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Mussel RL, De Sa Silva E, Costa AM, Mandarim-De-Lacerda CA (2003). Mast cells in tissue response to dentistry materials: an adhesive resin, a calcium hydroxide and a glass ionomer cement. J. Cell. Mol. Med. 7:171-178.

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*Full Length Research Paper*

# Combined oral and vaginal misoprostol use in therapeutic terminations at 14 to 28 weeks of gestation

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**This study involved an investigation of the effectiveness and complications of oral and vaginal misoprostol use on the termination of second trimester pregnancies. A total of 103 cases were recruited from the medical records of the Gynecology and Obstetrics Clinic of Taksim Research and Training Hospital and Şırnak İdil State Hospital. Women underwent therapeutic termination of pregnancy between the 14 to 28th week of gestation using the defined combined misoprostol regimen. After the women were admitted, 200 µg vaginal (100 µg intracervical, 100 µg into the posterior fornix), 200 µg oral doses and 200 µg of sequential doses were administered in the 2nd and 4th hour. Subjects were excluded from the study if they were out of the defined gestational weeks using additional drugs with misoprostol; their data has not been recorded in detail. Of the 103 cases, 86 had an abortion within 24 h and the mean expulsion time was calculated as 15.42 ± 7.14 h (min 6.39 to max 20.03) in this group. The success rate for the 24 h was found to be 83.4%. Six more cases had an abortion when the second dose was given. The mean expulsion time was found to be 9.31 ± 3.26 h (min 6.45 to max 13.21) for the second 24 h. The success rate over 48 h rose to 89.3%. The total expulsion time was 18.30 ± 8.74 h. There was a history of previous caesarean sections in 2 out of 11 cases that did not have an abortion and one of these cases underwent a hysterotomy. The pregnancy was terminated by evacuation and curettage, as abortion did not occur despite 3 different high dose misoprostol regimens as in the other cases. Pregnancies of the remaining 9 cases were terminated with different misoprostol doses, oxytocin infusion and the evacuation and curettage method. When complication rates were evaluated, analgesic requiring pain (18.4%) was the leading complication, followed by nausea (11.6%), fever (7.7%), headaches and dizziness (5.8%), transfusion-requiring haemorrhage (3.8%) and diarrhea (1.9%). Uterine rupture or death did not occur. A combined misoprostol regimen is relatively safe with acceptable side effects when used carefully for the termination of second trimester pregnancies.**

**Keyword**: Misoprostol, Pregnancy Trimester. Second, Termination of Pregnancy, Mean Expulsion Time, Medical Termination, Vacuum Curettage, Side Effects

## INTRODUCTION

Misoprostol (Cytotec 200 µg, Aris, Istanbul) is a synthetic prostaglandin E1 analogue approved by the FDA (Food and Drug Administration) with the aim of preventing the development of drug related peptic ulcer. It was first used for abortion purposes in 1988 in Brazil, after which it was used for first and second trimester pregnancy terminations, for induction of labor and in prevention and treatment of postpartum haemorrhage. Although it is effective, inexpensive, easily applicable and tolerable, it has some potential risks for the baby and the mother. Quite different doses and application types are available in the second trimester. Studies in the literature are limited in terms of case numbers and its use for abortion purposes has not yet been approved by the FDA.

**Table 1.** Mean age and gestational weeks.

| Parameter | Value |
|---|---|
| Mean age ± SD (year) | 22.50±5.5 |
| Mean gestational week ± SD (weeks) | 20.39±6.39 |

**Table 2.** Distribution of cases according to gestational weeks.

| Period (weeks) | Percentage |
|---|---|
| 14-18 | 31.06 (n:32) |
| 19-22 | 26.21 (n:27) |
| 23-26 | 34.95 (n:36) |
| 27-28 | 7.76 (n:8) |

**Table 3.** Obstetric histories of the cases.

| History | Percentage |
|---|---|
| Nulliparous | 43.7 (n:45) |
| Multiparous (previous vaginal delivery) | 46.6 (n:48) |
| Previous caesarean section | 9.7 (n:10) |

## MATERIALS AND METHODS

This study was conducted retrospectively in the Gynecology and Obstetrics Clinic of Taksim Research and Training Hospital in İstanbul and İdil State Hospital in Şırnak between 2003, January and 2009, September. A total of 103 cases between 14 to 28th gestational weeks who had undergone an abortion by using the defined misoprostol regime were included in the study. The misoprostol regimes were given in the hospital and the pregnant product expulsion was also in the hospital. The misoprostol regimen included a total of a 400 µg loading dose, composed of 200 µg vaginal (100 µg intracervical, 100 µg to the posterior fornix) and 200 µg oral misoprostol followed by sequential doses of 200 µg misoprostal administered through the oral route at the 2nd and 4th hours.

