Enhancing Diagnostic Precision: The Role of Specialized Head Coil MRI in Disc Displacement Diagnosis of Temporomandibular Joint

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Magnetic Resonance Imaging (MRI), Head Coil, Research Diagnostic Criteria (RDC).

ABSTRACT

Background: *This study discusses the use of coil heads in Magnetic Resonance Imaging (MRI) technology to diagnose Temporomandibular Joint Disc Dislocation (TMJ). TMJ disc dislocation is a common condition of the temporomandibular joint that can hurt a person's jaw and make it difficult for them to open their mouth fully. This study sought to assess the effectiveness of MRI with coil heads performed in locating and diagnosing TMJ disc dislocations.*

Method: *Analytic observational with cross-sectional design. A diagnostic test to assess the validity of MRI. Predictor analysis was performed using a multivariate logistic regression test.*

Result: *This study shows disparities in the findings of MRI and RDC tests for detecting temporomandibular joint disc dislocations. Clinical complaints have a strong correlation with disc displacement on MRI and RDC. In the MRI, disc dislocation was significantly correlated with all panoramic examination factors. Only the impaction variable in RDC significantly influences disc dislocation. Asymmetrical condyle position on panoramic inspection and complaints present for more than a year on physical examination indicate disc dislocation. These findings imply that MRI is more effective at identifying displaced temporomandibular joint discs, leading to a more precise diagnosis.*

Conclusion: *The diagnosis of TMJ disc dislocations often involves MRI with coil heads. Medical practitioners can more easily spot disc abnormalities or changes in position thanks to this technology, which offers an accurate and thorough image of the temporomandibular joint's anatomy.*

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INTRODUCTION

Temporomandibular joint disorders (TMD) or temporomandibular joint disorders are used for symptoms or signs involving musculoskeletal system disorders, temporomandibular joints, or both. In addition to internal disturbances that refer to a change in the typical temporomandibular joint motion path, which mainly involves the function of the articular disc, it can also be caused by various interrelated factors, namely local conditions consisting of contact occlusion relationships, activity, and response in muscles and joint structures. This disorder can be sourced from joint components or outside the joint, such as teeth, periodontal tissue, masticatory muscles, and psychological problems [1]. Complaints can be caused by pain when opening and closing the mouth, tenderness in the masticatory muscles, and limited temporomandibular joint movement. It will affect a person's chewing, speaking, and swallowing function. This symptom is found in about 12% - 68% of the population, and the highest incidence is in young women, with a ratio of 4:1 compared to men. Prevalence by age increases in those under 40 and decreases with age [2].

The various clinical symptoms make it difficult to make a proper diagnosis. Signs or symptoms such as pain, tenderness in the masticatory muscles or temporomandibular joint, and sounds during mandibular condyle movement (popping, clicking sound, or crepitus in the jaw), and limitation of mandibular movement are found in about 12% - 68% of the population. The most common symptom is a clicking sound at the temporomandibular joint, with an 8 - 50% prevalence. Temporomandibular disorders are the most common cause of headaches and face after toothache [3], [4]. The Research Diagnostic Criteria (RDC) is widely accepted as a diagnostic classification tool. Its validity has been tested several times so that it is now considered a standard by the research community but still has a value of subjectivity in the assessment. So those other modalities are needed to assess the temporomandibular joint structure. It is necessary to evaluate the patient, which includes anamnesis, history of the disease, clinical examination of the temporomandibular joint, clinical examination of the muscles of mastication, intraoral examination, occlusion analysis, and radiological examination to establish the diagnosis of a temporomandibular joint disorder [5].

Magnetic Resonance Imaging (MRI) is a non-invasive and non-radiative tool that produces images using a magnetic field and radiofrequency. MRI has good imaging capabilities for soft tissue and joint evaluation. MRI allows three-dimensional analysis of the temporomandibular joint, providing a complete assessment of the Relationship between the mandibular condyle, articular disc, mandibular fossa, and articular eminence. Various MRI techniques allow us to analyze the position of the disc, both coronal and sagittal, by assessing the dynamics of condylar translation and disc movement during the opening and closing movements of the mouth. Can properly assess articular discs from changes in shape and signal intensity or disc displacement with a high degree of accuracy (95%), assessing the head of the condyle, thickening of the lateral pterygoid muscle (LPM), rupture of the methodical layer or joint effusion [6], [7].

