

INTRA-ARTICULAR INJECTION OF CORTICOSTEROIDS MIXED WITH LOCAL ANAESTHETIC FOR INTERNAL DERANGEMENT OF TEMPOROMANDIBULAR JOINT (DISC DISPLACEMENT WITHOUT REDUCTION)

Zainab Akbar¹, Waseem Ahmed², Farah Farhan³, Zainab Shah⁴, Umer Ullah⁵, Khaula Gul⁶

¹Department of Oral Medicine. Rehman College of Dentistry, Peshawar

²Oral and Maxillofacial Surgery Department School of Dentistry, Shaheed Zulfiqar Ali Bhutto Medical University, Islamabad

³Department of Oral Pathology Foundation University College of Dentistry, Islamabad

⁴Department of Oral Medicine. Sardar Begum Dental College, Peshawar

⁵Department of Oral and Maxillofacial Surgery, Rehman College of Dentistry, Peshawar

⁶Department of Periodontology, Bacha Khan Dental College, Mardan

ABSTRACT

Objectives: To determine the mean change in pain and mouth opening after intra-articular corticosteroid injection mixed with local anesthetic in patients of temporomandibular joint internal derangement (disc displacement without reduction).

Materials and Methods: A Quasi-experimental study was conducted at the Oral and Maxillofacial Surgery Department, Armed Forces Institute of Dentistry (AFID), Rawalpindi; from February 2016 to December 2019. Patients of either gender, aged between 16-70 years, presenting with disc displacement without reduction were included in the study. Intra-articular injection of corticosteroids mixed with local anesthetic was administered into the affected joint. Pain using a Visual analog scale (VAS) and maximum mouth opening (MMO) using a vernier caliper were measured in every patient before and one week after the intra-articular injection. Data were entered in the statistical package for social sciences (SPSS) version 22 for analysis.

Results: A total of 107 patients were included in the study with a mean age of 30.5 ± 6.92 years (range 17 to 42 years). The mean pre-injection VAS score for pain was 6.29 ± 1.06 which decreased significantly to 3.46 ± 1.07 at one week following injection ($p < 0.001$) with a mean decrease of 2.83 ± 1.03 . This improvement in VAS score with injection was significant across all age, gender, educational and occupational groups. The mean pre-injection MMO was 28.76 ± 4.20 which increased significantly to 38.89 ± 3.88 at one week following injection ($p < 0.001$) with a mean increase of 10.0 ± 3.33 .

Conclusion: Intra-articular corticosteroid injection mixed with local anesthetic was associated with a significant decrease in mean VAS score for pain and a significant increase in MMO score after one week in patients presenting with TMJ internal derangement.

Key words: Internal derangement; Intra-articular corticosteroid injection; Mouth Opening; Pain,

INTRODUCTION

The articular surfaces of the temporal bone and

Correspondence:

Zainab Shah

Assistant Professor, Department of Oral Medicine

Sardar Begum Dental College

Cell: +923415684468

Email: zainab_shah123@yahoo.com

mandibular condyle constitute the compound articulation known as temporomandibular joint (TMJ)¹. The temporomandibular joint, the only joint of the head and neck region, is unique from other joints in the human body. Firstly, its articular surfaces are enclosed by fibrocartilage instead of hyaline cartilage. Secondly, both joints work together as a unit and hence cannot function independently. Lastly,

