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Chapter 6

Recognition of internal derangements

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Abstract

One of the most common symptoms of temporomandibular disorders is an internal derangement. The aim of this study was to test the inter-observer reliability of the recognition of internal derangements by means of auscultation, palpation or both. To that end, 120 women and 100 men were screened by two trained examiners for the presence of internal derangements. Anterior disc displacement was diagnosed in 14% of the cases and hypermobility in 12%. In 4% of the cases, the internal derangement was classified as "other". The inter-rater reliability (Cohen's kappa) was moderate for the presence of an internal derangement as such, while for the classification into type, an almost perfect reliability was found for the combined technique. It was concluded that the type of internal derangement can best be established with the combination of auscultation and palpation; for the establishment of an internal derangement as such, any of the three techniques would suffice.

Introduction

Temporomandibular joint (TMJ) clicking is a common symptom of temporomandibular disorders. In the general population, the prevalence of TMJ clicking ranges up to 65% (Hansson and Nilner, 1975; Glass *et al.*, 1993). Clicking is usually an indication of an internal derangement (ID). It is considered harmless, although in some cases limitation of mandibular movement may occur (Lundh *et al.*, 1987). Anterior disc displacement with reduction (ADD) and hypermobility are examples of IDs, but other types may occur also. ADD is characterized by an anterior displacement of the articular disc in the closed jaw position, and the disc improves its structural relationship with the condyle during mouth opening, usually resulting in a click (Farrar & McCarty, 1982). Hypermobility of the TMJ is a subluxation of the joint during mouth opening (McNeill, 1993). Another example of an ID that may cause clicking is deviation in the intracapsular soft and hard articular tissues (Carlsson and Öberg, 1974; McNeill, 1993).

The research diagnostic criteria (RDC) for temporomandibular disorders (Dworkin and LeResche, 1992) formulated clinical criteria for the detection of an ADD: there should be a click on opening and closing "at a point at least 5 mm greater interincisal distance on opening than on closing and is eliminated on protrusive opening". However, for hypermobility and other IDs, no clinical criteria were formulated. For hypermobility, it seems reasonable to suggest that clicking should occur close to the maximal mouth opening as an indication of subluxation and should not be eliminated on protrusive opening, since the subluxation is then not prevented. These criteria may yield a clinical differentiation between ADD, hypermobility, and other IDs.

Techniques for the clinical detection of sounds associated with IDs are auscultation with a stethoscope, manual palpation of the TMJ, and the combined use of auscultation and palpation. Both palpation and auscultation have a moderate inter-observer agreement for the detection of sounds associated with IDs (Dworkin *et al.*, 1988; Wabeke *et al.*, 1994; de Wijer *et al.*, 1995). The combined technique has, to our knowledge, never been tested, nor was any attention paid to a distinction between types of IDs. Therefore, the aim of the present study was to test the inter-observer reliability of the clinical assessment of various internal derangements by means of auscultation, palpation, or both, and to establish their respective prevalence.

Materials and methods

Participants

Two-hundred-and-twenty volunteer dental students (120 women and 100 men, aged 18 - 38 years (mean \pm SD = 21.9 \pm 3.6)), gave informed consent and participated in the study.

Training

As training, two observers independently examined a sample of 60 students for the presence of IDs, using the techniques described below. After the examination, the results were reviewed and evaluated. None of the students involved in the training procedure were examined in the experimental protocol.

Experimental protocol

All volunteers were asked whether they were aware of having joint sounds. Each was examined twice: once by each observer. The observers were blinded to the other's findings. Three techniques were tested: auscultation, palpation, and the combination of auscultation and palpation (see below). The technique used for the participant under examination was randomly assigned, but for each participant the same technique was used by both observers. 79 students underwent auscultation; 87 students underwent palpation; the remainder (54 students) was subjected to the combined technique.

The observers independently scored IDs using the assigned technique, while the participants performed, in a fixed order, the following movements. All of these started from and ended in the intercuspal position and were performed to maximum extent.

- Open and close (6 trials).
- Laterotrusion to the left and right (3 trials).
- Protrusion (3 trials).

If clicking was present during a movement task on at least two of three consecutive trials, the following, additional, movement tasks were performed:

- Protrusive opening movements that started from and ended in an incisal edge-to-edge position (3 trials).
- Free opening movements and loaded closing movements (3 trials).

Loading was a manual, downward directed force (about 30N) on the chin. Loading of the mandible reduces the intra-articular distance within the TMJ and as a result, it provokes the closing click (Huddleston Slater *et al.*, 1999).

Techniques

For the auscultation technique, the bell of an infant stethoscope (3M Littmann, St. Paul, MN U.S.A.) was placed over the lateral pole of the TMJ. No simultaneous palpation of the contralateral joint was performed: clicks were denoted only when they were heard with the stethoscope.

Palpation was performed with the index and middle fingers placed over the participant's lateral poles of the TMJ. The pressure was about 5 N (Dworkin and LeResche, 1992), which was calibrated using a weight scale. Both joints were palpated simultaneously. Clicks were denoted only when they could be felt.

For the combination technique, the above described palpation and auscultation techniques were performed successively. Which of the components was executed first, was randomized. Clicks were denoted when they were observed with either of the techniques.

Clinical diagnosis

ADD was diagnosed when all of the following signs were present:

- Reproducible TMJ clicking on opening and on (loaded) closing on at least two of three trials (Dworkin and LeResche, 1992; Huddleston Slater *et al.*, 1999).
- TMJ clicking that could be eliminated on protrusive opening (Dworkin and LeResche, 1992).

