provided. Several studies not indexed in MEDLINE and 11 dissertations (details given) were also identified, and the reference lists of retrieved publications were examined. Only studies reported in English were included.

Study selection
Study designs of evaluations included in the review
Studies that reported the diagnostic outcome of arthrography, CT and MRI of more than 15 temporomandibular joints in comparison with a specified reference standard, and which defined diagnostic criteria, were eligible for inclusion.

Specific interventions included in the review
No inclusion criteria relating to specific index tests were specified. Studies using arthrography (sagittal and anteroposterior arthrography for anterior disc position, arthrography for detecting sideways and rotational displacement), CT, and MRI (sideways and rotational displacement diagnosed from both sagittal and coronal images) were included.

Reference standard test against which the new test was compared
No inclusion criteria relating to the reference standard were specified. The imaging techniques were compared with the following reference standards: surgery, imaging and arthrography in clinical studies; and cryosection and macroscopy in studies of autopsy specimens. Studies in which the reference standard was another imaging method were excluded from the analysis.

Participants included in the review
Studies of temporomandibular joints from living patients or autopsy specimens were eligible for inclusion. Only studies based on a population with a disease prevalence of between 32 and 78% were included in the analysis.

Outcomes assessed in the review
The included studies were required to report sufficient data for the calculation of sensitivity and specificity values. Positive and negative likelihood ratios and predictive values were also calculated for the review. Observer performance was expressed as the overall intra- and inter-observer performance, and as a kappa index.

How were decisions on the relevance of primary studies made?
The authors did not state how the papers were selected for the review, or how many reviewers performed the selection.

Assessment of study quality
The authors did not state that they assessed validity.

Data extraction
The authors did state not how the data were extracted for the review, or how many reviewers performed the data extraction. Data were extracted on the numbers of joints, reference standard used, observer performance, disease prevalence and diagnostic outcome.
Methods of synthesis
How were the studies combined?
The mean sensitivities, specificities, and positive and negative predictive values (PPV and NPV, respectively) were calculated for each imaging technique.

How were differences between studies investigated?
Sources of possible heterogeneity were discussed. The authors also stated that a second analysis was conducted where studies were weighted according to their relative quality.

Results of the review
Arthrography: 5 clinical studies (251 joints) and 5 autopsy studies (208 joints: 179 anterior and 29 sideways or rotational displacement) were used to evaluate diagnostic outcome; 1 study (30 joints) was used to assess observer performance.

CT: 7 clinical studies (377 joints) and 2 autopsy studies (30 joints) were used to evaluate diagnostic outcome.

MRI: 7 clinical studies (293 joints) and 3 autopsy studies (55 joints: 15 anterior and 40 sideways or rotational displacement) were used to evaluate diagnostic outcome; 1 study (unspecified number of joints) was used to assess observer performance.

Arthrography.
The mean values from clinical studies were sensitivity 0.94, specificity 0.94, PPV 0.98 and NPV 0.73. The mean values from autopsy studies were sensitivity 0.9, specificity 0.8, PPV 0.88 and NPV 0.82. In terms of observer performance (7 observers), intra and inter-observer agreement gave kappa indices from 0.30 to 0.95 and from 0.54 to 0.68, respectively.

CT.
The mean values from clinical studies were sensitivity 0.97, specificity 0.76, PPV 0.97 and NPV 0.86. The mean values from autopsy studies were sensitivity 0.66, specificity 0.68, PPV 0.66 and NPV 0.74.

MRI.
The mean values from clinical studies were sensitivity 0.92, specificity 0.83, PPV 0.98 and NPV 0.4. The mean values from autopsy studies were sensitivity 0.81, specificity 0.87, PPV 0.82 and NPV 0.88. Intra- and inter-observer performance agreement gave kappa indices of 0.93 and 0.88, respectively.

After weighting.

For anterior position, the mean positive likelihood ratio was 4.5 for arthrography, 2.3 for MRI and 2.1 for CT; the mean negative likelihood ratios were 0.13, 0.22 and 0.5, respectively. For sideways and rotational displacements, the mean positive likelihood ratio was 3.8 for arthrography and 6.2 for MRI; the mean negative likelihood ratios were 0.43 and 0.22, respectively.

Authors' conclusions
Based on current evidence on the diagnostic outcome, the MRI scan seems to be the method of choice for diagnosing the temporomandibular joint disc position. Arthrography has a higher diagnostic outcome for anterior disc position, but is less reliable in diagnosing medial and lateral disc displacements, and has the added disadvantage of being an invasive method. The authors suggested that the quality of the evidence could be improved, and that an analysis of the impact of the imaging methods on patient treatment should be performed.

CRD commentary
The research question addressed by the review was poorly defined and the description of the inclusion criteria was limited. The search strategy was limited to a single electronic database and a search of reference lists; some specified theses were also included, although it was unclear how these were identified. In addition to these limitations, the review included only studies published in English. It therefore seems likely that relevant studies may have been omitted. The review methodology was poorly described, and the validity of the primary studies was not formally assessed. Thus, it is difficult to assess the potential impact of biases introduced by flaws in the methodology of the review or the primary studies, and the results presented.

The results from the individual studies were tabulated. However, since no details of patient selection or characteristics were provided for the primary studies, it is impossible to assess the comparability of, or differences between the groups studied, or the external validity of the review. There was no investigation or discussion of the heterogeneity between the studies and no discussion of the possible causes of the widely differing rates of disease prevalence (ranges: 50 to 100% in clinical specimens and 36 to 67% in autopsy specimens). Simple averaging of diagnostic outcome measures over a number of studies is a very poor method of deriving summary estimates; without full description of the study populations, and assessment and investigation of heterogeneity, it is certainly inappropriate. The weighted studies combining the evidence to allow comparison between imaging methods were all on autopsy specimens; different results may be obtained from living temporomandibular joint specimens. The number of joints on which the weighted evidence for sideways and rotational displacement were based was small: 29 and 40, respectively.

Given the limitations outlined above, the results of this review should be interpreted with considerable caution.

Implications of the review for practice and research
Practice: The authors suggested that MRI is the method of choice for diagnosing temporomandibular joint disc position.

Research: The authors stated that further assessment of the benefits of imaging the temporomandibular joint disc position is needed. They further stated that research assessing the effectiveness of imaging procedures at therapeutic and patient outcome levels, in addition to technical and diagnostic efficacy, might be a useful approach.

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This is a critical abstract of a systematic review that meets the criteria for inclusion on DARE. Each critical abstract contains a brief summary of the review methods, results and conclusions followed by a detailed critical assessment on the reliability of the review and the conclusions drawn.