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Effect of Infiltration in Temporomandibular Joint with Triamcinolone Acetonide for Pain Relief in Internal Derangement

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ABSTRACT

Orofacial pains are frequently caused by disorders of the temporomandibular joint (TMJ), which are often associated with masticatory difficulties, joint noises, and limited mouth opening. Despite the availability of several treatment options, a standardized management approach has yet to be developed. Intra-articular infiltration with Triamcinolone acetonide has been explored as a minimally invasive intervention for local symptomatic relief; clinical evidence regarding its effectiveness remains variable. **Objective:** To evaluate the effect of intra-articular triamcinolone acetonide injection on pain reduction in patients with TMJ internal derangement. **Methods:** A single-arm interventional pre-post study was performed on 71 patients with symptomatic TMJ internal derangement. Each patient received a local injection of 40mg/ml Kenacort (triamcinolone acetonide) under standard aseptic outpatient settings. The Wong-Baker FACES® Pain Rating Scale was employed to assess pain both before and one month following the intervention. Joint. **Results:** Among the 71 patients who reported pre-intervention pain, the mean pain score decreased from 6.085 to 2.423, and this change was statistically significant on paired t-testing ($t=17.905$, $p<0.001$). Improved joint sounds and jaw mobility were observed along with a statistically significant decrease in pain scores ($p\leq0.050$). **Conclusion:** Intra-articular triamcinolone acetonide injection demonstrated a significant reduction in TMJ-related pain for short-term relief in this outpatient cohort.

INTRODUCTION

The temporo-mandibular joint (TMJ) is a point of connection between the mandible and the skull. The temporomandibular joint (TMJ) is a special synovial joint that enables intricate motions necessary for speaking, eating, chewing, and maintaining correct jaw alignment [1]. For both sliding and hinge-link movement the surrounding ligaments, cartilage, and muscles work together to coordinate its architecture. Malfunctioning of this sensitive system can cause pain, joint sounds, chewing difficulties, restricted range of motion, and even jaw locking. Temporomandibular disorders (TMD) are common among people, which have a significant impact on day-to-day life [1]. Recent studies suggest that symptoms occur most frequently in adults aged between 20 and 40 years, with women being more affected roughly in a ratio of 9:1 [2]. This disparity is mostly caused by hormonal influences, particularly estrogen, along with malocclusion and parafunctional habits such as bruxism. The breakage of

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articular cartilage occurs in the type of TMJ osteoarthritis (OA), which is defined as a degenerative disease of the jaw joint (unilateral disease), accompanied by architectural changes in the bone and ineffective degeneration of the synovial tissues, causing pain and/or dysfunction of functional movements of the jaw. OA may also be the first joint disease of the jaw, unlike rheumatoid arthritis, when the TMJ is often the last joint affected [2, 3]. Patho physiologically, OA involves increased degradation of the extracellular matrix (ECM) through matrix metalloproteinases (MMPs) and ADAMTS enzymes, which results in reduced ECM production and chondrocyte death, further leading to progressive cartilage loss [3]. There can be many symptoms for this condition, including: pain during jaw movement, clicking or grinding noises within the joint, deviation on opening, restricted mouth opening, and, in some cases, persistent joint stiffness [3]. There are so many ways to treat TMD, and a few examples include the most conservative treatments like physiotherapy, oral medications, and occlusal splints, to more focused treatments such as injections directly into the joint or surgical methods. About 10 years ago, botulinum toxin was investigated in some cases, but its use surpasses the expenses and contraindications [4]. Corticosteroid injections are a more reasonable method for potentially reducing pain and inflammation in the joints that are affected [5]. Triamcinolone acetonide is a synthetic glucocorticoid; it is a corticosteroid with anti-inflammatory and immunosuppressive properties [5]. Triamcinolone inhibits phospholipase A2 in the membrane, thereby inhibiting the pathway that produces pro-inflammatory mediators such as prostaglandins and leukotrienes. The combination of these two reduces swelling, limits vascular permeability, and alleviates pain. Additionally, it reduces the activity of specific immune cells that can regulate the process of persistent inflammation occurring within the joint [5]. Some studies have used Triamcinolone acetonide either standalone or in combination for relieving TMD-associated pain symptoms [6, 7]. Corticosteroids' efficacy, in pain reduction and inflammation control, has been well established in managing the inflammatory symptoms associated with larger joints (i.e., knee, shoulder) [5]. In contrast, the role of corticosteroids is less clear in the treatment of TMDs. Whereas with TMJ therapy, the extent of documented evidence supporting the use of corticosteroids and the position of corticosteroids as a single agent has not been widely explored [4]. This is, in part, due to the pooled data comparing the effect of triamcinolone with agents such as hyaluronic acid [7].