Vaginal misoprostol was soaked in saline solution and administered to the posterior fornix and intracervical region. Doses administered through the oral route were observed. The expulsion rate of this regimen at the 24th and 48th hours and complications were investigated. Pregnancy terminations using any other regime besides the one mentioned above were excluded from the study. Patients who received oxytocin infusion, whose cervical dilation was greater than 3 cm were excluded from the study. The gestational weeks of the patients were calculated based on the first day of the last menstrual period. The calculated gestational weeks were confirmed with ultrasonography. Ultrasonographic fetal biometry was taken account in patients whose replace incompatibility was with discrepancy. Expulsion rates were evaluated at the 24th and 48th hours. Fever, abdominal pain, nausea and vomiting, diarrhea and uterine rupture were evaluated as complications. All cases were performed using Bumm curettage after the placenta had been separated immediately. The uterus was evaluated in terms of placenta retention by transvaginal ultrasonography after curettage. A first-generation cephalosporin antibiotic (Cephalozin Sodium, İespor 1 g IM. IE Ulugay) is used to avoid vaginal inflammation due to transvaginal ultrasonography. All patients were hospitalized at least 12 h after the procedure. Statistical analysis was done using the Statistical Package for the Social Sciences (SPSS) 13 (SPSS Inc., Chicago, IL, USA) program. Descriptive statistics were given as mean ± standard deviation for constant variables and in percentage for categorical variables.

## RESULTS

The mean age of the 103 cases was 22.50 ± 5.5 years and the mean gestational week was 20.39 ± 6.39 (Table 1). Distribution of cases according to gestational weeks is shown in Table 2. Obstetric histories of the cases are given in Table 3. Expulsion numbers of the cases at 24 and 48 h are given in Table 4. Reasons for therapeutic termination and quantitative distribution are given in Table 5. Complications after the misoprostol regimen and rates are given in Table 6. Mean expulsion time interval between the fetus and placenta, mean fetal and placental weight, mean bleeding volume and mean menstruation recovery time are given in Table 7.

## DISCUSSION

The use of medical methods has increased the termination of early pregnancies because of potential risks and complications of surgical methods (for example, incomplete abortion, uterine perforation and haemorrhage). One of the best studied prostaglandin analogues is misoprostol. The fact that it is stable at room temperature, inexpensive and easy of use has led to its being preferred rather than other analogues. Although misoprostol was first produced as an oral medication for use in the treatment of peptic ulcers, it may also be used for the termination of pregnancies through the intravaginal, intracervical, rectal and sublingual routes. However, there is no consensus regarding which route is better.

Second trimester abortions constitute 10 to 15% of all induced abortions and the availability of medical methods has increased the use of misoprostol regimens during recent 10 years (Lalitkumar et al., 2007). Accurate dosage and method are quite important in misoprostol use and while it may be ineffective in very low doses, complication rates may be high and complications may be severe in high doses. Especially combined misoprostol and mifepristone use provides high success rates in second trimester abortions (Newmann et al., 2010). A lacking of randomized double blind multicentric studies about therapeutic terminations of second trimester pregnancies has led to the administration of different regimes and doses of misoprostol. In literature,

**Table 4.** Expulsion numbers of the cases at 24 and 48 h, success rates and mean expulsion times.

| Dose | Expulsion Number ( n) | Success rate (%) | Mean expulsion time |
|---|---|---|---|
| Following the first dose (administered within the first 24 h) | 86 | 83.4 | 15.42±7.14 |
| Repeated second dose regimen (administered within the second 24 h) | 6 | 5.8 | 9.31±3.26 |
| Total (after 48 h) | 92 | 89.3 | 18.30±8.74 |