Hypermobility was diagnosed when all of the following signs were present:

- Reproducible TMJ clicking on opening and on (loaded) closing on at least two of three trials.
- TMJ clicking occurring in the last part of the opening and the first part of the closing movement, often in combination with characteristic jerky lateral movements of the mandible.
- No elimination of TMJ clicking on protrusive opening.

TMJ clicking was denoted as "other" when it did not meet the above described criteria.

In the present study, crepitation was not taken into account.

Statistics

Cohen's kappa was used to test for the inter-observer reliability for the presence of an ID. Both TMJs were treated as independent variables. In 27 joints, more than one diagnosis was made. These were regarded individually, so that in total 467 cases were statistically analyzed.

For each technique, kappa values were calculated for the presence of an ID. A second series of kappa values was calculated for the classification into type (e.g. ADD, hypermobility, and "other"). For the latter series, only those cases on which both observers agreed that an ID was present were used. (n=96)

The kappa values were interpreted according to Landis and Koch (1977).

Results

The prevalence of IDs, specified to type as found by the two observers is given in table 1. An ADD was scored in 14% of the cases and hypermobility in 12%. In 4% of the cases, ID was classified as "other".

Cohen's kappa for the clinical assessment of the presence of an ID as such was 0.48 for auscultation, 0.58 for palpation, and 0.58 for the combined technique. These values can all be qualified as "moderate" (Landis and Koch, 1977). The values of the inter-observer reliability (Cohen's kappa) for the classification to the type (e.g., ADD, hypermobility, or "other") of those IDs, on which both observers agreed that an ID was present, were 0.70 for auscultation, 0.63 for palpation, and 0.90 for the combined technique. These values are "substantial" for palpation and auscultation, and "almost perfect" for the combined technique (Landis and Koch, 1977).

Table 1. Prevalence of the various IDs, as found by the two observers. For palpation (Palp) a total of 177 cases was examined; for auscultation (Aus), 166 cases; and for the combined technique (Com), 124 cases.

	Observer 1			Observer 2			Mean prevalence
	Palp	Aus	Com	Palp	Aus	Com	
No ID	72.9%	74.7%	69.4%	63.3%	75.9%	61.3%	69.9%
ADD	15.3%	12.7%	12.0%	16.9%	10.2%	16.9%	14.0%
Hypermobility	9.6%	12.7%	13.7%	13.0%	10.8%	12.9%	12.0%
Other	2.2%	0%	4.8%	6.7%	3.0%	8.8%	4.0%

Discussion

In the present study, the inter-observer reliability was investigated for the clinical assessment of internal derangements in the TMJ and for their classification (i.e., anterior disc displacement (ADD), hypermobility, and "others"). Secondly, their prevalence was established.

For the diagnosis of an ADD, Magnetic Resonance Imaging (MRI) is often considered the "gold standard", although it is known that with the aid of MRI, overdiagnosis of ADD

occurs: up to 38% of MRIs of the TMJ in asymptomatic volunteers showed ADD (Kircos *et al.*, 1987; Barclay *et al.*, 1999). The use of the so called "12 o'clock" criterion (a disc position in which its posterior band lies superior to the condyle) for normal disc position may be a reason for this overdiagnosis (Stegenga, 2001). Alternatively, opto-electronic movement recordings have gained more attention lately. This technique may be superior to MRI because it yields dynamic information on the joint. The use of such recordings for the assessment of IDs is currently being tested by our group. However, in daily practice, the use of MRI as well as that of opto-electronic movement recordings is limited.

Clinical criteria, designed for the recognition of an ADD, were substantiated in the Research Diagnostic Criteria for Temporomandibular Disorders (Dworkin and LeResche, 1992). One criterion is that a click should occur on both opening and closing "at a point at least 5 mm greater interincisal distance on opening than on closing and is eliminated on protrusive opening". However, the 5 mm criterion has recently been questioned by the finding that 27% of IDs that showed the opto-electronic movement characteristics of an ADD did not fulfill this criterion (Huddleston Slater *et al.*, 2002a). Therefore, this criterion was not used in the present study. As an alternative criterion, the click should be present on opening and on loaded closing. Loading of the mandible reduces the intra-articular distance within the TMJ and as a result, it provokes the closing click (Huddleston Slater *et al.*, 1999). For the recognition of hypermobility clicks, no clinical criteria exist. The recognition in our study is based on the supposition that the click cannot be eliminated on protrusive opening, because the subluxation is then not prevented. Mandibular loading should amplify the closing click because the condyle is then thwarted from re-entering the fossa.

In some cases, ADD develops into a closed lock (Farrar and McCarty, 1982; Lundh *et al.*, 1987). Why this occurs is not completely understood (Stegenga, 2001). A reason for this uncertainty may be that in earlier studies, no differentiation between types of IDs was made (Lundh *et al.* 1987; Könönen *et al.*, 1996). Since our results indicate that ADD and hypermobility clicks have an almost equal prevalence for the age group under study, it is recommend to differentiate IDs into type in order to gain more insight in the conditions under which a closed lock develops.

Other studies of the inter-observer reliability of the assessment of clicking have been executed (Dworkin *et al.*, 1988; Wabeke *et al.*, 1994; de Wijer *et al.*, 1995). However, these studies were not executed in a "blind" design, since each examiner applied different techniques on the same participant. Nevertheless, a moderate reliability for these techniques was found. Hardison and Okeson (1990) concluded that palpation of the TMJ

discovers joint sounds that are not heard with a stethoscope, and fails to detect some sounds that can be detected with a stethoscope. This suggests that auscultation and palpation may pick up different information. The combined use of both techniques may yield more information and could be an explanation for the finding in the present study that the combined use of both techniques showed an "almost perfect" reliability for the classification to type. It was concluded that the type of an internal derangement can best be established with the combination of auscultation and palpation; for the establishment of an ID as such, any of the three techniques would suffice.