Disc dislocation (DD) is one of the primary forms of internal temporomandibular joint disorders. The most common forms are anterior disc dislocation and disc dislocation without reduction. [8], [9]. Classification of disorders of the internal disorders of the temporomandibular joint is an area that is often. Classificationfication has been differentiated into mand atherogenic subgroups in the last decade groups. However, these groupings are only sometimes clearly separated because these subgroups can overlap. For the first time, the American Academy of Orofacial Pain (AAOP) made a clear diagnostic definition in 1990, revised in 1993 and 1996. The classification is divided into three groups: groups with temporomandibular joint disorders whose diagnosis is

made if there is a temporomandibular joint structural abnormality (degenerative disease or disorder), internal disc, the group due to disorders of the masticatory muscle, and the group with developmental and congenital abnormalities. [3], [10], [11].

RESEARCH METHOD

In order to assess the diagnostic accuracy of MRI, this study used an analytical observational design with a cross-sectional approach. Multivariate logistic regression analysis was used to analyze predictors. During the investigation, the temporomandibular joint (TMJ) was the source of patients' complaints. Each patient underwent a clinical examination and MRI evaluation utilizing a specific coil head with 42 participants. The diagnostic efficacy of MRI in identifying a TMJ disc dislocation was assessed by contrasting the MRI findings with those from a clinical examination. Statistical research determined that MRI disc dislocation detection accuracy was correlated with age, gender, and clinical symptoms. The findings of this investigation shed light on the ability of MRI with a specific coil head to diagnose TMJ disc dislocations.

RESULTS

Table 1 Multivariate Analysis

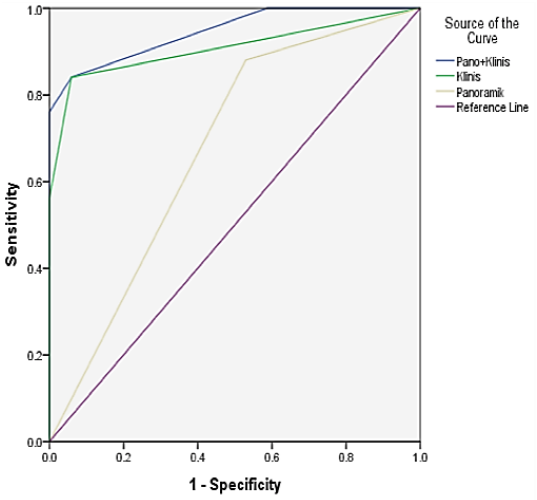
MRI			**RDC**		
Variable	OR	P	**Variable**	OR	P
Panoramic			**Panoramic**		
missing teeth	0.0001	0.998	missing teeth	1.734	0.188
impaction	0.0001	0.998	impaction	0.001	0.999
condyle	5.175	0.017**	condyle	0.617	0.617
clinical symptoms			**clinical symptoms**		
Long Complain	11.521	0.001**	Long Complain	0.001	0.998
Complaint Type	7.629	0.054*	Complaint Type	0.001	0.998

*Logistics Regression Analysis

**Significant

Source: Primary Data

Table 1 logistic regression analysis shows that asymmetric condyles and duration of complaint of more than one year can be predictors of disc dislocation if MRI is the gold standard. In contrast, based on RDC examination, no variables can predict disc dislocation.



AUC image with MRI as Gold Standard

AUC Panoramic = 67.5%

AUC Clinical Symptoms = 90.7%

AUC Panoramic and Clinical Symptoms = 94.6%

The ROC curve if MRI is the gold standard shows that the AUC value for panoramic examinations, when combined with the AUC value for clinical symptoms, is 94.6%.

Table 2 Diagnostic Value of Clinical Examination according to RDC using MRI as Gold Standard

Diagnose Klinis (RDC)	MRI				sensitivities	Specificities	PPV	NPV	Accuracy
	Normal		DD						
	n	%	n	%					
Normal	16	38.1	6	14.3	95.00%	72.70%	76%	94%	83.90%
DD	1	2.4	19	45.2					

Note: Analysis using ROC Curve

Table 2 shows that the highest frequency was found in patients diagnosed with disc dislocation (DD) based on RDC and MRI in 19 people (45.2%). The subsequent highest frequency were patients diagnosed as usual by RDC and MRI, as many as 16 people (38.1%). The difference is seen in the frequency of patients diagnosed as usual by RDC, but the results of the MRI examination found disc dislocations in as many as six people (14.3%). Likewise, one patient (2.4%) was diagnosed with disc dislocation by RDC, but no disc dislocation was found on the MRI examination. The analysis results show that the sensitivity of MRI is 95%, specificity is 72.7%, the positive predictive value is 76%, and the negative predictive value is 94%, with an accuracy value is 83.9%.

