ORIGINAL RESEARCH ARTICLE

EVALUATION OF MAGNETIC RESONANCE IMAGING FEATURES OF INTERNAL DERANGEMENT AND EFFUSION IN PATIENTS WITH UNILATERAL TEMPOROMANDIBULAR JOINT PAIN- AN IMAGING STUDY

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ABSTRACT

Background & Objectives: Among Temporomandibular disorders (TMD) Disc displacement (DD) is the most common disorder. The objective of this study was to determine the Magnetic Resonance Imaging (MRI) findings of DD and effusion in patients with unilateral TMJ pain and also to assess the relationship between TMJ pain, position of Disc and effusion.

Methods: A bilateral MRI study was conducted on 15 patients who had unilateral TMJ pain such that the contra lateral TMJ served as control. All patients were clinically examined and the intensity of pain was recorded. The patients were subjected to MRI by a 0.4 T MR scanners in open and closed mouth position. The images obtained were then interpreted by a radiologist.

Results: A total of 30 TMJ's were imaged; 15of which were symptomatic and 15 asymptomatic. A significant correlation was found between the presence of DD and TMJ pain ($p<0.005$). No significant findings were noted on effusion causing TMJ pain. There was no difference in the intensity of pain and between DD with reduction and DD without reduction. The intensity of pain in the TMJ having effusion was not significant when compared to the intensity of pain in the TMJ's not having effusion.

Conclusion: Based on the study TMJ pain is always associated with DD but not necessarily with TMJ effusion. Also the intensity of pain does not differ much based on the position of Disc or presence of effusion.

Keywords: Temporomandibular disorders; Disc displacement, Joint effusion; Magnetic Resonance Imaging.

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INTRODUCTION

The TMJ is a well designed fulcrum that leverages the masticatory power of muscles and dental apparatus and helps in performing multiple important functions such as those of suckling, speaking, cutting, grinding and swallowing. Though TMJ is a unique and complex joint they are vulnerable to extrinsic and intrinsic influences as well as time dependent changes like any other joints of the body. McNeill defines Temporomandibular Disorders (TMD) as a heterogeneous group of pathologies affecting the temporomandibular joints, the masticatory muscles, or both. [1] Disc displacement (DD) or Internal derangement (ID) is one of the most common forms of TMD. [2] DD is defined as an abnormal relationship between the Disc and mandibular condyle involving an anterior, medial, or lateral displacement of the Disc from its normal position superior to the condyle.[3] DD has been associated with pain in the TMJ, clicking and/or crepitation, headaches & limitations of jaw opening. Most painful TMJ's have a displaced Disc which leads one to suspect that DD can be linked to the onset, progress or cessation of TMD related signs & symptoms.[2] Various studies have also demonstrated an association between the presence of increased fluid density in the joint space and the presence of TMJ DD.[4] It is speculated that this increased fluid density or effusion (magnetic resonance imaging findings of a hyper intensity signal inside the joint space) as such represents a pathological inflammatory process within the TMJ's that causes TMJ pain.[2] MRI provides information of the articular Disc, surrounding soft tissue structures and also can reveal the presence of joint effusion. The technique is non-invasive and does not use ionizing radiation. Recent publications report MRI as a golden imaging technique for TMJ imaging. [5] So if an association between the presence of DD and joint effusion to painful joint could be established, this could be the basis for valuable additional diagnostic information from MR imaging of the TMJ. Thus the purpose of present study is to assess whether the MRI findings of TMJ DD and TMJ effusion can be associated with TMJ pain.

Methodology

Ethics: The proposed study is an interventional study in which patients are subjected to MRI and therefore ethical consent was obtained from the ethical committee before the commencement of the study.

Study design: 15 patients who were diagnosed with Unilateral TMJ pain during palpation or function and/or assisted or unassisted mandibular opening was taken as the sample. The contralateral, non-painful TMJ served as the matched control. Patients with degenerative joint disease, collagen vascular disease, TMJ trauma, developmental TMJ disorder and Patients having cardiac pace maker were excluded. Method of collection of data:

The symptomatic patients were subjected to Visual Analogue Scale for assessing the severity of pain. This was followed by a standardized clinical head and neck examination that included functional and structural examination of both joints followed by palpation of the TMJ and muscles of mastication.

