How Does Capsular Distension Pain Manifest in Patients with Anterior Disc Dislocation with Reduction of Temporomandibular Joint?

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Abstract: Joint effusion (JE) refers to the presence of a pathological collection of fluid in the joint space, and JE is one of the symptoms of the inflammatory process in the temporomandibular joint (TMJ) and it is associated with the presence of TMJ pain. The authors of this study focused on the ultrasonographic evaluation of TMJ capsular distension, capsular width in patients with unilateral anterior disc dislocation. The cohort included 200 patients, 169 women and 31 men, with a mean age of 34.3 years (range 11–82 years). All patients were diagnosed with disc dislocation with reduction. 102 patients were completely pain free, 98 patients reported pain localized to the TMJ area. 28 patients perceived their pain as persistent in the last week before the examination, 70 patients perceived their pain as irregular. The results showed that capsular distension was demonstrably greater in patients with pain than in patients without pain. The increase in capsular distension is not affected by whether the pain is persistent or irregular. Capsular distension is enhanced in patients with TMJ palpation pain and painful dynamic testing. The authors confirm the use of ultrasonography as an ideal method for diagnosing JE. Also an association between the presence of JE and pain in patients with disc dislocation has been demonstrated. Painful lateral palpation and painful dynamic test are clinical signs of JE and thus signs of an intra articular inflammatory process in patients with TMJ pain.

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Introduction

Anterior temporomandibular joint (TMJ) disc dislocation is a pathological condition in which the disc is dislocated anteriorly, out of its physiological position. It becomes an obstacle to the movement of the articular head. There is a distinction between disc dislocation with reduction (when the articular head is under the dislocated disc, in its physiological position, during mouth opening) and disc dislocation without reduction (when the disc is permanently in front of the articular head and prevents movement of the head) (Laskin et al., 2006; Okeson, 2008).

Pain is not a typical symptom of anterior disc dislocation with reduction (DDwR) of TMJ. The typical symptoms are sound phenomena (clicking), asymmetry of jaw movement. Jaw movement is unrestricted. If pain is present, then its origin may be of extra-articular origin (myogenic pain) or of intra-articular origin. The cause of intra articular pain in disc dislocation lies in the traumatization of the ligament capsule, traumatization of the retrodiscal tissue, which leads to hyperemia of the tissues of the joint. The hyperemia results in the production of free radicals and cytokines, with the development of traumatic arthritis (Laskin et al., 2006; Okeson, 2008).

One of the signs of an inflammatory process in the joint is the presence of a pathological collection of fluid in the joint space, which is referred to as joint effusion (JE) (Manfredini et al., 2003; Bas et al., 2011). Magnetic resonance imaging (MRI) is the gold standard for imaging and diagnosis of JE (Kundu et al., 2013). However, it is a costly examination requiring special equipment. Complications for performing MRI are claustrophobia of the patient and presence of metals in the patient's body. Ultrasonography (US) can be used as an alternative in the imaging of TMJ effusion (Manfredini et al., 2003). US has been used for TMJ examination since the early 1990s, and compared to MRI, it is a method with significantly lower cost, easily performed in the physician's office, with minimal discomfort to the patient. Like MRI, US allows for static and dynamic examination of the TMJ (Nebeith and Speculand, 1991; Kundu et al., 2013; Almeida et al., 2018). Longitudinal and transverses scan, frequencies ranging 7.5–20 MHz, are most commonly used for TMJ diagnosis by US (Almeida et al., 2018). The major disadvantage of US is the quality of imaging requiring the experience of the physician in assessing the findings (Manfredini et al., 2003; Kundu et al., 2013). US assessment of disc position and quality is difficult and assessment of bone changes is only indicative (Manfredini et al., 2003; Kaya et al., 2010; Kundu et al., 2013).

The authors of this study focused on the evaluation of TMJ capsular distance, capsular width (measurement between the condylar laterosuperior surface and the articular surface) in patients with DDwR (Manfredini et al., 2003; Jank et al., 2005; Bas et al., 2011, Kim et al., 2021). They set several goals:

What is the difference of capsular distension in patients with TMJ pain and without pain?

What is the difference of capsular distension in patients with irregular and persistent TMJ pain?

What is the difference capsular distension in patients with and without palpatory TMJ pain?

What is the difference capsular distension in patients with and without a positive dynamic test?