This study indicates that temporomandibular joint disorders most often occur in women by 40.5%, with the age group 20-40 years at 38.1%. This opinion is in line with research conducted by Schmitter M, where women are four times more likely to suffer from temporomandibular joint disorders than men and decrease with age. This disorder is rarely found in children, but its prevalence increases in adolescents and peaks at 20-40

years [12]. Many other descriptive epidemiological studies from various countries have shown that temporomandibular joint disorders are about twice as high in women of childbearing age, with pain complaints around 7.2 – 8% [13]. Research conducted by [14], [15] showed a high prevalence in women with a ratio of 5:1 compared to men. However, the cause of the high prevalence in women remains unclear.

DISCUSSION

Findings from a prospective cohort study conducted by Slade 2015 revealed that the incidence rate of clinically verified temporomandibular joint pain was only slightly higher in women than in men, while there was no difference in the rate of symptoms of chronic pain episodes temporomandibular joint disorders between the sexes [16]. Similar to the study by Himawan et al., temporomandibular joint disorders are more prevalent in men [17]. In contrast to musculoskeletal complaints located in other parts of the body, such as osteoarthritis [18], the incidence and prevalence of symptoms of temporomandibular joint disorders, especially pain in the masticatory muscles temporomandibular joints, decreases significantly during menopause and at age. Older ones [12]. Research by [19] suggests that in the elderly population, there is a weak and inverse correlation between signs and symptoms of temporomandibular joint disorders and perceptions of oral health. Research by [20] reported that age significantly influences the quality of life in patients with symptoms of temporomandibular joint disorders. The study by [21] showed that the prevalence of bilateral disc dislocations was more common in women than in men. This aligns with our results and suggests that genetic factors contribute to this.

This study indicates that the shape of the most articular disc in the closed mouth position is the convex shape, namely 40 (47.6%), while the most open mouth position is the biconcave shape, which is 45 (53.5%). The disc configuration has been considered an essential feature of the internal imbalance of the temporomandibular joint [7]. For disc transformation patterns, temporomandibular joints without disc dislocation do not have disc configuration transformation when the mouth is open. The disc has a biconcave configuration with the mouth closed and open. However, a significant correlation was found between disc configuration transformation and diagnosis of anterior disc displacement. The transformation from biplanar in the closed mouth to biconcave in the open mouth was the most common pattern in disc dislocation with a reduction [22]. [23] disc deformity was found in 29.3% of symptomatic patients and 4% of asymptomatic patients. Similarly, [24] that most temporomandibular joint disorders with anterior disc displacement ultimately have disc deformities [23], [24]. Disc deformities are essential and are known to be associated with temporomandibular joint disorders. A standard biconcave shape can usually be found under normal conditions. However, it can also be found in mild to moderate anterior disc displacement, whereas convex and folded forms are generally found in severe anterior disc displacement without reduction. [25] explained that a disc with a thick posterior band was the most common disc shape in anterior disc displacement with and without reduction. At the same time, [21] found that the biplanar shape was the most common in patients with temporomandibular joint disorders and found an association between disc deformity and osteoarthritis [3].

The disc configuration can be changed from a closed-mouth position to an open-mouth position. Information on disc configuration deformity patterns in the open mouth position is essential for planning and prognosticating treatment in patients with temporomandibular joint disorders. For example, the pattern of transformation of the disc configuration at mouth opening shown on MRI images may provide a prognosis for

non-surgical treatment in patients with anterior disc dislocation without reduction, where if the disc is not transformed from a closed mouth to an open position it will not respond well to treatment—non-surgical conservative [26]. In our study, it was found that the disc configuration deformity pattern in the normal disc position found the most deformity from convex to biplanar, namely 10 (11.9%), in anterior disc dislocations with reduction the most deformity was found from folded to biplanar, namely 8 (9.5%). In contrast, no dominant deformity pattern in anterior disc dislocation without reduction exists. It is different from the study conducted by [27], which stated that the incidence of disc deformity was more remarkable in cases of disc displacement than in regular disc positions, and the incidence of disc deformity was greater in unreduced disc displacement than in reduced disc displacement.

