RESEARCH PAPER

Dextrose prolotherapy for temporomandibular disorders: The prospective study

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ABSTRACT

Background: Temporomandibular joint disorders (TMDs) are common conditions affecting the temporomandibular joint, masticatory muscles, and associated structures. They may present with pain, tenderness, restricted mouth opening, clicking sound, deviation during mouth opening, difficulty in chewing, and functional limitation. Various conservative and minimally invasive treatment modalities have been used for the management of TMDs. Hypertonic dextrose prolotherapy is a minimally invasive technique that aims to reduce pain and improve joint function by promoting a localized healing response in periarticular tissues.

Aim: The aim of the present study was to evaluate the efficacy of hypertonic dextrose prolotherapy in patients with temporomandibular joint disorders.

Materials and Methods: This clinical study was conducted on 15 patients diagnosed with temporomandibular joint disorders in the Department of Oral and Maxillofacial Surgery, Maharaja Ganga Singh Dental College and Research Centre. Written informed consent was obtained from all participants. Prolotherapy solution was prepared using 50% dextrose, 2% lidocaine, and warm saline in a ratio of 1:2:1, resulting in 12.5% dextrose solution. A total of 3 ml solution was injected at three target sites: posterior joint space, anterior disc attachment, and tender masseter muscle region. Injections were repeated at two-week intervals, with follow-up at 1 month and 3 months. Parameters assessed included Visual Analogue Scale score, maximum incisal opening, tenderness, clicking sound, and deviation during mouth opening.

Results: Out of 15 patients, 9 were females and 6 were males, with a mean age of 29.53 ± 9.1 years. Mean pain score reduced from 7.47 ± 1.3 pre-treatment to 2.60 ± 1.5 at 3 months. Mean maximum incisal opening increased from 29.27 ± 5.2 mm pre-treatment to 38.60 ± 3.8 mm at 3 months. Tenderness improved in 14 patients, deviation improved in 12 patients, and clicking sound improved in 11 patients. Statistically significant improvement was observed from pre-treatment to post-treatment follow-up, with $p < 0.001$.

Conclusion: Hypertonic dextrose prolotherapy was found to be a safe, effective, and minimally invasive treatment modality for temporomandibular joint disorders, producing significant improvement in pain, mouth opening, tenderness, deviation, and clicking

Keywords: Temporomandibular joint disorders; Dextrose prolotherapy; Temporomandibular joint pain; Maximum incisal opening; Visual analogue scale.

How to cite this article*:* Hemkumar R, Goyal R, Siya S S, Dhayal J, Debbarma M, Harini BK. Dextrose Prolotherapy for Temporomandibular Disorders: A Prospective Study. Int J Drug Deliv Technol. 2026;16(60s):1919-1927. DOI: 10.25258/ijddt.16.60s.172

Source of support: Nil.

Conflict of interest: Nil.