the TMJ is a ginglymoarthrodial joint and performs both rotational and translatory movements. Essentially, TMJ plays crucial in mandibular form and function. Disease, trauma, or abnormality involving one or both TMJs will not only have an undesirable effect on mandibular function but can also affect the growth and symmetry of the lower third of the face². According to an estimate, temporomandibular disorders affect about 20-30% of the adult population. The abnormal anatomical and functional relationship of the articular disc with any components of the TMJ is termed internal derangement of the TMJ. TMJ internal derangement progresses through four clinical stages. First, TMJ disc displacement with reduction; second, disc displacement with reduction and intermittent locking; third, disc displacement without reduction and fourth, disc displacement without reduction (DDWOR) accompanied with perforation of the disc or posterior attached tissue (degenerative joint disease)^{2,3}. Among multiple etiologies of DDWOR, macro and micro trauma is the most common⁴. Pain, limited mouth opening, and a history of prior clicks are suggested as the most common signs and symptoms of this disease⁵. An array of co-existing reasons, including effusion, inflammation, tissue stretching, inadequate lubrication, and tissue injury, in addition to a displaced disc, cause clinical features of internal derangement⁶. Literature review shows that the management of TMDs is dependent upon the etiology, severity, and nature of the disease. Conservative management like patient reassurance and counseling, pharmacotherapy, splinting, local heat application and physiotherapy, or a combination of these, is the most commonly employed approach⁷. Minimally invasive procedures like arthrocentesis and arthroscopy were previously employed too. As a last resort, Surgical intervention can be done⁸. Multiple types of medications that have been used for the alleviation of pain, inflammation, muscular spasm, and other associated signs and symptoms connected with TMDs comprise non-steroidal anti-inflammatory drugs (NSAIDs), analgesics, muscle relaxants, corticosteroids, antidepressants, botulinum toxin along with hyaluronic acid injections⁹. Temporomandibular joint disorders in general, and disc displacement without reduction specifically, affect the quality of life of patients enormously. Various treatment options have been employed previously but with varied results. A minimally invasive and cost-effective procedure like Intra articular steroid

can prove to be a better option to improve the signs and symptoms of these patients. Although international literature is available in this regard locally published literature justifying the use of steroids as a frontline treatment modality is missing^{9,10}. Steroids have a profound effect on pain, hypomobility, and inflammation related to acute TMJ pathologies¹⁰. Several mechanisms have been proposed for the anti-inflammatory activities of glucocorticoids. These medications impede inflammatory mediator release from multiple cell types participating in inflammation including macrophages, T-lymphocytes, mast cells, dendritic cells, and neutrophilic leukocytes. Glucocorticoids also decrease prostaglandin formation by inhibiting the phospholipase A2 enzyme. The greatest remarkable effect of glucocorticoids is to impede the manifestation of multiple inflammatory genes translating cytokines, chemokines, inflammatory enzymes, receptors, and adhesion molecules¹⁰.

Our research aims to observe the average differences in pain and mouth opening after injecting intra-articular corticosteroid injection mixed with local anesthetic in patients suffering from TMJ Internal Derangement (Disc Displacement without Reduction).

MATERIALS AND METHODS

This quasi-experimental study was conducted at the Department of Oral and Maxillofacial Surgery, Armed Forces Institute of Dentistry, Rawalpindi. Before starting the study, ethical approval was taken via letter AFID/IRC/16/11 from the ethical committee of the Armed Forces Institute of Dentistry. The study protocol, as well as the risk-benefit ratio, were explained to all the patients beforehand and written informed consent was taken. The study started from 02/02/2016 to 31/12/2019. A sample size of 104 cases was calculated using Open Epi Calculator with a 95% confidence level, and a 5% level of significance. Non-Probability and Purposive Sampling technique was used for this purpose. Inclusion criteria included patients of either gender, ranging in age between 16 and 42 years and fulfilling the criteria of disc displacement without reduction¹, selected from the outpatient department of AFID. Clinical diagnosis of Disc Displacement Without Reduction of TMJ includes any history of abrupt reduction in the mandibular opening, unaided mandibular opening lesser than 35 mm, assisted mandibular opening

increased by < 3 mm from unassisted opening, lack of preceding click or pop in the affected joint with sudden reduced opening, TMJ pain (VAS >5). All of the symptoms mentioned above should be present for more than 3 weeks¹. Patients suffering from other myogenic or articular disorders of TMJ, a history of jaw trauma or fracture, any congenital dentofacial deformity, stress, psychiatric illness, headache, or migraine were not included in the study.