The condition of the painful joint was categorized according to the following diagnoses:

1. Anterior Disc displacement with reduction (ADDWR).
2. Anterior Disc displacement without reduction (ADDWOR).
3. Inflammatory conditions such as synovitis / capsulitis.

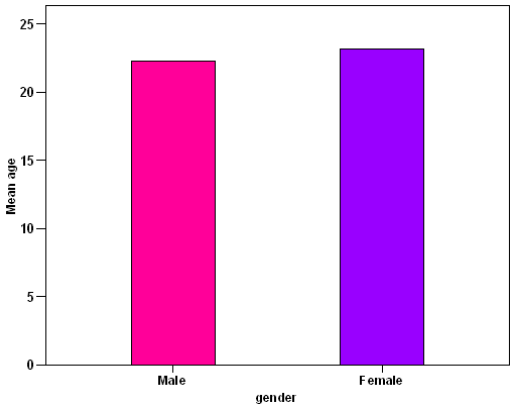
Bilateral TMJ MR Images were obtained of all patients included in the study by means of 0.4 T MR scanners (APERTO, Hitachi, Singapore) and a dedicated circular polarized transmit and receive joint coil. The data was collected on a 1024×1024 matrix with a field view of 220mm. Axial localizing images were taken from which the sagittal and coronal planes were prescribed. Both close mouthed and open mouthed images were obtained. Pulse sequences were obtained on sagittal and coronal T_1 weighted images, T_2 weighted images, proton density images (PD) and Gradient Echo (GRE) weighted images. The position of the Disc was diagnosed by a single radiologist for all the patients as: Normal: when the Disc was located superior to the condyle both in closed and open mouth position Disc displacement with reduction: when the Disc was displaced at the closed-mouth position and in the normal position in the open-mouth images.

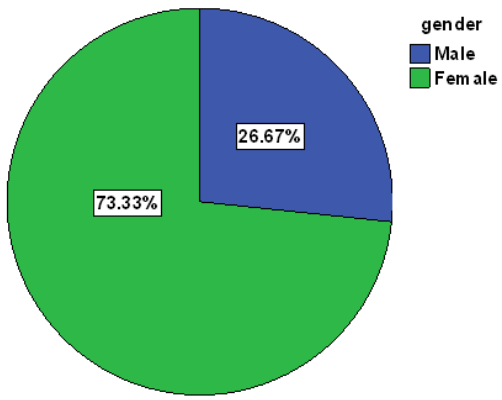
Disc displacement without reduction: when the Disc was displaced in both the closed- and open-mouth positions.

Effusion: On T2-weighted images, joint effusion was identified as an area of high signal intensity in the region of the upper or lower joint spaces.

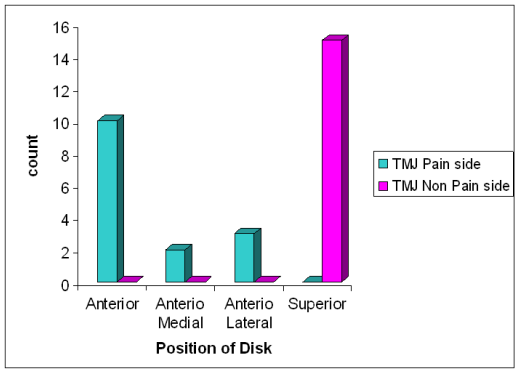
RESULTS

Age& Gender distribution - Of the total 15 patients, 4 were males and 11were females. The mean age of male patients were 22.25 and the mean age of female patients were 23.18.

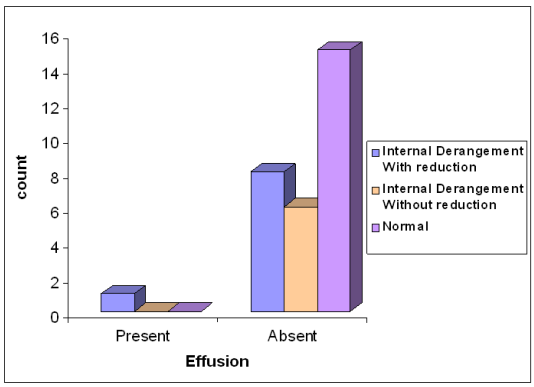




Position of Disc in patients with unilateral TMJ pain- Out of 30 joints 10 joints had anteriorly placed Disc (33.3%), 2 joints had anteriomedially placed Disc(6.7%) and 3 joints had anteriolaterally placed Disc (10%).All this displaced Disc were noted in pain side and this makes 50% of the total TMJ's displaced. The rest of the TMJs on the asymptomatic side had superiorly placed Disc or the Disc was in normal position.