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INTRODUCTION

Temporomandibular disorders are a group of musculoskeletal and neuromuscular conditions involving the temporomandibular joints, masticatory muscles, associated ligaments, articular disc, and surrounding tissues. They are not considered a single disease entity, but rather a collection of disorders that may present with pain, restricted mandibular movement, joint sounds, deviation of the mandible, difficulty in chewing, and functional limitation during routine oral activities. The temporomandibular joint is anatomically and functionally complex because both joints act together during mandibular movements, and the joint must tolerate rotational as well as translational forces during chewing, speech, swallowing, and yawning. Disturbance in any component of this system can produce symptoms that affect oral function and quality of life. Modern concepts emphasize that TMDs may involve structural, functional, physiological, and psychosocial factors, and therefore require careful clinical evaluation rather than a single-cause explanation.[1] The etiology of temporomandibular disorders is multifactorial. Local factors such as trauma, parafunctional habits, excessive joint loading, muscular hyperactivity, disc displacement, ligament laxity, degenerative joint changes, and occlusal instability may contribute to the development of symptoms. In addition, psychological stress, anxiety, sleep disturbance, central sensitization, and altered pain modulation can influence the severity and persistence of pain. Because of this complex background, TMD symptoms often differ between patients, and the same clinical sign may arise from muscular, articular, or combined pathology. Current understanding therefore supports a biopsychosocial model, in which biological dysfunction, psychological status, and social influences interact to determine the patient's clinical presentation and response to treatment.[2] Patients with TMD commonly present with pain in the preauricular region, tenderness of the muscles of mastication, limitation of mouth opening, deviation of the mandible during opening, clicking or crepitus, and difficulty in chewing. Pain may be localized to the joint or may radiate to the ear, temple, face, or neck, which may create diagnostic confusion with odontogenic pain, otologic disease, neuralgic pain, sinus-related pain, or headache disorders. Clinical examination remains the foundation of diagnosis and includes assessment of pain history, mandibular range of motion, joint sounds, deviation, muscle tenderness, joint tenderness, and functional impairment. Imaging may be used as an adjunct when disc displacement, degenerative change, ankylosis, trauma, or other structural pathology is suspected, but it should be interpreted in relation to clinical findings.[3] Classification of TMD is important because treatment planning depends on whether the primary problem is muscular pain, joint pain, disc displacement, degenerative disease, subluxation, dislocation, or a mixed condition. A structured diagnostic approach helps the clinician identify the source of pain and dysfunction and prevents unnecessary or irreversible treatment. TMD pain may be classified as myalgia, myofascial pain, arthralgia, or headache attributed to TMD, whereas intra-articular conditions include disc displacement with reduction, disc displacement without reduction, degenerative joint disease, and joint hypermobility. Since symptoms may overlap, clinical diagnosis should be based on history, examination, and appropriate diagnostic criteria rather than isolated signs such as clicking alone.[4] The pathogenesis of TMD-related pain may involve peripheral nociception, inflammation of joint tissues, muscle overactivity, ligamentous strain, altered biomechanics, and changes in central pain processing. In chronic cases, pain may continue even after the original local trigger has reduced, due to sensitization and altered neuromuscular control. The temporomandibular joint is supported by capsule, ligaments, discal attachments, and surrounding muscles; therefore, laxity or microtrauma in these structures may contribute to instability, recurrent clicking, painful movement, and limitation of function. A clear understanding of pathogenesis is essential because the clinician must differentiate TMD from other craniofacial pain disorders and must select therapy according to the dominant mechanism involved.[5] The management of TMD is generally directed toward pain reduction, restoration of mandibular function, improvement in mouth opening, reduction of joint sounds where possible, and prevention of further functional disability. Initial management often includes patient education, soft diet, avoidance of excessive jaw movements, habit correction, physiotherapy, jaw exercises, pharmacological support, occlusal appliances, and behavioral approaches. However, some patients do not respond satisfactorily to conservative treatment or continue to experience chronic joint pain, recurrent dysfunction, or instability. In such patients, minimally invasive interventions may be considered after careful diagnosis and patient selection, especially when symptoms are persistent and affect daily activities.[6] Dextrose prolotherapy has gained attention as a minimally invasive treatment option for selected temporomandibular disorders, particularly cases associated with chronic pain, joint laxity, hypermobility, and functional limitation. Prolotherapy involves injection of an irritant or proliferant solution, commonly hypertonic dextrose, into painful ligamentous, capsular, periarticular, or muscular attachment areas. The proposed mechanism is based on stimulation of a controlled local healing response, promoting fibroblast activity, collagen deposition, strengthening of weakened connective tissue, and improved joint stability. In TMJ disorders, dextrose prolotherapy may help reduce pain by improving support around the joint capsule and periarticular tissues, decreasing abnormal movement, and improving functional comfort during mandibular activity. Because it is simple, economical, repeatable, and minimally invasive, it may be considered a useful therapeutic modality when conventional conservative treatment has failed or when ligamentous laxity and chronic joint-related symptoms are clinically evident.[6]

MATERIALS AND METHODS

This clinical study was conducted in the Department of Oral and Maxillofacial Surgery at Maharaja Ganga Singh Dental College and Research Centre. A total of fifteen patients

diagnosed with temporomandibular joint disorders (TMD) and treated with hypertonic dextrose prolotherapy in the temporomandibular joint (TMJ) region were included in the study. Prior written informed consent was obtained from all participants before commencement of the treatment procedure. The diagnosis of TMD was established on the basis of detailed patient history and comprehensive clinical examination. Pain assessment was considered an important diagnostic parameter because pain perception involves intensity, quality, duration, and location.