**Table 5.** Reasons for therapeutic termination and distribution in cases.

| Reason | Value (%) |
|---|---|
| Fetal anomaly | 15 (14.5) |
| Teratogen drug use | 3 (2.9) |
| Anhydramniosis | 24 (23.3) |
| Intrauterine fetal death | 57 (55.3) |
| Radiation exposure + Teratogen drug use | 4 (3.8) |

**Table 6.** Complication rates.

| Complication | Rates in percent |
|---|---|
| Pain requiring analgesic | 18.4 (n:19) |
| Nausea | 11.6 (n:12) |
| Fever > 38°C | 7.7 (n:8) |
| Headache and dizziness | 5.8 (n:6) |
| Transfusion requiring haemorrhage | 3.8 (n:4) |
| Vomiting | 3.8 (n:4) |
| Diarrhea | 1.9 (n:2) |
| Uterine rupture | n:0 |
| Mortality | n:0 |

**Table 7.** Mean expulsion time interval between the fetus and placenta, mean fetal and placental weight, mean bleeding volume, mean menstruation recovery time.

| Means of parameter | Value |
|---|---|
| Mean expulsion time interval between the fetus and placenta | 22±13 min |
| Mean fetal weight | 564±310 g |
| Mean placental weight | 147±98 g |
| Mean bleeding volume | 340±126 cc |
| Mean menstruation recovery time | 38±17 days |

many misoprostol regimens have been described and recommended for the termination of second trimester pregnancies but as yet, the ideal dosage and regimen could not be described.

The effectiveness and side effects of misoprostol were investigated by administering 600 µg misoprostol through the vaginal route in 6 and 12 h intervals. A significant difference was not detected in mean induction times and misoprostol dose was found to be higher in the 6 h interval group (1800 µg) compared to the 12 h interval group (1200 µg). 24 h cumulative abortion rates were found to be 74 and 67%, respectively for 6 and 12 h, and

48 h cumulative abortion rates were found to be 94 and 92%. When complication rates were analyzed, fever was found to be higher in the 6 h interval group (53 to 31%, $p < 0.001$). Nausea, vomiting, diarrhea, severe haemorrhage and abdominal pain rates were seen to be similar. It was concluded that misoprostol given at 12 h intervals through the vaginal route was as effective as the other group and reduced fever incidence (Yilmaz et al., 2005).

An 800 µg vaginal misoprostol every 6 h (max 3 doses/24 h) was seen to be quite effective in the termination of second trimester pregnancies. Soaking these tablets in acetic acid was seen to be more effective than soaking them in saline solution (Herabutya et al., 2005). Oral and vaginal routes were compared in the termination of second trimester pregnancies due to fetal anomaly. Patients were divided into three groups as the ones who receive 400 µg vaginal misoprostol every 6 h (Group 1), 400 µg oral misoprostol every 3 h (Group 2) and 200 µg oral misoprostol every 3 h following the 600 µg vaginal loading dose (Group 3). Group 1 was found to be 1.9 fold better compared to the others in terms of delivery rates over 24 h (Dickinson and Evans, 2003).

Multiparous women who would undergo medical abortion in the16th or 20th gestational weeks were chosen and the adminstration of vaginal misoprostol (400 µg every 6 h) and combined oral-vaginal misoprostol (400 µg every 12 h followed by 400 µg at every 6 h) analyzed in terms of effectiveness. The mean expulsion time was found to be 13.28 h in the vaginal group and the expulsion rate was 83.33%; the mean expulsion time was found to be 8.93 h and the expulsion rate was found to be 87.5% in the combined oral-vaginal group ($p < 0.05$). According to these results, combined oral-vaginal misoprostol use was stated to have a higher success rate, shorter duration of hospital stay and low side effect incidence (Saha et al., 2006).

The misoprostol regimen used in our study was a 400 µg loading dose [200 µg vaginal (100 µg intracervical, 100 µg to the posterior fornix) and 200 µg oral misoprostol] followed by 200 µg of sequential doses in the 2th and 4th h through the oral route. After it was soaked in saline solution, vaginal misoprostol was applied to the posterior fornix and intracervical region. The mean expulsion time was 15.4 ± 7.1 h for the first 24 h and the expulsion rate was found to be 83.4%. The mean expulsion time after the repeated dose in the second 24 h was 32.8 ± 6.3 h and this increased success rate by 5.8%. The mean expulsion time was 23.8 ± 14.3 h after 48 h and the overall success rate was found to be 89.3%. The mean expulsion times found in our study were similar to those of other studies (Kunwar et al., 2010).