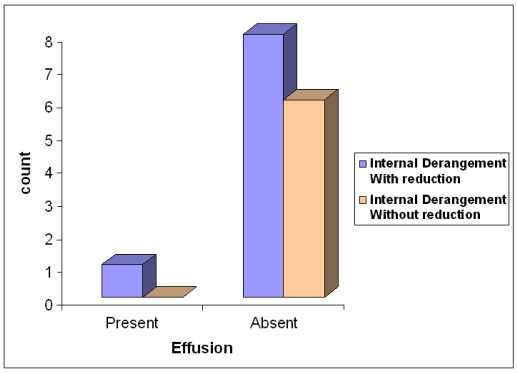


MRI findings of effusion in patients with unilateral TMJ pain- In patients who had no pain there was no effusion and thus the absence of effusion and absence of pain was found in 50% of total 30TMJ's. Presence of pain and presence of effusion was seen only in one TMJ of the 30 that makes 3.3% of 100% TMJ's imaged.

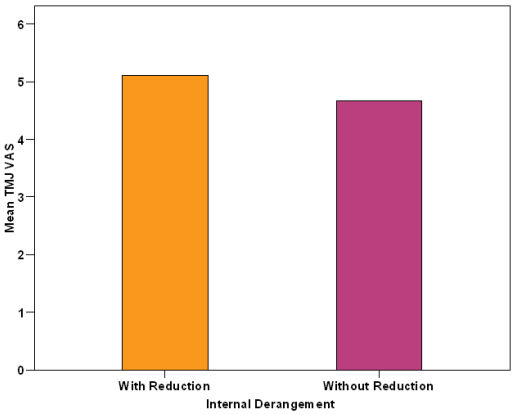


MRI findings of effusion in TMJ pain side

MRI findings of DD and MRI findings of effusion in patients with unilateral TMJ pain-Out of 30 TMJ's DD with reduction was seen in 09 TMJ's of which 1 had TMJ effusion where as rest 08 TMJ had no effusion. DD without reduction was seen in 06 TMJ's and none of these had effusion.



Relationship between TMJ pain by VAS and MRI findings of DD. There were 9 joints with reduction and 6 with out reduction. The mean pain in patients with reduction was 5.11 where as in with out reduction was 4.67. The P was 0.563 thus making the relationship between TMJ pain and MR findings of type of DD insignificant.



Graph assessing the relationship between TMJ pain (VAS scale) and MRI findings of DD

DISCUSSION

This study was done to assess the position of Disc and presence of effusion in patients having unilateral TMJ pain. This study also assessed if there was any relationship between the presence of TMJ pain with TMJ DD and TMJ effusion using MR imaging diagnosisIn the present study, it was noted that significant amount of female patients were affected by TMD than males. Patients affected by TMD in this study group ranged from 16-30 years. Studies conducted by Rudi TE et al (1990), [6] Warren MP et al [7] and Nekora Azak K [8] have shown a similar prevalence.

In our study, all the TMJs associated with pain had DD and those which are taken as control had no evidence of DD. This observation compares favorably with the results of Roberto ES et al, [9] Tallents RH et al , [10] Emshoff R et al, [11] RuDisch A et al [2], Emshoff R et al [12] and Kobs G et al.[13] But studies by Muller-Leisse C et al ,[14] Louis TK et al [15] and Bertram S et al [16] showed the presence of DD even in asymptomatic patients with no joint pain.

The frequency of anteriorly placed Disc in the TMJ pain side was much higher (66.7%) than the presence of anteriolaterally placed Disc (20%) and anteriomedially placed Disc (13.4%). Louis TK et al [15] also stated that anterior DD is more common in both symptomatic as well as asymptomatic patients. Whyte AM et al [17] also came to the same conclusion as our study that anterior DD is common and antero-lateral displacement was the second commonest type of displacement probably related to the weakness of the lateral Disc attachment.

