Correlation Between Clinical and Magnetic Resonance Imaging Findings in the Treatment of Anterior Disc Displacement

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Purpose: This study aimed to compare the agreement of clinical examination and magnetic resonance imaging (MRI) results before and after the treatment of nonreduction temporomandibular joint (TMJ) disc displacement. ***Materials and Methods:*** The study group consisted of 22 patients, each with anterior disc displacement without reduction in at least one TMJ. Diagnosis was performed clinically and with MRI prior to treatment. All patients received the same treatment protocol, consisting of occlusal appliance therapy and exercise for a period of 24 weeks. By the end of treatment, clinical and imaging examinations were repeated and the results subjected to statistical analysis. ***Results:*** Before treatment, MRI and clinical examinations matched in 35 of 44 joints (79.5%). On the basis of the kappa index, the agreement between clinical and imaging examinations was moderate (mean kappa index = 0.59, $P = .0001$). After treatment, these examinations matched in only 16 of 44 cases (36%) and the agreement was poor. ***Conclusion:*** Clinical criteria do not necessarily correlate with MRI findings in the postoperative period in patients treated for TMJ anterior disc displacement. *Int J Prosthodont 2013;26:138–142. doi: 10.11607/ijp.2692*

Temporomandibular disorders (TMDs) may manifest a variety of signs and symptoms. Classification, diagnosis, and treatment of anterior disc displacement of the temporomandibular joint (TMJ) are based on an appropriate diagnosis of the position of the TMJ disc using clinical examination procedures and radiographic examination. To diagnose anterior disc displacement of the TMJ, clinical examination consists of recording the existence of joint sounds and deviation or deflection and amount of maximum interincisal opening. Reciprocal clicking, existence of deviation or deflection, and amount of maximum interincisal opening can provide clinicians important information regarding the position of the TMJ disc.[1] Although there is a consensus regarding the relationship between joint sounds and TMJ disorders, some studies have reported the existence of joints demonstrating disc displacement with reduction that do not have reciprocal clicking.[2] Studies regarding joint sounds are well-equipped with microphones and computers.[3,4] Nevertheless, palpation and use of a stethoscope is still the first choice due to availability and ease of use. Deviation, deflection at opening, and the amount of maximum interincisal opening are other important signs of anterior disc displacement of TMJ. These signs, as well as symptoms such as pain, must be recorded to evaluate the success of treatment.

Magnetic resonance imaging (MRI) has become the gold standard for the diagnosis of TMJ disc condyle relationship, although the complexity and high cost of the procedure appear to be major disadvantages. The technique, however, provides the exact location of the TMJ disc, as well as other findings such as joint effusion, which cannot be diagnosed clinically. MRI records made before and after treatment can enable more accurate comparison of the change in position of the TMJ disc.[4–11]

The purpose of this study was to compare the agreement of clinical examination and MRI results before and after the treatment of anterior disc displacement without reduction of the TMJ.

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Materials and Methods

Selection of Patients

Records of the patients who were consecutively treated between January and December of 2008 were screened for the study. The records of 87 patients (72 women, 15 men) aged between 14 and 52 years (mean, 29.3 years) were included in the study. Selection of the study group was performed according to the inclusion and exclusion criteria described below.

Inclusion Criteria. All patients had a history of TMJ locking with limited mouth opening (less than 40 mm). Clinical and MRI findings yielded a diagnosis of unilateral or bilateral anterior disc displacement without reduction within the TMJ.

Exclusion Criteria. Patients that had previously been treated for TMD or had skeletal and dental anomalies, joint conditions such as polyarthritides (rheumatoid arthritis, crystal-induced joint disease, and other systemic diseases affecting the joints), acute traumatic injury, TMJ disc adhesion, degenerative arthrosis, extensive restorations and/or missing teeth, and fixed or removable partial dentures were excluded from the study.