Inclusion Criteria

Patients presenting with pain or tenderness in the temporomandibular joint during functional loading, pain in and around the ear, difficulty in chewing, restricted mouth opening, occasional locking of the joint, and chronic dislocation with objective clinical evidence were included in the study.

Exclusion Criteria

Patients with allergy to any component of the prolotherapy solution, especially dextrose, active infection, healing disorders, bleeding disorders, those receiving anticoagulant therapy, malignant conditions, acute gouty arthritis, and parafunctional habits such as bruxism were excluded from the study.

Treatment Protocol

The prolotherapy solution was prepared based on previously established studies regarding the concentration of dextrose injections. The solution consisted of 50% dextrose, 2% lidocaine, and warm saline mixed in a volume ratio of 1:2:1, resulting in a final concentration of 12.5% dextrose solution. A total volume of 3 ml was prepared for each patient, consisting of 0.75 ml of 50% dextrose, 1.5 ml of 2% lidocaine, and 0.75 ml of warm saline. Approximately 1 ml of the prepared hypertonic dextrose solution was injected at each designated target point.

A 26-gauge, 22-mm needle was used for administration of the prolotherapy injections. All three components of the prolotherapy solution were drawn into a syringe, mixed thoroughly by shaking, and any trapped air was expelled prior to injection. During the course of prolotherapy treatment and follow-up period, all other interventions for TMD were discontinued to avoid interference with study outcomes.

Number of Interventions

The standard treatment protocol involved repeating the prolotherapy injections at intervals of two weeks. In total, patients received four injection appointments over a period of six weeks. Following completion of the treatment protocol, patients were recalled for follow-up evaluation at one month and three months after the final prolotherapy injection.

Study Parameters

The study parameters included assessment of pain intensity using the Visual Analogue Scale (VAS), maximum incisal opening (MIO), tenderness of the temporomandibular joint and masticatory muscles, presence or absence of clicking sounds, and deviation during mouth opening. At every appointment prior to injection, tenderness of the involved muscles and joints was assessed by palpation. The joints were also evaluated for pain and clicking sounds. Jaw movements, including range of motion, mouth opening, and deviation, were measured and recorded systematically. Pain intensity was evaluated using the Visual Analogue Scale, which has been validated as a reliable method for assessment of clinical and chronic pain as reported by Huskinsson (1982) and Price et al. (1983).

Surgical Procedure

The prolotherapy procedure was performed under aseptic conditions. The first target area was the posterior joint space. The skin immediately anterior to the ear was disinfected with alcohol, and the lateral pole of the condyle was palpated while the patient performed mouth opening and closing movements. The target point corresponded to the depression formed immediately anterior to the tragus, approximately 5 mm from the middle margin of the tragus along the ala-tragal line, as the condyle translated downward and forward during mouth opening.

A bite block was placed to prevent the patient from closing the condyle into the glenoid fossa during the injection procedure. The needle was inserted through the marked point and directed anteromedially to avoid penetration into the external auditory canal. Approximately 1 ml of the prolotherapy solution was deposited into the posterior joint space. It was considered advisable to mark all three target points prior to injection because palpation of the posterior joint space becomes difficult after injection.

The second target area was the anterior disc attachment, corresponding to the superior insertion of the lateral pterygoid muscle into the articular disc. This area was identified with reference to the posterior joint space and the condylar head. For this injection, the bite block was removed and the patient was instructed to close the mouth gently so that the condyle repositioned into the fossa. The slight depression anterior to the condyle was identified and marked. The needle was inserted medially with slight anterior angulation to its full one-inch length, and after aspiration, 1 ml of prolotherapy solution was injected into the target area.

The third target area involved the masseter muscle below the zygomatic arch. The most rigid and tender point within the masseter muscle was identified by palpation. Patients were asked to clench their teeth to facilitate identification of the muscle bulk and the area of maximum tenderness. After locating the target point, the patient was instructed to relax the jaw, and the remaining 1 ml of prolotherapy solution was deposited into the masseter muscle.

RESULTS

The data were analysed to evaluate the efficacy of prolotherapy in temporomandibular joint disorders. All statistical analysis was carried out using SPSS for Windows, version 22. Descriptive statistics used in the present study included mean, standard deviation, frequency, and percentage. For repeated measures, the Friedman test was used to assess changes in VAS score and mouth opening at different time intervals. A probability value of

less than or equal to 0.001 was considered statistically significant.

