Case Report

# Joint Vibration Analysis A Functonal Tool in Diagnosis of Temporomandibular Disorders – Case Reports

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**A B S T R A C T**

**Introduction:** Temporomandibular disorder (TMD) was a group of clinical symptoms involving masticatory muscles,or joint in oro facial region, or both. Evaluation of joint sounds was considered a key diagnostic criterion in determination of TMD. Temporomandibularjoint [TMJ] sounds have especially been studied because of their possible relation with an interfering mechanical condition (internal derangement) or a focal degenerative disorder (degenerative joint disease (DJD/ osteo arthrosis) of the TMJ. Joint Vibration Analysis [JVA] measures the joint vibrations through electrovibratography (EVG) is more reliable than physical examination alone and can serve as a non-invasive method for screening patients with TMDs.

**Case report:** The aim of this report was to report cases of TMDS by comparing the diagnostic accuracy of JVA and MRI in patients with articular Disc Displacement with and without reduction.

**Conclusion:** Analyzing joint noise using electrovibratography suggests the type of joint dysfunction and may help to establish a diagnosis, as well as a treatment plan where as MRI is a gold standard imaging for disc displacements and its usage is limited because its cost.

**Keywords:** Joint Vibration Analysis, Magnetic Resonance Imaging, Temporomandibular Disorders

## INTRODUCTION

Temporomandibular disorders (TMD) are a broad group of clinical problems involving the masticatory musculature, the temporomandibular joint, surrounding bony and soft tissue components. Symptoms of TMD include decreased mandibular range of motion, pain in the muscles of mastication, temporomandibular joint (TMJ) pain, associated joint noise with function, generalized myofascial pain, and a functional limitation or deviation of the jaw opening. The prevalence of TMD is thought to be greater than 5% of the population. TMD can be divided into articular and nonarticular disorders. Most nonarticular disorders present as myofascial pain focused to the muscles of mastication. Other nonarticular disorders include chronic conditions, such as fibromyalgia, muscle strain, and myopathies. Articular disorders (internal derangement) can be divided into inflammatory and noninflammatory arthropathies. Inflammatory articular disorders include rheumatologic processes, such as rheumatoid arthritis (RA), seronegative spondylopathies, such as ankylosing spondylitis, psoriatic arthritis, gout, and infectious arthritis. Noninflammatory articular disk disorders include osteoarthritis, joint damage from prior trauma or surgery, or other cartilage or bone disorders. Diagnosing TMD requires a focused history and physical examination. Radiographic studies can also be used as supplemental diagnostic tools.[1] MRI is the gold standard imaging technique used to visualize the TMJ, inflammatory changes within the joint space,cartilage abnormalities and positional alterations of the joint disc. In recent years, joint vibration analysis (JVA) has been developed to record and analyze TMJ vibrations that are produced by joint tissues during opening and closing movements, visualize the wave shapes, analyze the eventual vibrations in the contralateral condyle, and calculate the frequency, as well as the amplitude of the vibration. JVA is a noninvasive detection technique and is of great value in the auxiliary diagnosis of TMD, because it provides more essential information of the articular noise than other methods do.[2]



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## CASE REPORTS

### Case 1

A 24 year old male patient presented to Our Department of Oral Medicine and Radiology with the chief complaint of pain in left side of TMJ since 3 months with no relevant medical history. On clinical examination inspectory findings manifested mouth opening of 30mm with deviation towards left side of 3mm. palpatory findings revealed tenderness of left lateral pterygoid, masseter and medial pterygoid, clicking sounds heard on auscultation. Based on above complaint and clinical examination provisionally diagnosed as Disc Displacement with Reduction. To confirm the diagnosis, JVA was carried out as chair side investigation. JVA has directly connected to the circuit using computer which works on BIOJVA software. It was placed over patient head at the level of TMJ area and a metronome was displayed on the system which guides patient in opening and closing cycles at rate of 40cycles/min. The movements were analyzed using BIOPAK software and evaluated using Pipers chart where specific wave forms of vibrations were analysed. By correlating the JVA standard values in flow chart (shown in fig 1) with the patient JVA values (shown in fig-2) it is diagnosed provisionally as Chronic Disc Displacement with Reduction. MRI was carried out for final diagnosis.