Kazandı et al. (1999) administered misoprostol through the intravaginal and intracervical routes and an oral combined form. Combined use resulted in a 64% abortion rate over 12 h, 80% over 24 h and 100% over 48 h. The mean expulsion time was found to be 12.6 ± 10.4 h. Time to complete the procedure was found to be 9.2 in dead fetuses and 19.6 h in live fetuses ($p < 0.05$) (Kazandı et al., 1999). In our study, misoprostol was used through the intravaginal and intracervical routes and an oral combined form. The abortion achievement rate was 83.4% over the first 24 h and 89.3% over 48 h. The mean expulsion time was found to be 18.30 ± 8.74 h in our study and this time is longer than that of the compared study.

In another study, 400 µg intravaginal misoprostol was administered every 12 h. The success rate over 48 h was found to be 89.4% and the mean expulsion time was found to be 17.07 ± 9.96 h. Both the success rate over 48 h and the mean expulsion time were similar to those of ours. Complication rates in this study were as follows: fever 24.5%, abdominal pain 16%, nausea and vomiting 5.3% (Prachasilpchai et al., 2006). Complication rates in our study were as follows: fever 7.7%, nausea 11.6% and the combined oral and vaginal use was seen to reduce fever incidence however, it increased nausea incidence.

It is obvious that misoprostol use will lead to abdominal pain by causing uterine contractions. Pain is the leading complication described in many studies in the literature. However, what was different in our study was that analgesic requiring pain was taken as a complication, except for abdominal pain, which may be seen in almost every case. In the literature, apart from pain, the side effects of misoprostol are usually mild and self-limited (Wildschut et al., 2011). Similarly in our study, except for pain, complication rates were low and other complications except nausea were self-limited. Half of the cases were given antiemetic medications for nausea. Pongsatha and Tongsong (2011) found the most common complications to be chill (43.7%), analgesic-requiring pain (39.3%) and fever (34.3%) in their patients who received 400 µg misoprostol through the intravaginal route every 12 h. High doses (800 µg in 24 h) may have affected the higher complication rates.

Herabutya and O-Prasertsawat (1998) administered a 200, 400 and 600 µg misoprostol regimen every 12 h. Abortion success rates over 48 h were found to be 70.6, 82 and 96%. Nausea-vomiting was found to be 3.9, 12 and 20%, respectively. Diarrhea rates were 0, 6 and 22%; fever rates were 0, 2 and 28% and incomplete abortion rates were 35.3, 28 and 22%, respectively. In our study, the rate of nausea (11.6%) was found to be similar, fever rate (7.7%) was found to be higher however diarrhea rate (1.9%) was found to be lower based on the 24 h results. As seen in this study, the success rate increased as the dosage increased, however complication rates also increased. Severe complications like uterine rupture and mortality were also not seen in our study. Of the cases in our study group, 9.7% had a history of caesarean sections. Abortion was achieved with this protocol in 80%

of these cases. The remaining two cases underwent surgical interventions like hysterotomy and dilatation and evacuation. Uterine rupture complication did not develop in the subjects who had the history of caesarean section.

Daskalakis et al. (2005) compared two groups, one with a history of caesarean section and one without, in terms of the rates of the complications which developed as the result of termination of second trimester pregnancies. Complications like blood transfusion-requiring haemorrhage, post-abortion infection, placenta retention were present in 16 women out of the 108 in the study group and 26 out of the 216 women in the control group (15% versus 12%, $p > 0.05$). One rupture case was seen in the control group (Daskalakis et al., 2005). Similar to our study, misoprostol use was seen not to increase uterine rupture risk in cases who had undergone previous caesarean sections. However, studies are also available in the literature reporting the opposite (Pongsatha and Tongsong, 2006; Mazouni et al., 2006; Chapman et al., 1996). Uterine rupture was seen in the termination of second trimester pregnancies and also in cases which did not have uterine scars and which had been treated conservatively (Letourneur et al., 2002). Although complete and incomplete uterine ruptures have been reported in the literature, misoprostol use is appropriate and cost-effective in these cases (Gotoh et al., 2000; Nayki et al., 2005).

