

## Viscosupplementation-the concept in alleviating symptoms of temporomandibular joint osteoarthritis: A clinical study

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### Abstract

**Purpose:** The aim of the present study was to evaluate the efficacy of hyaluronidase injection in the treatment of temporomandibular joint osteoarthritis.

**Patients and Methods:** Patients with symptoms of unilateral temporomandibular joint osteoarthritis, non-responsive to conservative measures such as pharmacotherapy, splint therapy and arthrocentesis were treated with injections of 150 TRU of hyaluronidase. The outcome variables were maximum voluntary mouth opening, deviation on mouth opening, pain- visual analog scale, joint sounds (crepitations/clicking).

**Results:** 54 patients, including 28 females and 26 males were studied. The age group was 25 to 40 years. Patients received 3 injections of hyaluronic acid at 10 days interval according to their symptoms. 38 patients showed a significant reduction in symptoms after the first injection. With the third injection all patients obtained complete relief and were symptom free during the follow up period.

**Conclusion:** Intra articular injection of Hyaluronic acid is a highly effective treatment modality in patients with TMJ OA, non-responsive to other conservative measures.

**Keywords:** temporomandibular joint, osteoarthritis, hyaluronic acid, pain, maximum voluntary mouth opening, clicking, deviation

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### Introduction

Osteoarthritis is characterized by chronic degeneration of the various hard and soft tissues around the joint.<sup>(1,2)</sup> This results in anatomical changes in the joint and joint pain due to alteration in peripheral and central pain processing mechanisms.<sup>(2,3)</sup> Stress bearing joints of the body such as knee, hips, spine, and fingers are most commonly affected.<sup>(4)</sup> Osteoarthritis can also affect other joints in the body such as wrist, shoulder, ankle and Temporomandibular joint (TMJ). TMJ osteoarthritis affects the cartilage, subchondral bone, synovial membrane, and other hard and soft tissues causing changes such as TMJ remodeling, articular cartilage abrasion and deterioration.<sup>(5,6)</sup> This leads to a progressive painful condition and cause joint dysfunction, joint sound, malocclusion, and locking of the mouth. At the cellular level the metabolic or mechanical factors initiates a series of biomechanical changes in the hard and soft tissues of the joint. Immune cells trigger an inflammatory response by releasing various inflammatory mediators such as cytokines and chemokines. The process is coupled with the activation of the complement system, the release of cartilage degrading factors such as matrix metalloproteinase (MMPs) and prostaglandin E (PGE) which further damage the articular cartilage. This results in the eventual degradation and abrasion of joint cartilage and the remodeling of the subchondral bone by the initiation of a local inflammatory response.<sup>(4,7)</sup> Normal tissue turnover involves a well-regulated balance of synthesis and breakdown. In the

degenerative state, this balance is upset, producing inflammation-derived alterations to the synovium, cartilage, capsules, tendons, and bone.<sup>(8)</sup>

According to the American Academy of Orofacial Pain, TMJ Osteoarthritis is categorized into primary and secondary. Primary TMJ osteoarthritis is characterized by the absence of any distinct local or systemic factor. Secondary TMJ osteoarthritis is however associated with a previous traumatic event or disease.<sup>(9)</sup> Epidemiologic studies on the prevalence of TMJ osteoarthritis vary due to variations in diagnostic criteria employed to define the condition.<sup>(10)</sup> TMJ Osteoarthritis may be unilateral or bilateral and has a strong preference for women.<sup>(11)</sup> This may be due to Estrogen Receptor alpha polymorphism and may be associated with increased pain susceptibility in female TMJ Osteoarthritis patients.<sup>(12)</sup>

Treatment of TMJ osteoarthritis should be directed at suppressing the active inflammatory process, preserving function, preventing further deformity and relieving pain.<sup>(7)</sup> Table 1 shows treatment pyramid for TMJ osteoarthritis.<sup>(13)</sup> Studies have shown that nonsurgical treatment modalities such as physical therapy, pulsed electrical stimulation, pharmacological, topical ointments, steroid injections and hyaluronic acid (HA) injections can successfully be used to treat patients with osteoarthritis.<sup>(14)</sup> Early initiation of concomitant multimodal therapies offers best outcome for long term management.

Emerging evidence has suggested that hyaluronic acid (HA) is highly effective in the treatment of

degenerative conditions of the joints. The rationale for the use of hyaluronic acid (HA) in the treatment of temporomandibular joint osteoarthritis is that the direct injection of HA into the joint space allows the achievement of proper concentrations with low doses favoring greater permanence in the joint. The therapeutic response includes restoration of viscoelastic properties, such as cushioning, lubrication and elasticity and it also helps restoration of joint rheology and possess anti-inflammatory and anti-nociceptive effects.