MRI right TMJ joint showed articular disc non visualization

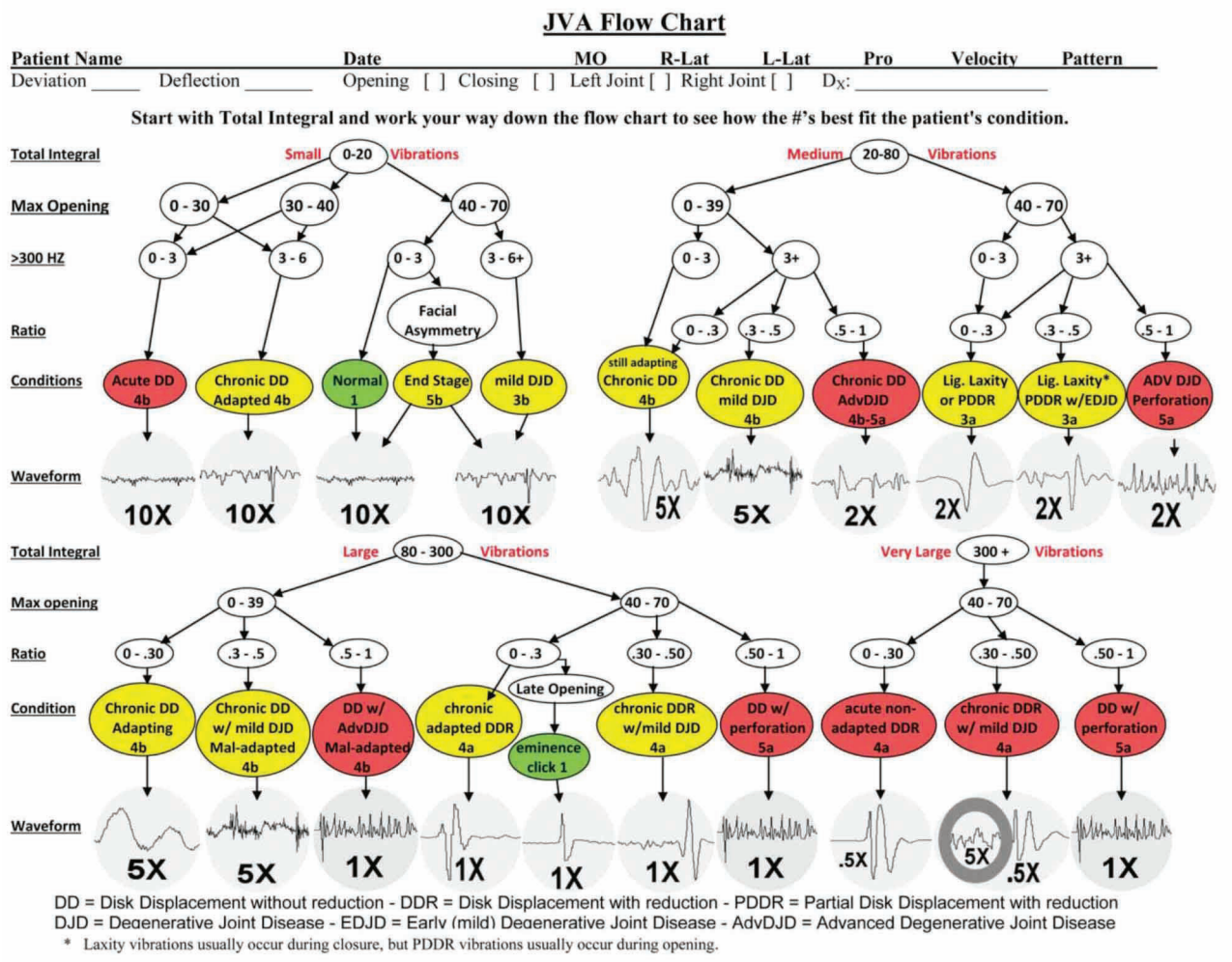


**Figure-1:** JVA flow chart

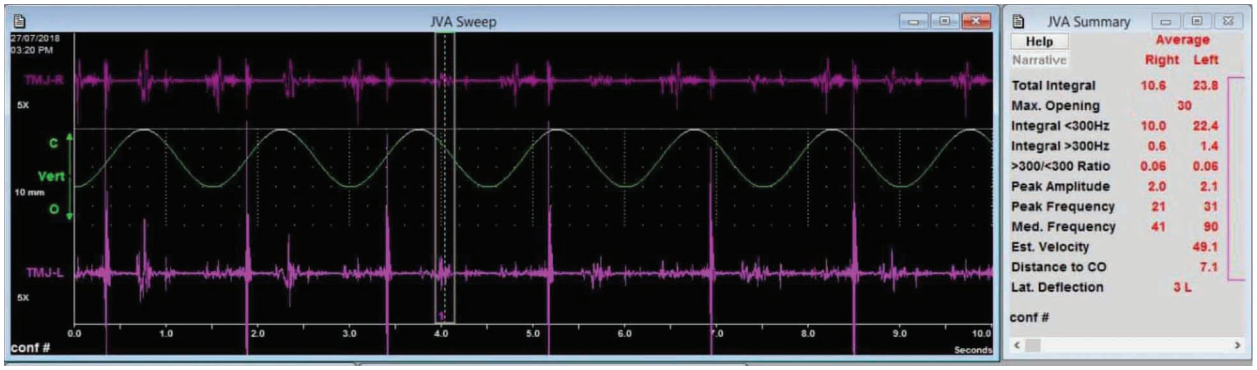


**Figure-2:** JVA findings of case report 1

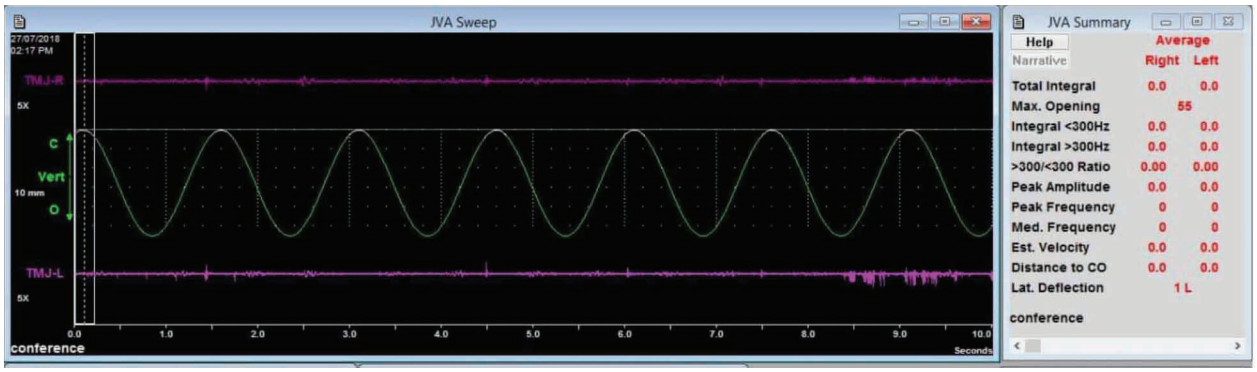


**Figure-3:** JVA findings of case report 1 after follow up

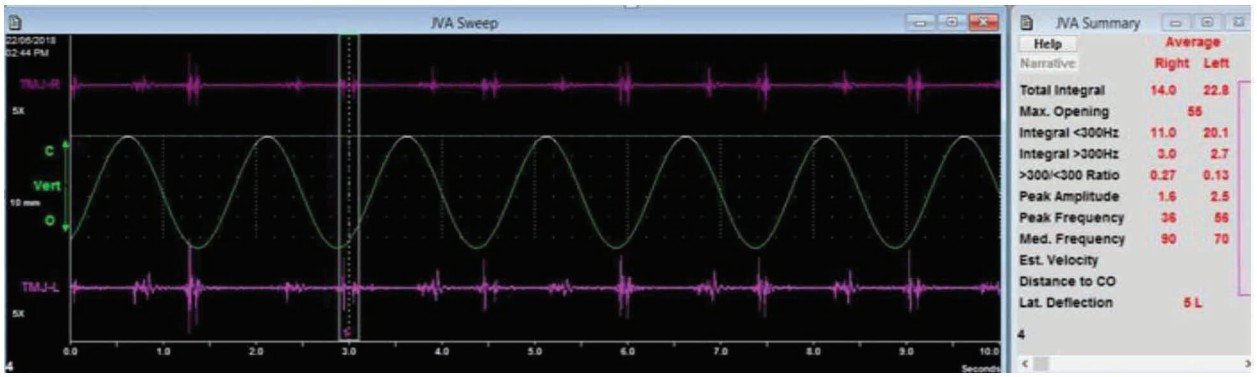


**Figure-4:** JVA findings of case report 2

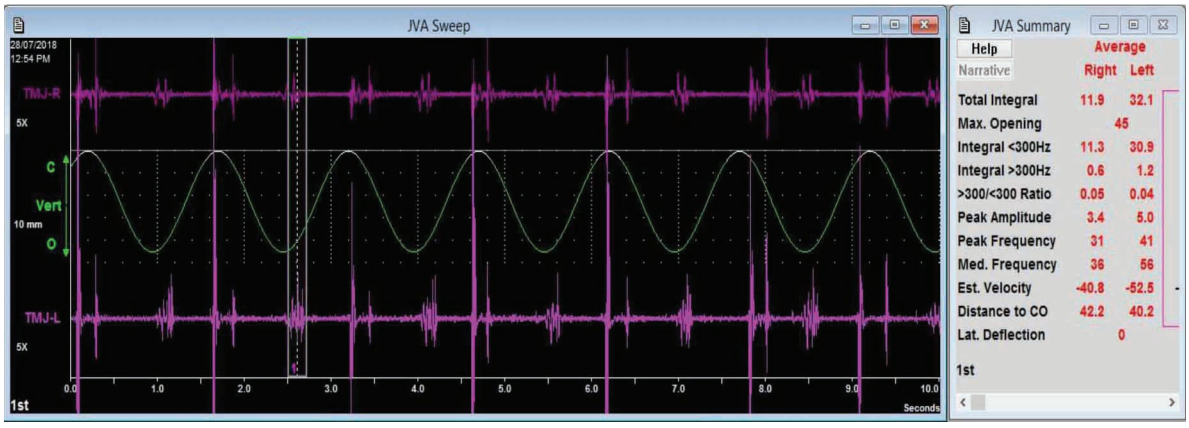


**Figure-5:** JVA findings of case report 3

of posterior band Anterior band seen at the level of articular eminence in closed mouth position and translating anteriorly in open mouth position.

MRI LEFT TMJ revealed articular disc normal contour and anteriorly dislocated in closed mouth position. Articular disc dislocated anteriorly in open mouth position with anterior translation with minimal joint effusion gives final impression as anterior dislocation of disc with minimal joint effusion.