## Conclusion

A combined oral and vaginal misoprostol regimen is relatively safe and quite effective with acceptable side effects in the termination of second trimester pregnancies when used carefully.

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*Full Length Research Paper*

# Correlation between clinical and magnetic resonance imaging (MRI) findings in temporomandibular disorders

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**This study was carried out to determine the value of Magnetic resonance imaging (MRI) as a diagnostic tool in patients with temporomandibular disorders. The clinical presentation and MRI findings on 88 temporomandibular joints belonging to 44 symptomatic patients were retrospectively studied. The disk position, configuration and signal intensity; mandibular condyle morphology and signal intensity; temporomandibular joint space and surrounding soft tissue abnormality were assessed. The correlation between the clinical and MRI findings was statistically analyzed using Fisher's exact (1-sided) test. Pain in the temporomandibular region was the most common clinical presentation, it accounts for 64% of cases. There was significant correlation between pain, and disc displacement with no reduction (DDWNR) and condylar hyperlaxity (p = 0.04, 0.03, respectively), as well as between clicking and each type of DD (p = 0.00). Statistically significant relationship was also found between tenderness, and DDWNR and presence of joint effusion (p = 0.02, 0.03, respectively) as well as between limitation of mouth opening and condylar marrow edema (p = 0.02). Causes of temporomandibular disorders can be well defined by clinical examination. However, MRI can be preserved for patients with pain in whom an initial medical conservative oral treatment failed in order to exclude other pathological process.**

**Key words:** Temporomandibular joint, magnetic resonance imaging, internal derangement, temporomandibular disorders.

## INTRODUCTION

Tempomandibular joint (TMJ) is a synovial joint and the diseases that affect other joints such as disk displacement (DD), degenerative joint disease, inflammatory arthritis, infection and synovitis can affect TMJ. Temporomandibular disorders are the most common causes of facial pain after toothache (Parnes et al., 2006). It had been reported that its etiology is multi-factorial and still widely disputed in literature (Emshoff et al., 2003). However, several studies demonstrated that DD (Tallents et al., 2002; Katzberg et al., 1980) and muscular disorders affecting the masticatory system are the most common the most common causes of these disorders (Emshoff et al., 2003; Carlsson, 1999). The initial examination used to image TMJ is usually plain radiograph and conventional tomography, since arthritic changes and congenital bone abnormalities are visualized well on these imaging modalities. Computerized tomography (CT) scan has the advantage in allowing a perfect visualization of the osseous components of the TMJ (Baily et al., 1990).

Several authors considered that MRI is the imaging modality of choice in temporomandibular disorders as it provides detailed information regarding the disc, joint space, and adjacent soft tissue structures (Emshoff et al., 2003; Rao, 1995). Therefore, the aims and reasons of this retrospective study determined the correlation between clinical presentation and MRI findings, to identify the

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**Table 1.** Clinical presentation in 88 TMJ (44 patients).

| Clinical presentation | n (%) | | | |
|---|---|---|---|---|
| | Right TMJ | Left TMJ | Bilateral | Total |
| Pain | 10 (11) | 10 (11) | 36 (40) | 56 (64) |
| Tenderness | 11 (12.5) | 17 (19) | - (-) | 28 (32) |
| Clicking | 12 (14) | 8 (9) | 18 (20) | 38 (43) |
| Limitation of mouth opening | - (-) | - (-) | - (-) | 34/44 patients |

the most common causes of patients' symptoms, and clarify the utility of MRI as a diagnostic modality.

## METHODS

### Patients

All the MRI changes of the patients who underwent MRI examination in Jordan University Hospital between January 2004 and December 2008 were obtained. Complete medical records were found for 44 patients. Therefore, 88 TMJs in symptomatic patients were studied retrospectively. The clinical data were obtained from patients records. There were 31 female patients aged from 17 to 67 years, with a mean age of 29 ± 11 years, and 13 male patients aged from 18 to 43 years with a mean age of 26 ± 7 years. The patients presented clinically with either one or more of the following symptoms: pain, tenderness, clicking, and limitation of mouth opening. Complete stomatognathic examinations according to the Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD) were performed for all patients by three consultant Oral and maxillofacial surgeons.