Thirty-two patients were excluded since they did not have at least one TMJ that had anterior disc displacement without reduction. Thirteen patients were excluded as they had been treated previously. Seventeen patients were excluded since their post-treatment examinations could not be completed and three patients refused to participate in the study by not signing the appropriate consent forms. The remaining 22 patients (19 women, 3 men), aged between 14 and 48 years (mean, 27.1 years), were included for analysis. Appropriate consent forms and ethical approval to publish the records of patients were obtained from each patient included in the study.

MRI

MRI examinations of all but two patients were performed on a 0.5 T scanner (T5 NT Gyroscan, Philips). Two patients were examined on a 1.5 T scanner (Symphony, Siemens) because of coil damage to the 0.5 T scanner. All patients underwent bilateral MRI of the TMJ with a dedicated surface coil. Proton density weighted (PDW) oblique sagittal images were obtained in both closed and maximum open mouth positions. T2 fast field echo (FFE) oblique sagittal images were obtained in closed mouth position. Both PDW and T2 FFE imaging included eight slices with 3-mm thickness and a 0.3-mm interslice gap. Technical parameters of the PDW imaging were: TR/TE; 1500/30, FOV: 180 mm, matrix: 192 $\times$ 256; and for T2 FFE imaging: TR/TE; 740/27, FOV: 180 mm, flip angle: 35 degrees, matrix: 192 $\times$ 256.

To record the extent of maximum opening as observed clinically, custom blocks were fabricated using wooden tongue depressors. These blocks were then used to reproduce the maximum opening during imaging. For temporomandibular disc locations in closed and open mouth positions, PDW images were used. T2 FFE images were used for evaluation of any bony abnormalities suggestive of degenerative disease and joint effusion. Normal disc position was defined as the posterior band of the disc located superior of the head of the mandibular condyle. Disc displacement was defined as having the posterior band of the disc located anterior to the mandibular condyle. Magnetic imaging diagnoses were achieved by two medical radiologists who were blinded to the study and each other.

Treatment Protocol

Each patient received manipulation by the same examiner to recapture the disc(s). Maxillary anterior repositioning splints were fabricated in cases of successful recapturing of the disc. Splints were made using autopolymerizing methyl methacrylate (Paladur, Heraeus-Kulzer) and adjusted intraorally. In cases of unsuccessful manipulation, muscle relaxation splints were fabricated. The splints were made for each patient and adjusted to have flat occlusal contacts for all opposing teeth, and uniform anterior and canine guidance was established. All occlusal appliances were fabricated and adjusted by the same clinician.

The patients were prescribed an exercise regimen of five times a day for 5 minutes, with a minimum of 3 hours between each exercise. During the exercise sequence, patients were asked to open their mouths as wide as possible and to stretch their mandibles to the right and left. Patients were instructed to wear the stabilization splints continuously. They were allowed to remove the stabilization splints only during meals and oral hygiene procedures. No muscle relaxants, analgesics, or anti-inflammatory agents were prescribed during the course of the treatment. Clinical examinations were performed on a weekly basis.

Clinical Examination

During each visit, protrusive and lateral excursions and maximum interincisal opening were recorded. Additionally, TMJs and strenocleidomastoid, masseter, temporal, and lateral pterygoid muscles were palpated and the stabilization splints were adjusted, if

Table 1 Comparison of TMJ Disc Analysis Findings of Clinical Examination and MRI Before Treatment

	MRI			
Clinical examination	Normal	Displacement with reduction	Displacement without reduction	Total
Normal	7 (15.9%)*	2 (4.5%)	4 (9.1%)	13 (29.5%)
Displacement with reduction	1 (2.3%)	2 (4.5%)*	1 (2.3%)	4 (9.1%)
Displacement without reduction	1 (2.3%)	0	26 (59.1%)*	27 (61.4%)
Total	9 (20.5%)	4 (9%)	31 (70.5%)	44 (100%)

*Indicates agreement between clinical examination and MRI.