**Table 1: Shows treatment pyramid for TMJ osteoarthritis**



The purpose of the present study was to evaluate the efficacy of Hyaluronic acid (HA) intra-articular injection in the treatment of TMJ osteoarthritis. We hypothesized that HA would improve the symptoms and functions through its viscoelastic, analgesic, anti-inflammatory, anabolic, and chondro-protective effects on a long term basis. The specific aim of the study was to evaluate the improvements in TMJ osteoarthritis symptoms such as maximum voluntary mouth opening, deviation on mouth opening, pain and joint sounds (crepitation's/clicking).

### Patients and Methods

Patients with symptoms of unilateral temporomandibular joint osteoarthritis, presenting to the department of oral and maxillofacial surgery were included in the study. The diagnosis of osteoarthritis of TMJ was based on the Research Diagnostic Criteria for TMJ-OA. Institutional ethical board approved the study. Signed informed consent was obtained from every patient. For inclusion in the study sample, patients should have clinical features suggestive of temporomandibular joint osteoarthritis (according to Research Diagnostic Criteria for Temporomandibular joint Disorders (RDC/TMD) axis). Patients unresponsive to conservative measures of treatment such as pharmacotherapy, splint therapy and

arthrocentesis for a period of two months were also included in the study. Systemically compromised individuals such as cardiovascular disorders, neurological problems, chronic liver disease, coagulative disorders, nephrological problems, uncontrolled diabetes mellitus and severe systemic hypertension were excluded from the study. Patients with other TMJ disorders such as dislocation, ankylosis, developmental disorders, MPDS and neoplasms were also excluded. Pathological conditions associated with difficulty in mouth opening such as oral sub mucous fibrosis, pericoronitis, odontogenic space infections, condylar fracture, and post radiation therapy were also not included in the study. Every patient received 3 intra-articular injections of 1 mL of low-molecular-weight HA one time per week for 3 consecutive weeks after arthrocentesis with 50 mL of lactated Ringer's solution. Figure 1 shows the point of needle penetration for entry into the temporomandibular joint space.

The primary outcome variable was treatment effectiveness determined by the measurement of the maximum voluntary mouth opening (MVMO). The inter-incisal distance on MVMO was measured. The pain index score was assessed using a 10 point visual analog scale (VAS), with 0 indicating the absence of pain and 10, the worst pain possible. The secondary outcome variable was joint sounds. The joint was palpated and auscultated for crepitations and clicking. Deviation on mouth opening was also noted. All outcome variables were assessed and compared at baseline, one, three, six months and after one year. Statistical analysis was done with SPSS statistics software version 20 using proportions, percentage, appropriate tabulation and analyzing with chi square test ( $X^2$ ). The significance level was set as P less than or equal to 0.05.

### Results

54 patients with TMJ osteoarthritis who satisfied the inclusion criteria were studied. The study group included 26 males and 28 females. Majority of the patients were between 25-40 years of age group, with a mean age of 38.6 years. Statistical analysis of the relationship of age with initial maximum voluntary mouth opening were significantly related ( $P < 0.01$ ). The older patients had significantly reduced mouth opening. A significant relationship was found between age and pain score. Older patients had a higher pain score. Gender was also significantly related to VAS score. Female patients had a higher VAS score. Figure 2 and 3 shows the initial mouth opening and mouth opening at one month respectively.

Parameters	Mean initial value	Mean value at 1 month	Mean value at 3 months	Mean value at 6 months	Mean value at 1 year
Maximum voluntary mouth opening	18.03 mm	40.09 mm	40.92mm	41.25mm	41.25mm
Pain score	>8	0-1	0	0	0
Joint sounds	Clicking +	Clicking -	Clicking -	Clicking -	Clicking -
Deviation in mouth opening	yes	no	no	no	no

The median of Maximum voluntary mouth opening at every follow up were compared. There was no significant difference in the median values during the first two recall visits. The median value after 6 months and one year (39.39 and 41.26 respectively) was significantly higher than the initial value (20.36). The baseline median pain score was 9.0. After one month there was a significant decrease in the median pain score, with 7.0, 4.0, and 1.0 at 1,3 and 6 months respectively. A significant decrease was found in the prevalence of joint sounds after 3 months. There was a gradual decrease in deviation of mouth opening and joint sounds after 3 months.