### Selection criteria

The criteria for including a patient in the study were the presence of pain in the temporomandibular region and presence of TMJ pain during palpation as well as with jaw function. Patients with ear problems and typical or atypical neuralgic facial pain were excluded. The patients were referred to our MRI unit for the evaluation of presence of DD or adjacent soft tissue anomalies that could be the source of patients' symptoms.

### Imaging technique and interpretation

All MR imaging were obtained with a 1.5 T Magnetom vision plus machine (Model of machine: Siemens, Germany) using bilateral TMJ surface coil. Our protocol consisted of oblique sagittal plane proton density and T2 weighted images at closed and then at open mouth. The images were taken for each side in each mouth position (closed and open) at angles perpendicular to the long axis of the mandibular condyle as determined by axial scout view image. A total of nine slices for each side in open and close position were obtained. The parameters used for proton density images were, slice thickness of 3 mm; repetition time, 2500 ms; echo time, 20 ms; field of view, 160 mm; and acquisition matrix size, 202 × 256. For T2-weighted images, the repetition time was 2900 ms, and the echo time was 80 ms.

Both TMJs were examined for disk position, disk configuration, signal intensity; morphology and signal intensity of mandibular condyle, presence or absence of joint effusion in the temporomandibular joint space, and signal intensity of surrounding soft tissues. Disk mobility was not assessed as CINE MRI is not available in our machine. The disk was considered normal if its posterior band was at 12 o'clock position relative to the mandibular condyle on close mouth position according to the criteria proposed by Katzberg and Westesson (1993); dumbbell-like configuration and hypointense homogenous signal. It was considered an abnormal position if the posterior band of the disk was in an anterior position relative to the superior part of the condyle. It was considered displaced anteriorly with reduction (DDWR) when the disk returns back to normal position on opened mouth. However, disk displacement without reduction (DDWNR) was considered when the displaced disk had the same position in close or open position.

Disc configuration was considered abnormal if it was of uniform thickness (biplanar), having a thicker central part (biconvex), or showing an enlargement of its posterior band. Mandibular condyle was considered normal if it was rounded shape; it was considered edematous if its signal was bright on T2 weighted sequence. All MRI examinations were reported by two general radiologists who were unaware of clinical information and working together in consensus with MRI experience of 15 to 18 years.

### Statistical analysis

Fisher's exact (1-sided) test was used to define the relationship between each clinical presentation and MRI findings. It was also used to define the presence of an association among patients' symptoms as well as among MRI findings. P value < 0.05 was considered statistically significant using SPSS 16 software package for statistical analysis.

## RESULTS

Thirty-one out of 44 patients were female with a female to male ratio 2.4:1. Table 1 shows the clinical characteristics of 88 TMJs in 44 patients. Abnormal MRI findings were detected in 70% (62/88 TMJs) of symptomatic joints; of these 45% were seen in female patients. Anterior disk displacement was the most common MRI finding; it was detected in 34% (30/88 TMJs). The MRI findings in 88 joints are demonstrated in Table 2. Pain was the most common symptom (56 TMJs); it was associated with DD in 41% (23/56 TMJs), 29% (16/56 TMJs) were with reduction and 13% (7/56 TMJs) without reduction. Pain with normal disk position was present in 59% (33/56 TMJ). Whereas, in about 22% (7/32 TMJs) where the disk was displaced, the side was painless. Clicking was the second common symptom (38 TMJs); it was associated with DD in 61% (23/38 TMJs); 39% (15/38 TMJs) were with reduction and 21% (8/38 TMJs) without

**Table 2.** MRI findings in 88 TMJs.

| MRI | n (%) | | | |
|---|---|---|---|---|
| | Right TMJ | Left TMJ | Bilateral | Total |
| Normal disc position | 8 (9) | 8 (9) | 42 (48) | 58 (66) |
| DDWR | 5 (6) | 5 (6) | 10 (11) | 20 (23) |
| DDWNR | 4 (4.5) | 4 (4.5) | 2 (2) | 10 (11) |
| Joint effusion | 5 (6) | 2 (2) | 4 (4.5) | 11 (12.5) |
| Osteoarthritis | 1 (1) | 3 (3.5) | 0 (0) | 4 (4.5) |
| Retrodiscal edema | 3 (3.5) | 1 (1) | 4 (4.5) | 8 (9) |
| Condylar hyperlaxity | 1 (1) | 2 (2) | 10 (11) | 13 (15) |
| Condylar bone marrow edema | 2 (2) | 2 (2) | 0 (0) | 4 (4.5) |
| Abnormal disc morphology | 4 (4.5) | 4 (4.5) | 4 (4.5) | 12 (13) |

reduction and clicking with mouth opening noticed with normal disc position in 18% (7/38 TMJ). Whereas, at the side without clicking, DD was present in 30% (15/50 TMJs) of cases.