Presence of pain and presence of effusion was seen only in 3.3% of the whole population and only in 6.7% of those TMJ's had pain. Mukrami K et al,[18] Adame CG et al [19] and Guler N et al [20] also could not correlate TMJ pain and TMJ effusion. But Schellas KP et al, [21] Westesson PL et al, [3] Sano T et al, [22] Takahasi T et al,[23] and RuDisch A et al,[2] Larheim TA et al,[24] Emshoff R et al [25] found that TMJ pain had a high association with TMJ effusion.

The presence of effusion was seen in association with DD with reduction and was absent in DD without reduction. This is in contrast to the studies conducted by Yamamoto M et al,[26] Larheim TA et al [27] and Manfredini D et al.[28] They reported that joint effusion is likely to appear in painful TMJ's having DD without reduction. Adame CG et al [19] could find no such differences in effusion between the two groups of DD with reduction and DD without reduction.

The TMJ's belonging to the control group did not have any DD or effusion. Badel T et al,[29] Muller-Leisse et al,[14] Louis TK et al [15] and Bertram S et al [16] found DD in asymptomatic joints.

Bertram S et al [16] reported a prevalence percentage of 69.5% to 100.0 % pain in TMJ having DD with

reduction and prevalence percentage of 47.5% to 100.0 % pain for TMJ DD without reduction. These findings support the concept that TMJ DD is involved significantly in the production of TMJ pain and dysfunction and this was in agreement with our study as all the 15 TMJ's having pain was found to be associated with MRI diagnosis of DD. But the severity of pain did not differ based on the type of DD in our study.

CONCLUSION

In the present study MRI of the TMJ was taken to assess the association between DD and effusion to joint pain. Displacement in the position of disc on the pain side was noted with no displacement in the control side. The frequency of anteriorly placed Disc in the TMJ pain side was much higher, followed by anteriolateral and anteriomedial displacements respectively. Presence of effusion was seen in only one out of the 30 joints imaged and this was in a painful joint which had DD with reduction. Also further analysis showed that there was no significant relationship between TMJ pain and DD with reduction and without reduction.

Thus based on the present study an assumption can be made that painful TMJ is associated with a displaced disc but not necessarily with the presence of effusion. Also the intensity of pain does not differ much based on the position of disc or presence of effusion.

REFERENCES

1. McNeill C. Management of temporomandibular disorders: concepts and controversies. Journal of Prosthetic Dentistry 1997;77:510-22.
2. RuDisch A, Innerhofer K, Betram S, Emshoff R. Magnetic resonance imaging findings of internal derangement and effusion in patients with unilateral TMJ pain. Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology Endodontics 2001;92:566-71.
3. Westesson PL, Brooks SL. Temporomandibular Joint: Relationship Between MR Evidence of Effusion and the Presence of Pain and Disc Displacement. American Journal of Roententology 1992 September; 159:559-63
4. Haley DP, Schiffman EL, Lindgren BR, Anderson Q, Andreasen K. The relationship between clinical and MRI findings in patients with unilateral Temporomandibular joint pain. J Am Dent Assoc 2001;132:476-81
5. Schmitter M, Gabbert O, Ohlmann B, Hassel A, Wolff D, Rammelsberg P, et al. Assessment of the reliability and validity of panoramic imaging for assessment of mandibular condyle morphology using both MRI and clinical examination as the gold standard. Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology Endodontology 2001;102(2):220-4.
6. Rudy TE, Turk DC, Berna SF. Quantification of biomedical findings of chronic pain patients: development of an index of pathology. Pain 1990;42:167-82
7. Warren MP, Fried JL Temporomandibular disorders and hormones in women. Cells Tissues Organs 2001;169:187-92
8. Nekora-Azak K. Temporomandibular disorders in relation to female reproductive hormones: a literature review J Prosthet. Dent. 2004;91:491-3
9. Roberto ES, Ross HT, Richard WK, Jeffrey AG, Rochester NY.Bilateral internal derangement of temporomandibular joint: Evaluation by magnetic resonance imaging. Oral Surg Oral Med Oral Pathol. 1988; 65:281-5.
10. Tallents RH, Katzberg RW, Murphy W, Proskin H. Magnetic resonance imaging findings in asymptomatic volunteers and symptomatic patients with temporomandibular disorders. J Prosthet Dent. 1996 May; 75(5):529-33
11. Emshoff R, Innerhofer K, RuDisch A, Bertram S. Relationship between temporomandibular joint pain and magnetic resonance imaging findings of internal derangement. Int J Oral Maxillofac Surg. 2001 Apr;30(2):118-22.
12. Kobs G, Bernhardt O, Kocher T, Meyer G.