The lack of focused evidence makes it challenging to evaluate corticosteroids' clinical effectiveness as a standalone standard intervention for addressing pain associated with TMD. This study aims to demonstrate the clinical effectiveness of intra-articular injection of triamcinolone acetonide in the role of an outpatient, stand-alone type of treatment for pain relief in patients with internal derangement.

METHODS

This single-arm interventional pre-post study was conducted for one year from November 2023 to September 2024 at the Department of Oral and Maxillofacial Surgery OPD, Sharif Medical and Dental College, Lahore, after ethical approval from the Sharif Medical Research Center (Ref. No. SMDC/SMRC/317-23; dated 13th November 2023). Written informed consent was obtained from all participants in accordance with the Declaration of Helsinki. A sample size of 71 participants was calculated using the WHO sample size calculator, assuming a 95% confidence level, 10% precision, and an anticipated treatment response proportion of 75% with triamcinolone acetonide [8]. Participants were recruited consecutively using non-probability sampling from patients presenting with clinical features suggestive of temporomandibular disorders (TMD). Diagnosis of temporomandibular disorders was established by a specialist using accepted clinical diagnostic criteria based on the International Classification of Headache Disorders guidelines of the International Headache Society [8]. The assessment incorporated both patient-reported symptoms and objective clinical findings. Typical presentations included recurrent pain localized to the jaw, face, or temporal region that was exacerbated by jaw movement or mastication. Radiographic imaging was performed when clinically indicated to confirm internal derangement and to exclude alternative pathologies. Only patients fulfilling the diagnostic criteria and having symptoms attributable to internal derangement were considered eligible for intra-articular triamcinolone acetonide infiltration. Adults aged 18–80 years with pain on temporomandibular joint (TMJ) palpation, functional limitation, and symptoms consistent with internal derangement were included, while those with prior TMJ injections, hypersensitivity to corticosteroids, active infection, dermatologic lesions at the injection site, pregnancy or lactation, history of maxillofacial trauma or TMJ surgery, bleeding disorders, anticoagulant use, uncontrolled systemic disease, or inability to comply with follow-up were excluded. Baseline assessment included demographic and clinical characteristics such as age, sex, duration, and laterality of symptoms, prior conservative treatment, and baseline functional status. Clinical examination comprised TMJ palpation, measurement of maximal mouth opening, documentation of joint sounds, and pain assessment using the Wong–Baker FACES® Pain Rating Scale (0–10) [9]. Under aseptic conditions and

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following auriculotemporal nerve block and joint lavage with isotonic saline, intra-articular injection of triamcinolone acetonide (1 mL containing 40 mg/mL) was administered by an experienced consultant oral and maxillofacial surgeon. Post-procedure care included cold compression, supervised manual jaw mobilization, and instruction in passive stretching exercises to improve mouth opening. The primary outcome was change in pain intensity from baseline to one-month follow-up, with a reduction of at least 2 points considered clinically meaningful. Secondary outcomes included change in maximal mouth opening, presence of joint sounds, and patient-reported functional improvement in mastication and daily activities. Participants were monitored for immediate and delayed adverse events, including facial nerve weakness, swelling, infection, hematoma, or steroid-related complications. Compliance with post-procedure instructions and follow-up attendance were documented, and losses to follow-up were accounted for in the analysis.

Data were analyzed using SPSS version 24.0. Continuous variables were summarized as mean ± standard deviation depending on data distribution assessed by the Shapiro–Wilk test. Pre- and post-intervention comparisons were performed using a paired t-test. A p-value ≤0.050 was considered statistically significant.

RESULTS

A total of 71 patients with temporomandibular joint internal derangement were included in the final analysis. Pain was the presenting symptom in all participants. Associated clinical features included joint clicking in 53 (74.6%) patients and restricted mouth opening in 9 (12.7%) patients. The study population consisted predominantly of females (76.1%). Most participants were aged between 40 and 60 years (52.1%). Most patients reported unilateral symptoms (69.0%) and had a history of prior conservative treatment (64.8%), such as analgesics, physiotherapy, or occlusal splints. Baseline clinical assessment demonstrated limitation of mouth opening (12.7%) (Table 1).