Limitation of mouth opening was observed in 34 patients with 68 TMJ, it was associated with DD in 38% (26/68 TMJs), 20% (14/68 TMJs) were with reduction, and 18% (12/68 TMJs) without reduction. Mouth opening limitation with normal disk position was observed in 62% (42/68 TMJs); whereas DD with normal mouth opening was observed in 85% (17/20 TMJs).

Tenderness at temporomandibular region was found in 28 TMJs; it was associated with DD in 43% (12/28 TMJs), 25% (7/28 TMJs) were with reduction and 18% (5/28 TMJs) without reduction. At the side of tenderness, normal disk position was found in 57% (16/28 TMJs) of cases. At the side without tenderness, DD was present in 30% (18/60 TMJs) of cases.

### Statistical results

On testing the relationship between the clinical presentation and MRI findings, a statistically significant relationship was found between pain and DDWNR and condylar hyperlaxity ($p = 0.04$, 0.03, respectively), as well as between clicking and each type of DD ($p = 0.00$). Statistically significant relationship was also found between tenderness and DDWNR and presence of joint effusion ($p = 0.02$, 0.03, respectively) as well as between mouth opening limitation and condylar marrow edema ($p = 0.02$). Detailed statistical relationship and percentage rates of association of each sign and symptom, and MRI findings are shown in Table 3. There was no statistically significant association neither among patients' symptoms ($p = 0.3$ to 0.6), nor among MRI findings ($p = 0.09$ to 1). A significant relationship between tenderness and disk morphology was found ($p = 0.02$).

## DISCUSSION

Dysfunction of the TMJ is a common clinical problem, and imaging of the temporomandibular region has become essential in identifying the origin of patients' symptoms. Seventy percent of our symptomatic patients demonstrated abnormalities in the temporomandibular region on MRI examinations. It had been reported that temporomandibular disorders are more common in female patients; the results of these studies were based on history and clinical examination (Gesch et al., 2004; Nassif and Hilsen, 1992). Although 70% of symptomatic patients in this study were females, abnormal MRI findings were seen in 45% females, and only in 25% male patients, respectively. Several authors described a relationship between psychological status of the patient such as depression and stress and temporomandibular disorders that may explain the difference in the frequency of symptoms and MRI abnormalities (Selaimen et al., 2007; Korszun et al., 1998).

It has been reported that DD can be seen in up to one-third of asymptomatic individuals (Kircos et al., 1987). Haley et al. (2001) demonstrated that 26% of DD were at the side without pain while this rate in our study was 43%. The results of the present study demonstrated that DD was the most common finding in symptomatic patient and that it compares favourably with the results of other studies (Emshoff et al., 2003; Tasaki et al., 1996). Farina et al. (2008) found a significant correlation between TMJ pain and MRI findings of DD, and that was only observed in our patients with DDWNR (0.04). The incidence of DD in painful subjects in their study was 82%, and in ours was 54%.

Whyte et al. (2006) reported that DD is usually unilateral and reducible in asymptomatic patients while in symptomatic patients, it is bilateral and reducible in 76% of cases. Our results demonstrated that 83% of bilateral DD were reducible. In general, the reducible displaced disks were more common than the non-reducible disks