Material and Methods

The study used the records of patients examined in a specialist outpatient clinic for TMJ disease to evaluate capsular distension. It was determined that the studied group would consist of 200 patients with anterior disc dislocation. In all these patients, US examination (Mindray DP-50, 7.5 MHz, Shenzen Mindray Bio-medical Electronics) was used to make the diagnosis, and the capsular width (measurement between the condylar laterosuperior surface and the articular surface) was recorded in all patients. The capsular widht value was measured not only on the side with disc dislocation but also on the side with physiological disc position. The data obtained was then the difference of capsular widht (CWD) of the two sides. This difference between the affected and unaffected side served as the JE value.

An X-ray (panoramic image) was performed in each patient to assess the bony changes of the TMJ structures.

Data from the examination record were used to determine whether or not the patient subjectively perceived TMJ pain, whether or not he subjectively rated his pain as constant or irregular (associated with jaw movement, mastication) in the last week before the examination. The patient's examination was also used to record whether pain was present on lateral TMJ palpation and whether TMJ pain was present on dynamic testing. The dynamic test entailed the patient performing mandibular movements (opening, closing, protrusion) with the examiner exercising a resistance against the direction of the movement.

Patients included in this study met the following criteria:

Including criteria: patients with unilateral TMJ involvement, according to clinical examination and according to ultrasound examination with a diagnosis of anterior disc displacement with reduction.

Excluding criteria: patients who presented changes in the shape of the articular head, socket and tuberosity (erosion, plating) on panoramic radiographs. Patients who had already undergone any TMJ therapy were not included. In addition, patients with endocrine, autoimmune disease, psychiatric therapy and patients who reported a history of facial skeletal trauma, higher stress load in the last year, bruxism were not included. Patients with palpatory pain of the masseter, neck and neck muscles were excluded.

The 200 patients included 169 females and 31 males (84.5:15.5%), with a mean age of 34.3 years (12–74 years). These were patients who were treated in the outpatient clinic for TMJ disorders between October 2022 and April 2023. 102 patients were completely pain free, 98 patients reported pain localized to the TMJ area. 28 patients perceived their pain in the last week before the examination as constant, 70 patients as irregular.

Statistical analysis
Liliefors test (based on Kolmogorov-Smirnov test) and Mann-Whitney test were used for statistical evaluation of the results.

Results

What is the difference of capsular distension in DDwR patients with and without pain?
98 patients (49%) perceived pain subjectively (regular and irregular). They were 86 females and 12 males, and the mean age was 36.1 years (14–74). The mean difference in capsular distension between TMJ on the affected and unaffected side was +0.41 mm in favour of the affected TMJ.

102 patients (51%) were without subjective pain perception. They were 83 women and 19 men, and the mean age was 32.4 years (range 12–62). The mean difference in capsular distension between the TMJ on the affected and unaffected side was +0.14 mm in favour of the affected TMJ.

Statistical evaluation
Liliefors test (Kolmogorov-Smirnov test): differences between patients with and without pain are statistically significant. Mann-Whitney $p<0.05$.

What is the difference of capsular distension in DDwR patients with irregular and persistent TMJ pain?
Of the 98 patients with pain, 70 patients reported their pain as irregular. They were 62 females and 7 males, with a mean age of 35.3 years (range 12–74). The mean difference in capsular distension between the affected and unaffected side was +0.41 mm in favour of the affected TMJ.

Twenty-eight patients perceived their pain as permanent. They were 24 women and 4 men, and the mean age was 38 years (range 22–64). The mean difference in capsular distension between the affected and unaffected side was +0.42 mm in favour of the affected TMJ.

Statistical evaluation
Liliefors test (Kolmogorov-Smirnov test): differences between patients with irregular and persistent TMJ pain were not statistically significant. Mann-Whitney $p>0.05$.

What is the difference in capsular distension in DDwR patients with and without TMJ palpation pain?
Palpation TMJ pain was noted in 22 patients (19 females, 3 males), with a mean age of 41.6 years (range 17–60). The mean difference in capsular distension between the affected and unaffected side was +0.5 mm in favour of the affected TMJ.

Palpation-free TMJ pain was noted in 178 patients (150 females, 28 males), and the mean age was 41.6 years (12–74). The mean difference in capsular distension between the affected and unaffected side was +0.24 mm in favour of the affected TMJ.

Statistical evaluation
Liliefors test (Kolmogorov-Smirnov test): differences between patients with and without TMJ palpation pain were statistically significant. Mann-Whitney $p<0.05$.

What is the difference in capsular distension in patients with and without a positive dynamic test?
Pain was present in 47 patients when the dynamic test was performed. They were 44 females and 3 males, the mean age was 39.6 years (16–74). The mean difference in capsular distension between the affected and unaffected side was +0.4 mm in favour of the affected TMJ.