Study procedure comprised of intra-articular corticosteroid mixed with local anesthetic injection administered to the patient. In the first step, a 70% isopropyl alcohol pad or 10% povidone-iodine pad was used to sterilize the preauricular skin region. Later injection of 1 ml of 2% lidocaine HCl (Xylocaine, 20 mg per ml) and 0.5 ml of Triamcinolone acetonide (Kenalog 40, 40 mg per ml) was administered using a 10 c.c. disposable syringe. The patients were requested to open up their mouths with about 2/3rd of the maximum opening. Landmarks utilized were the midpoint of the tragus and lateral canthus of the ipsilateral eye. Three-fourths of the needle was

inserted in an anterior-medial-inferior direction in the superior joint space and the solution was injected gradually. An ice pack was applied post-procedure. Signs of facial palsy were evaluated five minutes after the procedure and the jaw was manually mobilized. Patients were instructed verbally to rest their joints for three days, take a soft diet and perform passive stretching mouth-opening exercises. Any other treatment modality like splint therapy or physiotherapy was not suggested during the study period. Before the injection and one week after the injection, parameters like pain and maximum mouth opening were observed (using the visual analog scale for measuring pain and a vernier caliper for mouth opening). Self-designed Performa was used to enter demographics and patient parameters. statistical package for social sciences (SPSS) version 22 was used for data entry and analysis. Frequency and percentage were used for Categorical variables like gender. Paired t-test has been utilized to compare mean pre and post-injection pain and maximum mouth opening taking a p-value ≤.05 as significant. To address effect modifiers, data were stratified for occupation, gender, age, and education. Post-stratification independent

Table I: Mean VAS Score for Pain

	VAS Score for Pain		P Value
	Pre-Injection	Post-Injection	
Overall	6.29 ± 1.06	3.46 ± 1.07	0.000*
Age Groups			
• 17-25 years	6.30 ± 1.34	3.30 ± 1.25	0.000*
• 26-34 years	6.23 ± 0.83	3.46 ± 0.97	0.000*
• 35-42 years	6.14 ± 1.22	3.14 ± 0.69	0.003*
Gender			
• Male	6.25 ± 0.97	3.42 ± 0.99	0.000*
• Female	6.22 ± 1.17	3.28 ± 1.02	0.000*
Occupation			
• Student	6.44 ± 1.24	3.33 ± 1.32	0.000*
• Teacher	6.14 ± 0.90	3.57 ± 0.98	0.000*
• Doctor	6.00 ± 1.16	3.43 ± 0.98	0.000*
• Housewife Driver Sweeper	6.29 ± 1.11	3.00 ± 0.58	0.001*
Education			
• Illiterate	6.33 ± 0.58	3.00 ± 0.00	0.010*
• Matric	6.33 ± 1.16	3.33 ± 0.58	0.035*
• Graduate	6.08 ± 1.19	3.54 ± 1.05	0.000*
• Masters	6.29 ± 0.76	3.29 ± 1.11	0.001*

Paired sample t-test, * observed difference was statistically significant

Table II: Mean Maximum Mouth Opening

	Maximum Mouth Opening		P Value
	Pre-Injection	Post-Injection	
Overall	28.76 ± 4.20	38.89 ± 3.88	0.000*
Age Groups			
• 17-25 years	29.50 ± 4.01	38.50 ± 3.57	0.000*
• 26-34 years	29.31 ± 6.05	38.38 ± 5.99	0.000*
• 35-42 years	29.43 ± 3.31	40.00 ± 2.65	0.001*
Gender			
• Male	30.42 ± 4.34	39.17 ± .80	0.000*
• Female	28.72 ± 4.98	38.56 ± 4.50	0.000*
Occupation			
• Student	29.11 ± 4.96	37.78 ± 5.17	0.000*
• Teacher	29.57 ± 4.39	39.14 ± 4.49	0.001*
• Nurse	28.43 ± 6.60	39.29 ± 6.26	0.000*
• House Wife	30.57 ± 3.10	39.29 ± 1.70	0.000*
Education			
• Illiterate	29.67 ± 3.51	39.33 ± 1.53	0.028*
• Matric	29.33 ± 3.22	37.33 ± 1.53	0.020*
• Graduate	29.31 ± 5.53	39.00 ± 5.26	0.000*
• Masters	29.71 ± 5.62	38.71 ± 6.37	0.002*