The disc will lose its original biconcave shape as the anterior disc dislocation without reduction continues [27]. [22] found that biconcave was the most common disc configuration in the asymptomatic group, and biplanar was the most common disc configuration in the disc dislocation group with a reduction in the mouth closed position to the open mouth position; the disc then moved superiorly to the condylar head with a biconcave configuration. In disc dislocations without reduction, the configurations commonly found are convex and folded. In contrast, [28] found that the biconcave shape was typical in the closed and open mouth positions under normal conditions. The convex shape was found primarily on disc dislocations without reduction. In addition, several studies have found that a biplanar shape is familiar in non-displaced discs [27]. [22] explains a significant relationship between disc configuration transformation and disc reduction. When the disc is displaced by reduction, the general pattern of disc configuration is biplanar in the closed mouth and is converted to biconcave in the open mouth position. However, in the disc displacement group without reduction, the typical pattern was convex folding from the closed to open mouth position at the symptomatic joint. A previous study conducted in 2010 also found that the disc displacement without reduction in the closed mouth position, the posterior and anterior points of the disc are more anteroinferior than the standard disc position. In the normal disc position, the anteroposterior disc length was longer in the open-mouth position than in the closed-mouth position. However, the disc length did not differ for the closed and open-mouth positions in the unreduced disc displacement. The greater the severity of disc displacement, the greater the transformation of disc configuration, so early treatment for internal disorders should be carried out to reduce the possibility of progression to disc deformities [22].

In this study, it was found that in the symptomatic patient group, there were 19 people (45.2%) who were positive for disc dislocation both on RDC and MRI examinations, one person (2.38%) who was positive for disc dislocation on RDC but negative on MRI. 6 people (14.28%) were negative for disc dislocation on RDC but positive on MRI. Sixteen people (38.1%) were negative for disc dislocation on RDC and MRI examinations. From these data, it can be seen that MRI can detect disc dislocations in asymptomatic patients. Our study data also show that the diagnosis of disc dislocation is more frequent when using an MRI examination. In contrast, patients diagnosed with normal are more frequently diagnosed with RDC. Although RDC has been widely accepted as a diagnostic classification tool, the value of subjectivity in the assessment of RDC and the assessment index of other temporomandibular joint disorders is still difficult to avoid; it is considered essential to add an MRI examination modality to the permanent procedure for diagnosing temporomandibular joint disorders [5]. MRI is a tool with good imaging capabilities for soft and dense tissues and accurately evaluating

the temporomandibular joint (95%). MRI is considered reliable in diagnosing disc dislocation events; some recent literature has strengthened the assumption that MRI can become the Gold Standard [5]. This study also shows that parameters that can be examined using MRI will complement RDC and panoramic examinations. The function of MRI is not only limited to diagnosis but also includes planning for implants and making a better prognosis. Measurements with MRI after one week of repetition are not much different in patients with or without clinical symptoms; this examination can still be used with good predictor ability [29]–[31]. According to Pupo's clinical examination protocol, the sensitivity is only 44%, and the specificity is 51% [32]. It is not in line with other studies that suggest that this RDC's specificity is higher than its sensitivity [33].

The results of this study indicate that the duration of the complaint, which is more or less than one year, is significantly associated with the incidence of DD on both RDC and MRI examinations. Complaints are usually subjective, but if the complaint has persisted for a long time, this indicates a severe problem that is more than just subjective. Ohrbach and Greene state that pain associated with the masticatory muscles or temporomandibular joint and limitation of jaw movement (mostly jaw opening is restricted), e.g., mandibular dysfunction, is a clinical symptom and sign that requires treatment, at least in most cases [5]. Epidemiological studies show a high prevalence of signs and symptoms of temporomandibular joint disorders, such as pain and tenderness in the joints and muscles of mastication, joint sounds, and limitations and abnormalities of mandibular movement. Eighteen epidemiological studies conducted in the early 1980s showed prevalences varying from 16% to 59% for reported symptoms and 33% to 86% for clinical signs [2]. Clinical signs are obtained, such as clicking sounds which will eventually be replaced by pain when opening the mouth and displacement of the jaw [34]. If these clinical symptoms are not resolved, they will worsen with age [20]. Some people may be able to reduce the clinical symptoms or complaints they feel but still have the potential to experience joint dislocation without proper treatment [20].