No pain was elicited in 153 patients when the dynamic test was performed. They were 125 females and 28 males, and the mean age was 32.7 years (12–73). The mean difference in capsular distension between the affected and unaffected side was +0.23 mm in favour of the affected TMJ.

Statistical evaluation
Liliefors test (Kolmogorov-Smirnov test): differences between patients with and without a positive dynamic test were statistically significant. Mann-Whitney $p<0.05$.

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Discussion

Pain is not a typical symptom of disc dislocation with DDwR. Typical symptoms are sound phenomena (clicking), asymmetry of jaw movement. The cause of pain in disc dislocation can be extra articular (in the sense of myofascial pain) or intra articular. The origin of intra articular pain lies in the traumatization of the ligament capsule, traumatization of the retrodiscal tissue, leading to hyperemia of the tissues of the joint. As a consequence of hyperemia, free radicals and cytokines are produced, and traumatic arthritis develops (Laskin et al., 2006; Okeson, 2008). The inflammatory process in the joint may be accompanied by an increase in synovia, the presence of a pathological collection of fluid in the joint space. The presence of a pathological collection of fluid in the joint space is referred to as joint effusion (Manfredini et al., 2003; Bas et al., 2011; Kim et al., 2021).

The gold standard (if we disregard arthroscopy with direct visualization) for the assessment of inflammatory changes is MRI. JE can be recorded on MRI as a hyperintense signal within the articular space (Almeida et al., 2018). Another option for the diagnosis of JE is the use of US (Manfredini et al., 2003; Jank, et al., 2005; Bas et al., 2011; Almeida et al., 2018). The presence of inflammatory changes can be assessed by measuring the capsular width, which indicates the value between the condylar laterosuperior surface and the articular surface (Manfredini et al., 2003; Jank et al., 2005; Bas et al., 2011). Jank et al. (2005) reported an accuracy of US to detect of TMJ JE of up to 95%. Manfredini et al. (2003) presented a US value of capsular widht for JE above 2 mm. Bas et al. (2011) reported this value above 1.65 mm.

The use of US in the evaluation of JE means easier accessibility (the examination can be performed in a few minutes in the office), with significantly lower cost, and it is an examination without objective contraindications. Yet, the disadvantage of US is the subjective factor of interpretation of the results, which is related to the experience of the physician performing the US examination (Manfredini et al., 2003; Bas et al., 2011; Kundu et al., 2013; Severino et al., 2021). US has a number of limitations in the assessment of disc position and changes in joint head shape (Manfredini et al., 2003; Kaya et al., 2010; Kundu et al., 2013). However, for the assessment of JE, the use of US is comparable to the use of MRI (Nebeith and Speculand, 1991; Melis et al., 2007; Kundu et al., 2013; Almeida et al., 2018).

The results in the authors' work demonstrate that the presence of pain is related to the capsular widht value. By comparing the affected and unaffected joint, there was a statistically significant widening of the capsular widht in patients with TMJ pain than without pain. This is confirmed by the results of other authors who corroborate the association between increased intra-articular fluid and TMJ pain (Tanaka et al., 2002; Manfredini et al., 2003; Bas et al., 2011; Kim et al., 2021). The prevalence of JE in patients with TMJ pain is high, with Manfredini et al. (2003) reporting it to be 73–88%. Kim et al. (2021) evaluated capsular widht in patients with and without pain. The value of capsular widht in painful TMJs was 2.04 ± 0.52 mm, while in pain-free joints the value was 1.37 ± 0.36 mm. Bas et al. (2011) compared the mean capsular widht value with the mean pain value (visual analogue scale 0–10) in 91 patients with TMJ internal derangement. The mean pain value in patients with capsular widht up to 1.65 mm was 2.1, while in patients with capsular widht above 1.165 mm the pain value was 3.75. These values are consistent with the authors' results, with capsular distension being greater in patients with pain than in patients without pain. An interesting finding of the authors is that there was no statistically significant difference in the capsular widht value between patients with regular pain and patients with irregular pain.

Manfredini et al. (2003) confirmed the association of the presence of JE with clinical symptoms, pain on TMJ movement, pain on lateral and/or posterior TMJ palpation, and pain in the TMJ during dynamic tests. The authors' results support this finding. Pain during lateral TMJ palpation and during dynamic testing was associated with a statistically significantly higher capsular widht value than in patients with painless lateral palpation and painless dynamic testing.

Conclusion

The authors confirm the use of US as an ideal method for the diagnosis of JE. The authors' results demonstrate an association between the presence of JE and pain in patients with disc dislocation with reduction. Painful lateral palpation and painful dynamic test are associated with the presence of JE, confirming the fact that they are clinical indicators of an intra-articular inflammatory process.

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