In the present study, out of 15 patients, 9 patients were female, constituting 60% of the study population, and 6 patients were male, constituting 40%. The age of the patients ranged from 18 to 47 years, with a mean age of 29.53 ± 9.1 years. The demographic characteristics of the patients are shown in Table 1. All patients received prolotherapy injections in the affected joints and ipsilateral masseter muscle origins at four separate appointments. Relevant clinical findings were recorded for all patients before treatment and at three consecutive appointments, that is, at the 2nd week, 4th week, and 6th week visits before injection. Post-operative clinical findings were also assessed during follow-up at the 1st month and 3rd month. The collected data were subjected to statistical analysis comprising descriptive statistics.

Pain intensity was evaluated using the Visual Analogue Scale (VAS). It was observed that the mean pre-treatment pain score was 7.47 ± 1.3. After the first dose of prolotherapy, at the 2nd week, the mean pain score decreased to 6.00 ± 1.4. After the second dose, at the 4th week, the mean pain score was 5.07 ± 2.2, and after the third dose, at the 6th week, it was 4.53 ± 2.1. At the 1st month post-operatively, the mean pain score further reduced to 3.20 ± 1.9, and at the 3rd month post-operatively, it reduced to 2.60 ± 1.5. The average decrease in pain level was 4.87, indicating a substantial reduction in pain after therapy. There was a statistically significant difference in the decrease in mean pain level from the pre-treatment to post-treatment period at the end of 3 months. The pain score improved to a level less than 5 in 14 patients, representing 93.33% of the study population, and reached a score of zero in 2 patients. The distribution of VAS scores is shown in Table 2.

The mean maximum incisal opening before treatment was 29.27 ± 5.2 mm. After the first dose of prolotherapy, at the 2nd week, the mean mouth opening increased to 31.93 ± 4.1 mm. After the second dose, at the 4th week, it increased to 34.87 ± 2.6 mm, and after the third dose, at the 6th week, it increased to 36.00 ± 2.6 mm. At the 1st month post-operatively, the mean mouth opening was 37.20 ± 3.1 mm. When reviewed after 3 months of the last prolotherapy injection, the mouth opening had substantially increased to 38.60 ± 3.8 mm. The mean increase in mouth opening was found to be 9.33 mm at the end of follow-up. There was a statistically significant difference in the increase in mouth opening from the pre-treatment to post-treatment period at the end of 3 months. These findings are presented in Table 3.

The effect of treatment on tenderness in the TMJ region, deviation during mouth opening, and clicking sound was assessed on the basis of improvement in their presence or absence at the end of treatment. At the 3rd month post-operative recall, tenderness on palpation had improved significantly in almost all patients. Deviation during mouth opening improved in 12 patients, accounting for 80% of the cases, and 11 patients, representing 73.3%, showed substantial improvement in clicking sound, which was no longer detectable by clinical palpation and was also reported as absent by the patient. These findings are shown in Tables 4, 5, and 6.

A statistically significant association, with a p-value less than 0.001, was observed from pre-treatment to post-treatment follow-up at 3 months after the last dose of prolotherapy. All patients tolerated the prolotherapy injections well, and no serious complications were observed. There were very few incidents of dizziness. Out of 15 patients, only one patient experienced mild dizziness, which was most likely due to anxiety related to the procedure, and the patient recovered soon. Mild preauricular swelling was noted in three patients, which disappeared within an hour. None of the patients had significant bruising, and no transient facial palsy was reported in any patient.

TABLE 1: DEMOGRAPHIC CHARACTERISTICS

Variable	N	Mean ± S.D. / Percentage
Age	15	29.53 ± 9.1
Male	6	40%
Female	9	60%

TABLE 2: PAIN — VAS SCORE

VAS Score	Pre-treatment	2nd Week	4th Week	6th Week	1st Month	3rd Month
0	0	0	1	1	2	2
1	0	0	0	0	1	2
2	0	0	1	2	2	2
3	0	1	1	1	3	4
4	0	1	2	3	2	4
5	1	3	3	3	4	1
6	3	4	2	1	1	0
7	3	4	4	4	0	0
8	4	2	1	0	0	0
9	4	0	0	0	0	0
10	0	0	0	0	0	0
Mean ± S.D.	**7.47 ± 1.3**	**6.00 ± 1.4**	**5.07 ± 2.2**	**4.53 ± 2.1**	**3.20 ± 1.9**	**2.60 ± 1.5**
Mean Rank	**6.00**	**4.67**	**3.87**	**3.27**	**1.83**	**1.37**
P-value	**<0.001***					

* <0.001 is statistically significant.Friedman test used.