The long relationship between complaints and the incidence of DD also reminds people that several complex behaviors can be shown by people who experience symptoms of complaints related to temporomandibular joint disorders, so the role of doctors becomes vital in the healing process. Decisions regarding the clinical symptoms complained of, and prognostic predictions in a person with suspected temporomandibular joint disorders require an assessment of the position of the articular disc concerning the mandibular condyle, the location of the condyle concerning the surface of the temporal joint, the depth of the glenoid fossa of the temporomandibular joint [7]. The proper treatment will improve the patient's condition even though the complaints have persisted for several years [35]. The data in this study indicate a relationship between tooth loss and the incidence of disc dislocation. It is in line with the results of previous studies that there is a relationship between the loss of posterior teeth and the incidence of disc dislocation; replacement of missing teeth does not guarantee the prevention of the development of temporomandibular joint disorders. However, if missing teeth are not replaced, it will accelerate degenerative joint disease [23]. Posterior tooth loss has a high prevalence of temporomandibular joint disorders, especially in young women [23]. Stress in temporomandibular joint disorders is associated with tooth loss [36]. Anterior teeth function to protect posterior teeth during mandibular movement. Loss of anterior teeth will induce Occlusion time disturbances [37]. Occlusion associated with temporomandibular joint disorders is a critical issue in dentistry because it is a cause of joint disorders. The temporomandibular joint is a risk factor for muscle disorders [38]. The etiology of temporomandibular joint disorders is multifactorial and can be grouped into three main factors: anatomical

factors of the teeth and joints, neuromuscular factors, and psychological factors. The specific anatomical factor considered is the difference in height or vertical asymmetry of the left and right condyles. Vertical asymmetry of the condyle is a common condition and does not always describe the presence of a disease but is a risk factor that can cause temporomandibular joint disorders. Condyle vertical asymmetry in patients with signs and symptoms of temporomandibular joint disorders has a prevalence of 54.2 - 70.8% [39].

Research conducted by [40] suggested that in the elderly with no teeth, the sound in the temporomandibular joint that was more often found was crepitus (16%) compared to clicking sounds (10%). It is different from the results obtained in this study [38]. The study results found more disc dislocations in people who had lost teeth, although not significant compared to those who had not lost teeth. It is because chewing breaks down and grinding food into smaller pieces in preparation for swallowing. This process involves functional units regulated by the neuromuscular system. It involves various components of the masticatory system, such as teeth, periodontal tissues, muscles of mastication, temporomandibular joints, palate, tongue, salivary glands, nervous system, and blood vessels. The masticatory process is ideal because it allows for alternating periods of activity and rests in the muscles and joints to balance masticatory and musculature functions. The habit of chewing using one side of the oral cavity exclusively in the chewing process can cause unbalanced stimulation of dentofacial growth and cause structural instability in the stomatognathic system. Chewing consistently or predominantly on one side is known as side chewing preference. Chewing using one side of the jaw is prevalent among 45 - 97% of the global population [38].

The habit of chewing exclusively using one side of the oral cavity is known as unilateral mastication. Unilateral application of mastication can cause unbalanced stimulation of dentofacial growth and lead to structural instability of the stomatognathic system. Unilateral mastication causes the muscles on the working side (the side with food), especially the masseter, temporalis, and buccinator muscles, to work harder. In contrast, the muscles on the balancing side (the side without food) experience elongation and have lower muscle tone, so muscle asymmetry can be found visually. The visible unilateral mastication results from an adaptation process, also influenced by other factors such as occlusal barriers, dental problems, periodontal tissue problems, tooth loss, dental anatomic abnormalities, and any abnormalities or problems in the temporomandibular muscles and joints. Chewing done consistently or more dominantly on one side is known as chewing side preference and is strongly influenced by individual habits in chewing. Even in individuals with bilateral mastication, one side is generally primarily used for chewing [38]. Bianchini et al. (1998) in [41] suggested that the habit of chewing on one side can cause instability of the structures in the stomatognathic system because it causes muscles on the working side (the side with food). Especially the masseter, temporalis, and buccinator muscles work harder. In contrast, the muscles on the balancing side (the side without food) are elongated and have lower muscle tone, so muscle asymmetry can be seen visually. From this statement, chewing on one side is more influential on the masticatory muscles' asymmetry than on the condyle's structure. From the data of this study, seven people (16.5%) had clinical symptoms in the form of a clicking sound, and the duration of the complaint was more than one year; as many as ten people (23.8%) had joint effusion. Bivariate analysis showed that the incidence of joint effusion was significantly associated with disc dislocation. It is in line with the results of a previous study by Westesson P 1992 that there is a strong relationship between joint effusion and disc dislocation. Where 7% of joint effusion is in the standard disc, 40% in disc dislocation with reduction, and 27% in joint arthrosis. The Relationship between the incidence of DD and joint effusion has