Treatment: Mandibular splint was reconstructed after 3 weeks of active treatment and follow up showed increased mouth opening of 55mm and reduced deviation of 1mm. Post -JVA values showed no vibrations on opening and closing (fig 3).

### Case 2

A 55 year old male patient reported to our Department of Oral Medicine and Radiology with signs and symptoms of pain and clicking sounds on the left side of jaw for past 2 years with no relevant medical history. On clinical examination inspectory findings revealed mouth opening of 55mm with deviation towards left side of 5mm. palpatory findings revealed tenderness on left lateral pterygoid, masseter and medial pterygoid. Auscultation manifested clicking sounds. On Conducting JVA examination revealed partial Disc Displacement with reduction (fig 4). Confirmed with MRI.

MRI RIGHT and Left TMJs revealed Articular disc was normal in contour and position in closed position and open mouth position. The final impression was normal.

### Case 3

A 24 year old male patient visited to our Department of Oral Medicine and Radiology with chief complaint of pain and clicking sounds during opening on both sides of jaw since 6months. With noncontributory medical history. The clinical


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examination included palpation of TMJs and masticatory muscles, revealed tenderness of left lateral pterygoid, masseter and medial pterygoid with mouth opening of 45 mm. On Auscultation presence of clicking sounds. JVA was carried out which exhibited values of partial disc displacement with reduction (fig-5) and finally Confirmed with the gold standard MRI.

Radiographically MRI of RIGHT and Left TMJ showed normal contour and position of Articular disc in open and closed mouth position. Hence the final impression of TMJ MRI was normal.