TABLE 3: MAXIMAL INCISAL OPENING

Time Interval	Mean ± S.D.	Mean Rank	P-value
Pre-treatment	29.27 ± 5.2	1.20	<0.001*
2nd Week	31.93 ± 4.1	2.07	
4th Week	34.87 ± 2.6	3.17	
6th Week	36.00 ± 2.6	3.97	
1st Month	37.20 ± 3.1	4.97	
3rd Month	38.60 ± 3.8	5.63	

* <0.001 is statistically significant.Friedman test used.

TABLE 4: PRESENCE OF TENDERNESS IN TMJ REGION

Time Interval	Absent	Present
Pre-treatment	1 (6.7%)	14 (93.3%)
2nd Week	1 (6.7%)	14 (93.3%)
4th Week	5 (33.3%)	10 (66.7%)
6th Week	7 (46.7%)	8 (53.3%)
1st Month	10 (66.7%)	5 (33.3%)
3rd Month	14 (93.3%)	1 (6.7%)

TABLE 5: PRESENCE OF DEVIATION WHILE MOUTH OPENING

Time Interval	Absent	Present
Pre-treatment	2 (13.3%)	13 (86.7%)
2nd Week	2 (13.3%)	13 (86.7%)
4th Week	3 (20%)	12 (80%)
6th Week	8 (53.3%)	7 (46.7%)
1st Month	11 (73.3%)	4 (26.7%)
3rd Month	12 (80%)	3 (20%)

TABLE 6: PRESENCE OF CLICKING SOUND

Time Interval	Absent	Present
Pre-treatment	0	15 (100%)
2nd Week	2 (13.3%)	13 (86.7%)
4th Week	6 (40%)	9 (60%)
6th Week	7 (46.7%)	8 (53.3%)
1st Month	10 (66.7%)	5 (33.3%)
3rd Month	11 (73.3%)	4 (26.7%)

Fig.1 -op photograph showing mouth opening of 28 mm with mild deflection of his jaw to the left on opening.

Fig. 2 Marking of all three points and bite block was placed

Fig. 3 First target area - Posterior joint space

Fig.4 Second target area - Anterior disc attachment

Fig.5 Third target area- Most rigid, tender area of masseter muscles below the zygomatic arch

Fig.6 Post-op photograph after 3rd month of last dose Showing maximum opening had improved to 36 mm

DISCUSSION

In the present study, the majority of patients were female, with 9 females constituting 60% and 6 males constituting 40% of the total sample. The age of patients ranged from 18 to 47 years, with a mean age of 29.53 ± 9.1 years. This female predominance and young adult distribution are in accordance with Sharma et al. (2011), who reported that temporomandibular disorders are more commonly observed in females and are an important cause of non-dental orofacial pain. The findings of the present study therefore support the general observation that TMD is more frequently encountered in young adult females, possibly due to biological, hormonal, psychosocial, and functional factors influencing pain perception and joint loading.[7] The treatment protocol of the present study involved hypertonic dextrose prolotherapy injections into the affected TMJ region and ipsilateral masseter muscle origin at four appointments, with follow-up evaluation up to 3 months. In the present study, pain, mouth opening, tenderness, deviation, and clicking all showed improvement after prolotherapy. Similar clinical improvement was reported by Dasukil et al. (2021), who evaluated prolotherapy in TMJ disorders and concluded that it reduced TMJ pain, improved joint stability, and increased range of motion, without permanent complications. Their findings are comparable to the present study, in which no serious complication was observed, and all patients tolerated the procedure well.[8] Pain reduction was one of the most important outcomes in the present study. The mean VAS score decreased from 7.47 ± 1.3 pre-treatment to 6.00 ± 1.4 at the 2nd week, 5.07 ± 2.2 at the 4th week, 4.53 ± 2.1 at the 6th week, 3.20 ± 1.9 at the 1st month, and 2.60 ± 1.5 at the 3rd month. The average reduction in pain was 4.87, and the improvement was statistically significant with $p < 0.001$. Refai et al. (2011), in a randomized, double-blind, placebo-controlled clinical trial on TMJ hypermobility, also reported that dextrose prolotherapy produced therapeutic benefit in symptomatic patients and helped reduce pain and associated clinical symptoms. The present study showed a marked reduction in pain intensity, which is in agreement with the pain improvement reported by Refai et al., although the present study used 12.5% dextrose and included patients with TMD rather than only hypermobility cases.[9] In the present study, 14 out of 15 patients, representing 93.33%, improved to a VAS score below 5 by the 3rd month, and 2 patients reached a pain score of zero. Louw et al. (2019), in a randomized controlled trial involving 42 participants and 54 joints, reported that dextrose prolotherapy produced greater improvement in jaw pain than control injection at 3 months, with pain reduction of 4.3 ± 2.9 points in the dextrose group compared with 1.8 ± 2.7 points in the control group. At 12 months, pooled data showed jaw pain improvement of 5.2 ± 2.7 points, representing 68% improvement. The pain reduction of 4.87 points in the present study is close to the magnitude of improvement reported by Louw et al., supporting the effectiveness of hypertonic dextrose injection for reducing TMJ-related pain.[10]