yet to be established because the results of many studies still need consistency [42]. Joints with anterior disc dislocation have a potential of 2.01 to experience degenerative deformities or 2.85 times more significant potential to experience joint effusion. Anterior joint dislocations without reduction have the potential for 4.43 times to experience degenerative deformity and 4.61 times to experience joint effusion. Joint effusion conditions will increase joint dislocation in patients with temporomandibular joint disorders [43]. Degenerative changes in the bone can occur in children and adolescents who experience disc dislocation [44]. Patients with temporomandibular joint disorders with joint effusion may experience spontaneous pain. This effusion represents an inflammatory response to the dysfunction of the disc-condylar junction. The incidence of DD in young adult patients can cause condylar changes ([45], [46]. Joint effusion can be a biological marker of headache associated with temporomandibular joint disorders and can help classify patients' diagnosis and treatment [46], [47].

The mean protein concentration of joint fluid in patients with effusion is higher than in regular patients or patients without effusion [48]. [49]suggested that joint effusion is a fluid collection due to inflammatory changes in the synovial membrane. No statistically significant association was found between pain experienced by patients with joint effusion or bone marrow edema [49], [50]. Larheim et al. (2001) reported the presence of bone marrow abnormalities in 31.4%. In his study, condylar bone marrow edema was found in only 5% of patients, and there was no evidence of osteonecrosis [8]. [51]again reported that fluid collections accompanied by subacute disc dislocation without reduction were more common than before, and high signal intensity within the disc space was considered a fluid collection. Several authors have found joint effusion and DD common even in patients with painless temporomandibular joint disorders [11], [52]. Retrodiscal soft tissue edema is rare and generally not associated with the patient's symptoms. Excessive stretching of the ligaments when the mouth is open, as mentioned by [53], is associated with functional hyperemia and peri-vascular inflammation of the temporomandibular joint with pain. [54] suggested that synovitis was significantly correlated with joint effusion. Hyperplasia and inflammatory cells correlate with the number of joint effusions. The joint effusion may contain synovial fluid and hyperplastic synovial tissue that may form in response to an inflammatory reaction [54]. According to [11], a significant difference was observed between TMJ pain and the amount of joint fluid where fluid was reduced, indicating improvement in pain or no pain. [11] also revealed a statistically significant relationship between the presence of pain and joint effusion and suggested an increase in the probability of intra-articular pain with joint joint joint effusion in disc dislocations without reduction.

This study showed the highest frequency in patients diagnosed with disc dislocation (DD) based on RDC and MRI, 19 people (45.2%). The subsequent highest frequency were patients diagnosed as usual by RDC and MRI, as many as 16 people (38.1%). The difference is seen in the frequency of patients diagnosed as usual by RDC, but the results of the MRI examination found disc dislocations, namely six people (14.3%). Likewise, one patient (2.4%) was diagnosed with disc dislocation by RDC, but no disc dislocation was found on the MRI examination. The analysis results show that the sensitivity of MRI is 95%, specificity is 72.7%, the positive predictive value is 76%, and the negative predictive value is 94%, with an accuracy value is 83.9%. Several studies have been conducted to validate the clinical diagnosis of disc shift [9], [11], [55]–[57], with the majority using MRI as the gold standard for assessing the position of the temporomandibular joint disc [48], [58], [59]. MRI can determine if a disc is partially or wholly dislocated with the mouth closed and if the disc has

undergone partial or total reduction at the opening time. Several previous studies regarding diagnostic criteria for temporomandibular joint disorders have shown excellent diagnostic accuracy [29].