Paired sample t-test, * observed difference was statistically significant

sample t-test was used $p\text{-value} \leq 0.05$ as significant.

RESULT

A total of 104 patients were enrolled in the study with a mean age of 30.5 ± 6.92 years (range 17 to 42). Out of 104, there were 45 (44.1%) male, and 57 (55.9%) female study participants. The majority of the patients were masters 38 (37.3%), followed by graduates 36 (35.3%) and matric 13 (12.7%); while 15 (14.7%) were illiterate. Most of the patients were students 33 (32.4%), followed by housewives 27 (26.5%), teachers 15 (14.7%), doctors 14 (13.7%), drivers 10 (9.8%), and sweepers 3 (2.9%). The mean pre-injection VAS score for pain was 6.29 ± 1.06 which decreased significantly to 3.46 ± 1.07 at 1 week following injection ($p < 0.001$) with a mean decrease of 2.83 ± 1.03 (Table I). The mean pre-injection MMO was 28.76 ± 4.20 which increased significantly to 38.89 ± 3.88 at 1 week following injection ($p < 0.001$) with a mean increase of 10.0 ± 3.33 (Table II).

DISCUSSION

Temporomandibular disorders affect a considerable percentage of the adult population^{11,12}. Multiple pathologies can affect temporomandibular joints like temporomandibular pain dysfunction syndrome, TMJ ankylosis, TMJ dislocation, TMJ infections and inflammation, trauma, and tumors¹³. Disc displacement with and without reduction is included among the common pathologies. Micro and macro traumas due to occlusal discrepancies, stress, and parafunctional habits like bruxism have been suggested as the etiology of various temporomandibular joint disorders^{11,13}. Patients can present with disc displacement without reduction itself but in the majority of cases, disc displacement with reduction progresses to a disc displacement without reduction and in more severe cases to osteoarthritis as disease sequelae. Treatment modalities for TMJ are multifactorial. If the patient does not respond to conservative measures, lifestyle modification, pharmacotherapy, or splints, surgical procedures are suggested as last resort. Arthrocentesis was previously employed as a first-line treatment for DDWOR^{14,15}. The hyaluronic acid injection was used in some studies and showed promising results. In recent studies effectiveness of corticosteroids mixed with local anesthetic (L.A.) has been established in patients with internal derangement of TMJ¹⁶. It also offers the advantage of reduced cost, potent anti-inflammatory properties, and increased

duration of action¹⁷. However, no such locally published material was available during the literature search. In addition to temporomandibular disorders, corticosteroids are also used for multiple diseases affecting the orofacial region like immune-mediated diseases like lichen planus, white lesions like oral submucous fibrosis, ulcers, facial pains like cluster headache, and bells palsy.

Regarding our study, patients ranged in age from 17 years to 42 years with an average age of 30.5 ± 6.92 years. In another previous study in India, reported by Giraddi et al, a mean age of 27.13 ± 6.83 years has been observed¹⁸. Samiee et al. in 2011 however reported a much higher mean age of 34.4 ± 6.9 years in American such patients while Seleman et al. (2015) reported a much lower mean age of 24.25 ± 5.08 years among such patients presenting at the Department of Prosthodontics at de' Montmorency College of Dentistry, Lahore¹⁹. A majority ($n=13$, 43.4%) of the patients were between the age range of 26-34 years. A similar higher proportion of this age group among patients of TMD has been shown by Ishfaq et al. in 2007 (40%)²⁰, Seleman et al. in 2015 (34.66%)¹⁹ and Anjum et al. in 2014 (31.8%)²¹. So main age group affected by temporomandibular internal derangement is adults.