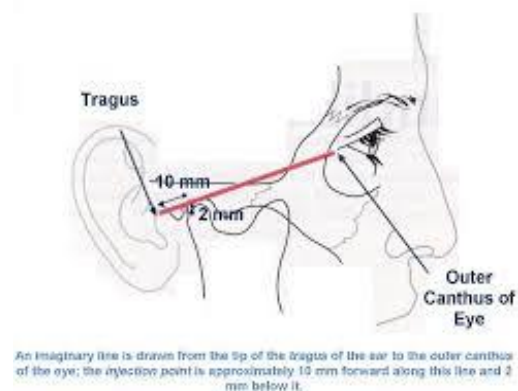
### Discussion

In general, the natural course of TMJ osteoarthritis is favorable<sup>(15)</sup> and can be divided into three slow progressive phases, with periods of remission and cartilage regeneration.<sup>(16,17)</sup> The initial stage where there is evolution of the condition is termed early phase. This may take on average 2.5-4 years. Clinically it is associated with clicking sounds and intermittent locking. The intermediate phase, associated with TMJ destruction, lasts on average 6 months to a year and clinically the patient may undergo spontaneous joint pain at rest or with function, limitation in opening, and grating sounds. The late phase is the stage at which there is no degenerative activity, and the joints are said to be stable or in the "burnout phase". It lasts about 6 months, and it will eventually stabilize with time and therefore, if invasive procedures can be postponed with medical management, patients will ultimately benefit from it. There is absence of joint pain, absence or presence of limitation, absence or presence of grating sounds. The entire process from initiation to the final burnout phase takes approximately 5.5 years.<sup>(17)</sup>

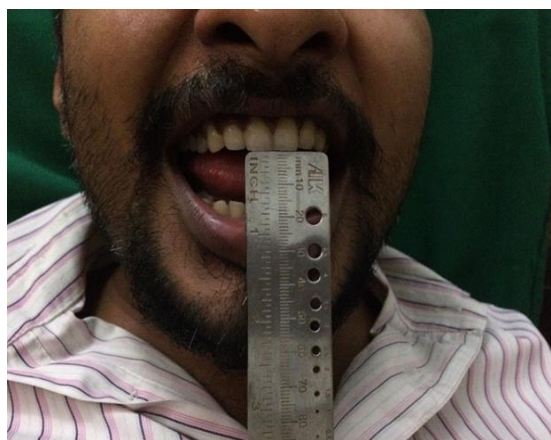
The most common clinical signs and symptoms include pain, restriction in joint function, and joint sounds. Pain is usually dull aching and may have occasional sharp component on movement. Pain is prevalent in initial phases due to the presence of synovitis.<sup>(16)</sup> It may be associated with joint stiffness, limitation in mouth opening, increasing sensitivity to cold and damp and may be relieved with rest, and NSAIDs. Patients usually have morning stiffness for more than 30 min, joint crepitus, joint sounds and absence of joint warmth. Patients in advanced stages may exhibit facial skeletal remodeling, with chin deviation towards the affected side, unstable or fluctuating malocclusion with occlusal discrepancies.<sup>(18)</sup>

Occlusal changes like skeletal anterior open bite, reduced overbite and increased over jet may be associated with osteoarthritic TMJ.<sup>(7,19)</sup> In addition, internal derangements may co-exist in the same joint in approximately one-third of cases.<sup>(20,21)</sup> Intra articular injections of steroids and hyaluronic acid is gaining popularity. In the study all the signs and symptoms of TMJ-OA has significantly reduced with three injections of Hyaluronic acid, hence improving the quality of life.

Anatomical Landmarks for Needle Entry into the TMJ



**Fig. 1:** Shows the point of needle penetration for entry into the temporomandibular joint space



**Fig. 2:** Showing initial mouth opening



**Fig. 3: Showing mouth opening at one month.**

### Conclusion

The concept of “Viscosupplementation” is now gaining popularity. Viscosupplementation is effective in primary and secondary osteoarthritis.<sup>(22)</sup> Viscosupplementation has analgesic, anti-inflammatory, anabolic, and chondroprotective effects.<sup>(23)</sup> It is a disease modifying agent as well as provides pain relief.<sup>(24)</sup> Arthrocentesis combined with HA injections may be useful in reducing pain, improving function: Controversy exists in the use of low molecular weight or high molecular weight HA. Further studies are required to compare the effectiveness of high molecular weight HA over low molecular weight HA.

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