Critical Assessment of Temporomandibular Joint Clicking in Diagnosing Anterior Disc Displacement. Baltic Dental and Maxillofacial Journal 2005;7:28-30.

13. Muller-Leisse C, Augthun M, Roth A, Bauer W, Gunther RW. Disc displacement of the temporomandibular joint: correlation of magnetic resonance tomography and clinical findings. Rofo. 1996 Sep; 165(3):264-9

14. Muller-Leisse C, Augthun M, Roth A, Bauer W, Gunther RW. Disc displacement of the temporomandibular joint: correlation of magnetic resonance tomography and clinical findings. Rofo. 1996 Sep; 165(3):264-9

15. Louis TK, Douglas AO, Alexander SM, Mitsuaki A. Magnetic Resonance Imaging of the TMJ Disc in Asymptomatic volunteers. J Oral Maxillofac Surg. 1987;45:852-4.

16. Bertram S, RuDisch A, Innerhofer K, Pumpel E, Grubwieser G, Emshoff R. Diagnosing TMJ internal derangement and osteoarthritis with magnetic resonance imaging. J Am Dent Assoc. 2001 Jun; 132(6):753-61

17. Whyte AM, McNamara D, Rosenberg I, Whyte AW. Magnetic resonance imaging in the evaluation of temporomandibular joint Disc displacement-a review of 144 cases. Int J Oral Maxillofac Surg. 2006 Aug; 35(8):696-703

18. Murakami K, Nishida K, Bessho T. MRI evidence of high signal intensity and temporomandibular arthralgia and relating pain: Does the high signal correlate to the pain? Br J Oral Maxillofac Surg 1996;34:220

19. Adame CG, Monje F, Offnoz M Martin-Granizo R Effusion in magnetic resonance imaging of the temporomandibular joint: a study of 123 joints J Oral Maxillofac Surg 1998 Mar; 56(3):314-8.

20. Guler N, Uckan S, Imirzalıoglu P, Acıkgozoglu S Temporomandibular joint internal derangement: relationship between joint pain andMR grading of effusion and total protein concentration in the joint fluid. Dentomaxillofacial Radiology 2005;34:175-81.

21. Schellas KP, Wilkes CH.Temporomandibular joint inflammation: comparison of MR fast scanning with T1 and T2 weighted imaging techniques. Am J Roentgenol 1989;153:93-8.

22. Sano T, Westesson PL. Magnetic resonance imaging of the temporomandibular joint. Increased T2 signal in the retroDiscal tissue of painful joints. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 1995 Apr; 79(4):511-6.

23. Takahashi T, Nagai H, Seki H, Fukuda M. Relationship between joint effusion, joint pain, and protein levels in joint lavage fluid of patients with internal derangement and osteoarthritis of the temporomandibular joint. J Oral Maxillofac Surg. 1999 Oct; 57(10):1187-93.

24. Larheim TA, Westesson P ,SanoT. MR grading of temporomandibular joint fluid: association with Disc displacement categories, condyle marrow abnormalities and pain International Journal of Oral and Maxillofacial Surgery 2001 Apr; 30(2):104-12.

25. Emshoff R, Brandlmaier I, Bertram S, RuDisch A. Risk factors for temporomandibular joint pain in patients with Disc displacement without reduction - a magnetic resonance imaging study. J Oral Rehabil. 2003 May; 30(5):537-43.

26. Yamamoto M, Sano T, Okano T Magnetic resonance evidence of joint fluid with temporomandibular joint disorders. J Comput Assist Tomogr. 2003 Sep-Oct; 27(5):694-8.

27. Larheim TA. Role of magnetic resonance imaging in the clinical diagnosis of the temporomandibular joint. Cells Tissues Organs 2005; 180(1):6-21.

28. Manfredini D, Basso D, Arboretti R, Guarda-Nardini L.Association between magnetic resonance signs of temporomandibular joint effusion and Disc displacement .Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2009 Feb; 107(2):266-71.

29. Badel T, Marotti M, Keros J, Kern J, Krolo I. Magnetic resonance imaging study on temporomandibular joint morphology. Coll Antropol. 2009 Jun; 33(2):455-60.