## DISCUSSION

Temporomandibular joint (TMJ) sounds are the most common symptoms among patients with temporomandibular joint dysfunction (TMD). Click and crepitus are mostly used to describe the various types of TMJ vibrations.[3] Clicking and crepitation should be considered signs of morphological alterations, being indicative of articular disc displacement with reduction (ADDwR) and arthrosis, respectively. The key diagnostic criterion in determination of TMDs is evaluation of joint sounds. Unfortunately, it is not so easy to detect the joint sounds clinically.[4] There are many objective and subjective methods have been developed to record and analyse the TMJ sounds ranging from simple palpation and auscultation to complex Electromyography (EMG), Jaw Tracking, Thermography, Sonography, Dopper Ultrasound, Magnetic Resonance Imaging (MRI), Arthrography, Arthroscopy, Computerized Tomography (CT) scan which are expensive and provide static information. In search of an inexpensive method which provides dynamic information about joint, a personal computer based tool – JVA was developed based on principles of motion and friction. It is a precise, quick, non-invasive, passive device that objectively records all the vibrations of the underlying tissue during function, distinguishes which side the vibration originates on, creates a visual image of the vibration and measures its intensity.[5] During electrovibratography, temporomandibular joint (TMJ) noise is recorded and analyzed in terms of intensity, frequency, duration, and location of the occurrence within the mandible range. This is recorded during opening and closing movements. Such parameters are important because joint dysfunction tends to produce characteristic sounds that are not conveniently detected or analyzed through any other method.[6] In a healthy Temporomandibular joint there exists little, if any, vibrations present during the repeated mandibular opening and closing. Normal is characterized by a Total Integral of 0-10 Pascal-Hz bilaterally, recorded between successive tooth contact vibrations. With a normal TMJ, frequency range should be accompanied by a normal range of motion without deviation, deflection, or any other patient TM joint related complaints. In Closed-Locked TMJ Vibration Pattern Joint Vibration Analysis determines the presence of vibrations throughout opening and closing range of motion, it is possible to observe none, or minimal joint vibrations. In this circumstance, there will likely be insignificant joint vibrations detected using JVA. With a closed-locked joint there will be limited opening and only slight mandibular deflections towards the affected side, because the articular disc is trapped in front of the condylar head, limiting the condyle's ability to translate down the eminence. In Ligament Laxity and Disc Movement When stress on the Temporomandibular joint complex stretches the supporting ligaments of the articular disc, or minor discal tissue tearing occurs, laxity (excessive movement) of the articular disc on the head of the condyle results. This most frequently occurs at the lateral ligamental attachment, which allows the lateral pole of the disc to slip around on top of the condyle. JVA records this excessive movement as a low amplitude, open, 1 or 2 cycle waveform. These inconsistent vibrations typically have a Total Integral ranging between 20-50 Pascals detected. (Dawson, 2007). This displacement of the disc upon opening will then occur in conjunction with a reduction of the displaced disc upon closing; each occurring when the disc moves posteriorly with respect to the head of the condyle. When detected by the Joint Vibration Analysis, DDR is characterized by a compressed waveform with high amplitude. The Total Integral of DDR vibrations typically exceeds 80 Pascals, and can reach to 1000 Pascals in very acute displacement circumstances. There are many studies conducted on JVA, Ishigaki et al conducted a study on 213 patients with TMDS 75 to 77% sensitivity.[7] Ishigaki et al showed 102 joints with meniscal displacement, 70 joints displaying meniscal displacement without reduction and 96.6% diagnostic sensitivity for the MDR and 96.6% diagnostic sensitivity for the MDR.[8] Ishigaki et al showed 42 temporomandibular joints (TMJ) with degenerative joint disease (DJD) (diagnostic specificity 75% diagnostic sensitivity= 80.2%).[9] Deregibus, T Castroflorio et al showed 90 patiens with disc displacement, 90% specificity in disc displacement with reduction.[4] Ishigaki et al.[7] reported a disc displacement with reduction generates a "click" in the lower frequencies (under 300 Hz) and a degenerative condition generates "crepitus" in the higher frequencies (over 300 Hz).[10]

## CONCLUSION

Temporomandibular disorders are the complex disorders with multifactorial etiology. JVA is a advanced diagnostic tool noninvasive inexpensive gives the early pathological status of the tmj with a time span of 1min QUICK JVA where are MRI gold standard imaging for disc displacements its usage is limited because its cost.

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