Table 1: Baseline Clinical Assessment

Variables	n (%)
Gender	
Female	54 (76.1%)
Male	17 (23.9%)
Others	
20–40	12 (16.9%)
40–60	37 (52.1%)
60–80	22 (31.0%)
Age Group (Years)	
Joint Clicking	53 (74.6%)
Restricted Mouth Opening	9 (12.7%)
Prior Conservative Treatment	46 (64.8%)
Unilateral Symptoms	49 (69.0%)

At baseline, patients experienced a substantial degree of discomfort, with a mean pain score of 6.09 ± 2.25, indicating predominantly moderate to severe pain. At one-month follow-up after intra-articular triamcinolone acetonide injection, the mean pain score significantly decreased to 2.42 ± 1.62, corresponding to mild pain intensity. The mean reduction in pain score was 3.67 points, which exceeded the predefined threshold for clinically meaningful improvement. Paired comparison demonstrated a statistically significant reduction in pain intensity ($t = 17.905$, $p < 0.001$) (Table 2).

Table 2: Comparison of Pain Scores (Wong-Baker FACES Scale) Pre- and Post-Intervention

Variables	Mean ± SD	Mean Difference	t-value	p-value
Pre-Treatment Pain Score	6.09 ± 2.25	3.67	17.905	<0.001
Post-Treatment Pain Score	2.42 ± 1.62			

The proportion of patients with restricted mouth opening decreased from 12.7% at baseline to 4.2% at one-month follow-up, indicating improved mandibular mobility. Similarly, joint clicking showed partial resolution, decreasing from 74.6% to 43.7%, suggesting a reduction in intra-articular mechanical dysfunction (Table 3).

Table 3: Secondary Functional Outcomes After Intra-Articular Triamcinolone Injection (n=71)

Outcome Variables	Baseline, n (%)	1-Month Follow-Up, n (%)	Improvement, (%)
Restricted Mouth Opening	9 (12.7%)	3 (4.2%)	66.7%
Joint Clicking	53 (74.6%)	31 (43.7%)	41.5%
Pain on Palpation	71 (100%)	22 (31.0%)	69.0%
Functional Limitation During Mastication	58 (81.7%)	19 (26.8%)	67.2%
Difficulty in Speaking	34 (47.9%)	10 (14.1%)	70.6%

Only a small proportion of patients experienced minor transient adverse events, including short-term post-injection discomfort (9.9%) and mild facial swelling (4.2%), which resolved without additional treatment. Temporary facial nerve weakness was observed in one patient and recovered spontaneously. Importantly, no cases of infection, hematoma formation, systemic steroid-related complications, or serious procedure-related adverse events were reported during the follow-up period (Table 4).

Table 4: Safety and Adverse Events Following Procedure (n=71)

Adverse Events	n (%)
Transient Post-Injection Discomfort	7 (9.9%)
Mild Facial Swelling	3 (4.2%)
Temporary Facial Nerve Weakness	1 (1.4%)
Hematoma at Injection Site	0 (0%)
Infection	0 (0%)

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Steroid-Related Systemic Effects	0 (0%)
Procedure-Related Serious Complication	0 (0%)