The study by [4] is the first study to examine the diagnostic accuracy of a clinical diagnosis of disc dislocation without reduction with limited mouth opening, which is a sub-type of disc dislocation which shows a sensitivity value of 85%, specificity of 73% and diagnostic accuracy of 80%. A clinical diagnosis of up to 85% indicates that the clinical criteria used can recognize disc dislocation without reduction with limited mouth opening when the condition is present. The high sensitivity value for a diagnosis also indicates that when the clinical diagnosis is negative, our confidence increases to rule out or eliminate the presence of the diagnosis.

In addition, the clinical benefit of the diagnostic criteria is also quite good, as shown by the likelihood ratio and predictive value to rule out or confirm whether there is a disc dislocation without reduction with limited mouth opening [4]. The overall accuracy of clinical diagnoses in previous studies was found in establishing the diagnosis of disc shift without reduction [57]. Testing clinical benefits, such as likelihood ratio and predictive value, is currently expected in evidence-based practice [60], [61]. Predictive value can indicate how likely a patient with a positive or negative diagnosis does or does not to suffer from the condition in question. In addition to sensitivity and specificity, the current study provides predictive value and propensity ratio to support clinical utility by using predefined diagnostic criteria to identify a clinical subtype of disc shift. Other studies have shown that the accuracy of the RDC examination has been proven in detecting the incidence of disc dislocations with reduction but is less capable of disc dislocations without reduction ([9]. However, the results of other studies still confirm that the clinical examination has a specificity of up to 88% and a sensitivity of 78% [62]. This inconsistency reinforces the need for a combination of clinical examination with MRI for more valid and reliable results. This study's sensitivity and specificity test showed that the MRI examination had a higher sensitivity while the RDC examination had a higher specificity. Research that has emerged regarding comparing the validity of the RDC and other diagnostic criteria with MRI examinations is still rare, especially in Indonesia, and still needs to be studied further to strengthen that MRI is the gold standard. Some of the published literature is about the suitability of the observers tested with the Kappa test or the validity of MRI and RDC separately [63]. Clinical examination is still considered low validity compared to MRI examination; a meta-analysis study has been compared to compare these two examinations [32]. The literature review suggests that using more than one type of examination for an accurate diagnosis is best.

Nonetheless, MRI can assess various morphological deformities occurring at various oral positions, and the results of the condylar examination on MRI are strong indicators of disc dislocation (Yang et al., 2017). This study also shows that MRI is better at detecting patients with disc dislocation than RDC but requires a combination with other examinations to increase its sensitivity. It has been mentioned that the validity or superiority of MRI should make this examination the gold standard. However, some experts and clinicians still consider RDC the Gold Standard, and some clinicians choose panoramic examination because it is cheaper [64].

There are certain conditions where the validity of the RDC becomes very weak, for example, in the condition of a disc dislocation patient without reduction with limited mouth opening [29]. MRI will be complementary because of its ability to detect various conditions. Efficiency factors with high diagnostic accuracy should also be considered so that faster clinical and therapeutic decisions will benefit the patient. MRI examination can evaluate various morphological deformities with different positions and the position of the

condyle, which determines whether there is a reduction. Although some literature considers that MRI should be used in severe patient conditions, resistant cases, and surgical purposes, researchers believe that the evidence shown with high sensitivity indicates that MRI should be considered the Gold Standard [62]. Comparing the clinical diagnostic accuracy against an MRI diagnosis will show a reasonably good sensitivity value but a low sensitivity value compared to previous comparisons for diagnostic criteria against the clinical gold standard examination using expert experience and radiological imaging findings. Nonetheless, using diagnostic criteria in a clinical population can provide helpful input for informing the evidence-based practice of physical therapists according to the evidence demonstrated by propensity ratio and predictive value to rule out and confirm the presence of a type-specific disc shift condition.

CONCLUSION

The outcomes of MRI and RDC tests differ when identifying temporomandibular joint disc dislocation. On MRI and RDC testing, the temporomandibular joint disc dislocation incidence is significantly correlated with clinical complaints. The incidence of temporomandibular joint disc dislocation on the MRI scan was substantially correlated with all variables on the panoramic evaluation. Disc dislocation was only significantly associated with the impaction variable on the RDC analysis. Strong indicators of disc dislocation include an unequal alignment of the condyles on panoramic examination and a history of symptoms lasting more than a year on physical examination. The unique innovation and possibilities given by this technique in diagnosing this issue are highlighted by MRI's superior capacity to detect displaced temporomandibular joint discs when compared to RDC.

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