**Table 3.** Relationship between clinical presentation and MRI findings in 88 TMJs.

| MRI | Clinical presentation | | | |
|---|---|---|---|---|
| | Pain | Clicking | Mouth opening limitation | Tenderness |
| | n (%) | | | |
| Normal disc position | 33 (38) | 15 (17) | 21 (24) | 16 (57) |
| DDWR | 16 (18) 0.7 | 15 (17) 0.00 | 7 (8) 0.4 | 7 (8) 0.3 |
| DDWNR | 7 (8) 0.04 | 8 (9) 0.00 | 6 (7) 0.4 | 5 (6) 0.00 |
| Disc morphology | 10 (11) 0.1 | 7 (8) 0.2 | 7 (8) 0.1 | 7 (8) 0.02 |
| Joint effusion | 9 (10) 0.06 | 7 (8) 0.07 | 3 (3.4) 0.4 | 4 (4.5) 0.03 |
| Osteoarthritis | 1 (1) 0.1 | 2 (2.3) 0.6 | 3 (3.4) 0.1 | 1 (1) 0.7 |
| Retrodiscal edema | 6 (7) 0.4 | 3 (3.4) 0.5 | 3 (3.4) 0.6 | 2 (2.3) 0.6 |
| Condylar hyperlaxity | 13 (15) 0.03 | 6 (7) 0.5 | 3 (3.4) 0.9 | 5 (6) 0.4 |
| Condylar marrow edema | 3 (3.4) 0.5 | 1 (1) 0.4 | 4 (405) 0.02 | 1 (1) 0.7 |

P = P-value by Fisher's exact (1-sided) test.

and that was in agreement with other reports (Tallents et al., 2002). In addition, our results as that of others did not find a statistically significant difference in the frequency of disk involvement of each side (Whyte et al., 2006).

MRI did not reveal any abnormality in 30% of our cases, and absence of DD in 66%; this indicates that DD is not the main source of patients' symptoms. This finding is in accordance with that of Kobs et al. (2004). Emshoff et al. (2002) reported that MRI was considered as an imperfect standard of reference in TMJ disorders, as some of the DD depicted with high-resolution sonography were missed on MR images. Some authors questioned whether anterior DD is a pathologic finding or just a normal variant (Lieberman et al., 1992). However, in our study, no control subjects had been examined, so we cannot consider the variation normal unless documented as asymptomatic.

Joint effusion is a collection of fluid due to inflammatory changes in the synovial membrane. We did not find a statistically significant relationship between patient's pain and the presence of joint effusion or bone marrow edema, and that was comparable to other reports (Farina et al., 2008; Adame et al., 1998).

Larheim et al. (2001) reported bone marrow abnormality in 31.4%. In our study, condylar bone marrow edema was found in only 5% of patients with no evidence of osteonecrosis, and that compares favourably with other report (Larheim et al., 2001b). Huh et al. (2003) reported that fluid collection was found more frequently with sub acute disk displacement without reduction, and the high signal intensity within the disk space should be considered a simple matter of fluid collection.

The etiology of this MRI finding in the literature is still under debate. Some authors found that joint effusion and DD are often present even in non-painful TMJ patients (Emshoff et al., 2003; Haley et al., 2001).

Although retrodiscal soft tissue edema was not a common finding in our patients, it was only observed during mouth opening and was no statistically related to patients' symptoms. This can be explained by over-stretching of ligaments on mouth opening as mentioned by Sano and Westesson (1995) who attributed that to a functional hyperaemia and peri-vascular inflammation in painful TMJ.

Emshoff et al. (2003) found that osteoarthritic changes were present in 92% of asymptomatic control group subjects. It has been reported also that if osteoarthritic changes occur in young individuals, a longstanding disc displacement without reduction should be ruled out (Helms, 1998). This study did not demonstrate a statistically significant correlation between osteoarthritic changes and DD, neither with nor without reduction. However, local tenderness was associated with alteration in disk morphology ($p = 0.02$) which is usually related to degenerative changes and that could be attributed to the disrupted normal relationship with the adjacent structures.

Although limitation of mouth opening could be related to either arthrogenous or extra-articular problems, the causes of mouth opening limitation in our patients were unclear. The only statistically significant relationship was found with condylar marrow edema and that was only present in four patients. No significant association was found among patients' symptoms in one hand, and among MRI findings on the other hand. This observation is important as it may indicate that the patients' symptoms and MRI findings are non-specific to a certain pathological process.

## Conclusion

Our data are in favour that temporomandibular disorders are most likely related to muscular and ligamentous

dysfunction rather than derangements in the TMJ itself. Therefore, the indications of MRI should be adapted according to patient symptoms where it may assist in determining the nature of the problem. Local tenderness is commonly related to degenerative condylar changes and the diagnosis can be confirmed by conventional tomography, clicking upon mouth opening is commonly associated with DD and does not require further MRI examination, and MRI is not sufficiently useful as a diagnostic modality to determine the cause of mouth opening limitation.

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