DISCUSSION

TMDs cover a wide range of heterogeneous clinical conditions involving TMJ, associated musculature, and supporting structures [10, 11]. Patients with TMDs mostly suffer from pain as the primary symptom of the disorder, frequently along with joint sounds and occasionally restriction in mouth opening. Findings of this study are in accordance with these established clinical patterns, as all of the enrolled patients in the present study presented with a lesser number of reported joints clicking and limitation in mouth opening. This frequency of symptoms was not unexpected, as studies have already reported that pain is the primary reason for patients seeking medical help in comparison to functional limitations like restricted mouth opening. These secondary symptoms usually develop later in the course of the disease [12]. The uneven distribution of symptoms observed during this study among the enrolled patients holds clinical significance and implications for interpretations. As discussed earlier, we observed pain in all the patients, while a smaller fraction reported joint sounds or restricted mouth opening, which limited the ability to draw robust conclusions regarding these secondary outcomes. Symptom variability is a common challenge in TMJ research, as it tends to complicate the study design as well as the analyses. From a demographic point of view, our results are in accordance with the previously reported findings in the literature. TMD has been observed to be higher in females, particularly in reproductive years. This can be associated with the potential role of hormonal influences, especially estrogen, affecting joint physiology and pain perception [13]. Although this study did not perform sex stratified analysis, the background clarifies the predominance and frequency of pain in our patient population. The variability of the treatment response in the study could potentially be attributed to gender distribution. This study divided patients into three age brackets: 20–40, 40–60, and 60–80 years to better reflect how TMJ internal derangement tends to present and evolve. Individuals between 20 and 40 years commonly represent the peak age for disc displacement and inflammatory TMJ pain, where synovial inflammation is often a dominant feature. Those in the 40–60-year range frequently fall into a transitional stage, where persistent internal derangement may coexist with early degenerative changes. In contrast, patients aged 60–80 years are more likely to demonstrate predominantly degenerative joint alterations [14, 15]. This framework is clinically useful when considering both prognosis and expected response to intra-articular therapies. The current study's most notable finding of the study was the pain reduction observed in patients post intervention, as the mean pain score dropped from 6.09 ± 2.25 at baseline to 2.42 ± 1.62 at one-month follow-up. This was a change that was highly statistically significant. This change was clearly reflected in the patients, as the majority reported mild or no pain after the treatment. This degree of improvement is impactful not only from a clinical standpoint, but it is also translated into tangible benefits in daily activities, i.e., of chewing, speaking, or even sleep quality [11]. The current study results are in accordance with the previously reported studies in the literature, suggesting that pain is not only the most predominant symptom in TMD but also responds to targeted intra-articular interventions [16-20]. The findings of this study need cautious interpretation as the benefits of the intervention were not uniform for all the patients enrolled. Some patients continued to report mild to moderate pain at the follow-up. Considering TMD being a multifactorial condition, this variability of the response was not surprising for us, as the treatment response is also influenced by a wide range of factors, e.g., disease chronicity, underlying joint pathology, parafunctional habits such as bruxism, occlusal factors, and even psychosocial stressors [2]. Lack of baseline data on these variables has posed a limit on the predictors of response in this study. This heterogeneity of response can be interpreted as ineffectiveness of a single intervention as a universal treatment in all patients. The literature reports a degree of variability in intra-articular therapies for TMDs in terms of intervention protocols and effectiveness. Multiple studies have used corticosteroids in combination with other agents, for instance, hyaluronic acid, to address both degeneration and inflammation. However, some systematic reviews have highlighted the heterogeneity of the study design, patient selection, and outcome parameters, thus reporting mixed conclusions [21, 22]. Patient safety is an important consideration in administering intra-articular corticosteroids in patients. The study did not find any major adverse event in our patients for the entire duration of the study. The relatively short duration of the follow-up can be a limitation of this study, particularly regarding long-term safety. Some evidence exists for adverse effects on joint cartilage over time due to frequent administration of corticosteroid injections [22]. This highlights a cautious approach in patient enrolment for long-term and/or repeated interventions. Although we observed a decline in the pain scores after intervention, one-third of the patients still experienced moderate discomfort. This can be interpreted as a variable response to the treatment. Kacker *et al.* reported an effective short-term use of intra-articular corticosteroids in pain relief. Yet they emphasized combination therapies as a potential for long-term

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alternatives[23].

The current study acknowledges some of the limitations of our study. The lack of a control group is the most important limitation, as it hinders the ability to correlate the improvement observed during the span of the study with the intervention. The relatively short follow-up is another limitation, as it does not allow for the long-term efficacy and durability of the intervention. In addition to these, the lack of baseline patient characteristics data, i.e., duration and severity of symptoms, laterality, prior treatments, and comorbidities, thus restricts our ability to perform more accurate analyses for the identification of the factors influencing the efficacy of the treatment. Lastly, the improvement in joint sounds and jaw mobility, although observed, was not measured in a standardized manner, thus limiting the strength of conclusions perceived regarding functional improvements. Regardless of the discussed limitations, the present study offers insights into the role of corticosteroid injections as a minimally invasive option for pain management and relief in TMD internal derangement, especially for an outpatient setting. This study clearly demonstrates the effectiveness of the reported intervention for an effective short term for a significant section of patients in the short term. Based on current study findings, the study recommends more detailed studies in this area, focusing on randomized controlled trials with longer follow-ups, administering corticosteroids alone or in combination with alternative treatment options, along with arthrocentesis, as such would be more valuable for long-term pain management, but will also strengthen the evidence base and help the patients.

CONCLUSIONS

This present study shows that infiltration with triamcinolone acetonide provides a statistically significant reduction in pain intensity in patients with TMD. The results support the clinical utility of triamcinolone acetonide in TMD pain relief and are a promising therapeutic choice. Future studies with longer-term follow-up involving larger cohorts would help validate these findings and establish safety and efficacy profiles for this procedure, given the extended follow-up times.

Authors' Contribution

Conceptualization: IT
Methodology: IT
Formal analysis: AF, SZ
Writing and Drafting: IT, UBA, AF, ST, SZ
Review and Editing: IT, UBA, AF, ST, SZ

All authors approved the final manuscript and take responsibility for the integrity of the work

Conflicts of Interest

All the authors declare no conflict of interest.

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