Table 2 Comparison of TMJ Disc Analysis Findings of Clinical Examination and MRI After Treatment

	MRI			
Clinical examination	Normal	Displacement with reduction	Displacement without reduction	Total
Normal	16 (36.6%)*	6 (16.6%)	22 (50%)	44 (100%)
Displacement with or without reduction	0	0	0	0
Total	16 (36.6%)	6 (16.6%)	22 (50%)	44 (100%)

*Indicates agreement between clinical examination and MRI.

necessary. The following criteria were used to determine the status of the TMJ:

1. Normal TMJ: maximum interincisal opening of 40 mm or more, normal range of protrusive and lateral excursions, no joint sounds, no pain on palpation of the TMJ.
2. Anteriorly displaced disc with reduction: reciprocal click at TMJ, no click after disc recapture in protrusion.
3. Anteriorly displaced disc without reduction: maximum interincisal opening of less than 40 mm, history of clicking, deflection of mandible to affected side, and hard end feel at maximum opening.

The treatment continued for 24 weeks. MRIs were obtained at the end of 24 weeks to compare initial and postoperative disc positions objectively.

Results

The main reason for referral to the clinic was limited opening (all patients had limited opening) and orofacial pain (81%, 18 of 22 patients). Although TMJ sounds were not the primary complaint, a majority of patients (54%, 12 of 22) had joint sounds previously or at the time of first clinical examination. The mean age of the patients was 27.1 years, and 19 (86.6%) were women. Mean time from the onset of limited mouth opening was 13 weeks.

Clinical examination of 44 TMJs revealed that 4 joints (9.1%) had anterior disc displacement with reduction, 27 joints (61.4%) had anterior disc displacement without reduction, and 13 joints (29.5%) were clinically normal before the treatment. MRI findings before the treatment revealed that only 9 joints (20.5%) were normal, while 4 joints (9%) had anterior disc displacement with reduction and 31 joints (70.5%) had anterior disc displacement without reduction. Before treatment, findings in both MRI and clinical examination matched in 35 of 44 joints (79.5%) (Table 1). According to reliability analysis, Cohens's Kappa value was 0.59, implying that there was an intermediate association between clinical examination and MRI findings before treatment ($P = .0001$). After the treatment, all TMJs were clinically normal. However, MRI findings showed that 16 joints (36.6%) were normal, 6 joints (13.6%) had anterior disc displacement with reduction, and 22 joints (50%) had anterior disc displacement without reduction. After the treatment, there was an agreement between clinical examination and MRI findings in only 16 joints (36.6%) (Table 2). According to reliability analysis, the Cohen Kappa value was 0, since the overall proportion of observed agreement ($P_O = .36$) is equal to the overall proportion of chance-expected agreement ($P_C = .36$). Accordingly, there was poor association between clinical examination and MRI findings after treatment.

Discussion

The comparison of clinical examination and MRI results has some drawbacks since the conditions of the two examination protocols are not identical. There is a lapse of time between the two tests, and the posture of the patient is different. However, in the present study, the results of two test methods were compared both before and after the treatment and, thus, such drawbacks which actually existed both before and after the treatment could only have little if any effect on the results. Several studies have investigated the efficacy of clinical examination protocols to diagnose TMD.[12,13] Clinical examination procedures always consist of recording the existence of joint sounds and deviation or deflection and amount of maximum interincisal opening, as well as other examination protocols that aid in the diagnosis of anterior disc displacement of the TMJ. There is controversy regarding the connection between joint sounds and TMD, although it is generally accepted.[14] The possible reason for this disagreement might be differences between the methodologies used in recording the existence of joint sounds. Some researchers have used advanced armamentarium such as microphones and computers.[3,4] However, palpation and use of a stethoscope is still the first choice of clinicians due to availability and ease of use. In the present study, palpation was used for detecting the existence of joint sounds and this may have reduced the positive yield. None of the patients reported the existence of joint sounds at post-treatment clinical examination.