There were 45(44.1%) male and 157 (55.9%) female patients in the study group giving a male-to-female ratio of 1:1.5. Similarly, Seleman et al. (2015) reported female predominance (1:1.5) among such patients presenting at the Department of Prosthodontics at de Montmorency College of Dentistry Lahore¹⁹. Several other studies have also reported female predominance among such patients; Giraddi et al. (100% females), Samiee et al. (94.12%), Ishfaq et al. (1:2.8), Noor-Ul-Wahab et al. (1:2.7)²². Anjum et al. on the other hand didn't observe any significant difference (48% male vs. 52% female patients)²¹

The mean pre-injection VAS score for pain was 6.29 ± 1.06 in our study, which decreased significantly to 3.46 ± 1.07 at 1 week following injection ($p < 0.001$) with a mean decrease of 2.83 ± 1.03 . This improvement in VAS score with injection was significant across all age, gender, educational and occupational groups. Our results are in line with those of a previously published study by Giraddi et al. in 2012 who also observed a significant difference in mean VAS score before and after injection

(6.13±1.73 vs. 3.25±0.89; p=0.008) 18. Samiee et al. in 2011 however didn't observe any significant difference in mean VAS score before and after injection (8±2 vs. 4±3; p>0.05)¹.

The mean pre-injection MMO was 28.76±4.20 which increased significantly to 38.89±3.88 at 1 week following injection (p=<0.001) with a mean increase of 10.0±3.33. This improvement in maximum mouth opening with injection was significant across all age, gender, educational and occupational groups. Our results are consistent with the findings of Samiee et al. in 2011 who correspondingly showed a significant difference in the mean maximum mouth opening before and after injection (29±6.25 vs. 39±6.25; p=0.0004)¹. Giraddi et al. however observed this difference to be insignificant (35.25±2.31 vs. 39.63±3.07; p=0.351)¹⁸. The findings of our study are comparable to the majority of the previous literature.

The strength of our study is that although many studies have been conducted regarding temporomandibular joint and its treatment modalities holistic and systematic view regarding the use of intra-articular corticosteroid injection mixed with local anesthetic in patients of disc displacement without reduction was missing. The results of the present study are promising and encourage the use of intra-articular corticosteroid injection mixed with local anesthetic in patients presenting with TMJ Internal Derangement as it is associated with a significant decrease in mean vas score for pain (3.33±0.99 vs. 6.23±1.07; p=<0.001) and a significant increase in maximum mouth opening score (38.80±4.55 vs. 29.40±4.73; p=<0.001) at 1-week follow-up in patients presenting with TMJ Internal Derangement.

One of the major limitations of our study is that we didn't consider the immediate and long-term side effects of treatment which need to be considered before adopting this treatment in routine. A longitudinal study in this regard will prove to be highly beneficial. Besides that, more molecular-level studies are needed the hour to delve into the exact pathophysiology of this disorder. Regarding the impact of our research, intraarticular corticosteroid injection is a cost-effective, minimally invasive procedure for a patient who either has already tried other conservative measures, exercises, medications, and splints or is not in the favor of exploring surgical options and

expensive procedures. Our future recommendation is that further studies should be conducted, comparing the effects of intraarticular steroids with other medications like botulinum toxin. Multi-institution studies would ensure the generalizability of our research.

CONCLUSION

Intra-articular corticosteroid injection mixed with local anesthetic was associated with a significant decrease in mean VAS score for pain and an increase in maximum mouth opening in patients of TMJ Disc displacement without reduction, at the one-week post-injection follow-up visit, irrespective of patient's age, gender, educational and occupational status.

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