The overall agreement between the clinical diagnoses and MRI before treatment in the present study was 79.5%, which corroborates some previous studies. Usumez et al reported an overall agreement of 81% between the clinical and MRI diagnoses for joints with disc displacement without reduction.[15] Marguelles-Bonnet et al confirmed their clinical diagnoses by MRI in 106 of 146 suspected TMJs that had disc displacement without reduction.[16] Good correlation between clinical and MRI results could be evidence for the reliability of the clinical criteria of the present study.

The clinical success rate of the current treatment was 100% at the end of 6 months. However, MRI findings demonstrated a very low morphologic success rate. Only 12 of 44 joint discs had improved positions and only 7 of these discs were in normal position. This success rate is very low when compared with the results of Summer and Westesson.[17] After their treatment protocol was performed on 115 joints with displaced discs, 52% of the discs were normally positioned, 23% were improved in position, and 25% showed persistent disc displacement following treatment. The disagreement of results could originate from different treatment modalities and the period of treatment. Murakami et al stated that short-term results have little effect on long-term outcomes.[18] The treatment protocol used herein has been explained in detail by Okeson and has met wide acceptance.[1] However, few publications regarding its treatment outcome have included MRI. The diagnostic agreement of 36% (16 of 44) between clinical examination and MRI has to be considered poor. Nevertheless, this finding could be compared to that of Barclay et al.[19] In their study, they found a poor agreement between research diagnostic criteria diagnoses and MRI and stated that the high number of false negative diagnoses in asymptomatic joints led to this result. The disagreement between clinical examination and MRI after the treatment period might be considered as evidence for the inefficiency of this treatment method in changing the disc position, but not in relieving clinical symptoms such as pain and range of motion. This is a sound reason to use MRI before and after treatment, if the improved disc position is the primary goal of the treatment.

Conclusion

Within the limitations of this study, clinical examination alone is very effective in diagnosing disc displacement without reduction. Yet, if improved disc position is the primary goal of the treatment, clinical data should be supported with MRI before and at completion of the treatment.

Acknowledgments

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Literature Abstract

Epidemiology of cancer from the oral cavity and oropharynx

Oral and oropharygnx cancers are often diagnosed at a late stage and display a poor prognosis. Their treatment may be followed by significant adverse impact on the patients' quality of life. This study was aimed at summarizing the descriptive and causal epidemiology of these cancers. More than 90% of tumors of the mucosal lining are classified as squamous cell carcinoma developed from premalignant lesions such as leukoplakia and erythroleukoplakia. These carcinomas are significantly correlated to environmental and lifestyle risk factors, among which tobacco smoking and alcohol consumption play a major role. In addition to tobacco smoking, smokeless tobacco is another risk factor as well as betel quid and areca nut chewing in some Asian and Western countries. Certain strains of viruses, such as the sexually transmitted human papilloma virus, also play a role in carcinogenesis. The temporal trends in incidence of these tumors relate to environmental factors; there is an increase in tendency in countries without prevention and a decrease in countries having an active policy of prevention of alcohol and tobacco consumption. In contrast, an increased incidence occurs in the world at tumor sites related to human papilloma virus infection at the base of the tongue and tonsils associated with sexual habit changes and a trend towards oral sex. The author concluded that these cancers are highly curable when detected early. Gastronenterologists could contribute to prevention by systemic visual inspection of the oral cavity and oropharygnx in those individuals with significant risk factors.

Lambert R, Sauvaget C, de Camargo Cancela M, Sankaranarayanan R. *Eur J Gastroenterol Hepatol* 2011;23:633–641. **Reprints:** Professor René Lambert, International Agency for Research on Cancer, Lyon, Cedex 8 69372, France. Email: lambert@iarc.fr—*Arthur S. Sham, Hong Kong*