The mean maximum incisal opening in the present study increased from 29.27 ± 5.2 mm pre-treatment to 31.93 ± 4.1 mm at the 2nd week, 34.87 ± 2.6 mm at the 4th week, 36.00 ± 2.6 mm at the 6th week, 37.20 ± 3.1 mm at the 1st month, and 38.60 ± 3.8 mm at the 3rd month. The mean increase in mouth opening was 9.33 mm, which was statistically significant. Priyadarshini et al. (2021) compared prolotherapy with occlusal splints in patients with internal derangement of the TMJ and found significantly greater improvement in pain, mouth opening, and clicking in the prolotherapy group. The present study also showed progressive improvement in mouth opening after each injection visit, indicating that reduction of pain and improvement in joint function may contribute to better mandibular mobility.[11] In the present study, TMJ clicking was present in all 15 patients before treatment. At the 3rd month follow-up, clicking was absent in 11 patients, representing 73.3%, and persisted in only 4 patients, representing 26.7%. Mohammed et al. (2023), in a study on dextrose prolotherapy for internal derangement of the TMJ, reported that clicking decreased from 70% pre-operatively to 50% at 2 weeks, 15% at 4 weeks, and 5% at 12 weeks. Although the final clicking reduction in the present study

was slightly less than that reported by Mohammed et al., both studies demonstrate a clear improvement in joint sounds after dextrose prolotherapy.[12] Deviation during mouth opening was present in 13 patients, representing 86.7%, before treatment in the present study. At the 3rd month follow-up, deviation was absent in 12 patients, representing 80%, and persisted in only 3 patients, representing 20%. Abdulmuhsin et al. (2022) studied 40 patients divided into prolotherapy and medication groups and assessed joint pain, masseter muscle pain, mouth opening, clicking, and hypermobility at follow-up intervals of 1 week, 1 month, and 2 months. They reported lower mean joint pain and masseter muscle pain scores in the prolotherapy group compared with the medication group, although the differences were not statistically significant. In comparison, the present study showed statistically significant improvement in deviation and pain, suggesting that repeated prolotherapy injections may have a beneficial effect on both muscular and joint-related components of TMD.[13] Tenderness in the TMJ region was present in 14 patients, representing 93.3%, before treatment in the present study. At the 3rd month follow-up, tenderness was absent in 14 patients, representing 93.3%, and present in only 1 patient, representing 6.7%. Mustafa et al. (2018) evaluated different concentrations of dextrose prolotherapy in TMJ hypermobility treatment and reported that all treatment procedures were effective in improving clinical symptoms, with no superiority of one dextrose concentration over another. The present study used 12.5% dextrose and showed marked reduction in tenderness, supporting the view that clinical improvement may be obtained when the dextrose solution is sufficiently hypertonic to initiate a therapeutic response.[14] The overall findings of the present study showed statistically significant improvement in pain and maximum incisal opening, with $p < 0.001$, along with marked improvement in tenderness, deviation, and clicking at 3 months. The treatment was well accepted by all patients, with only one case of mild dizziness and three cases of mild preauricular swelling, all of which resolved without serious complication. Sit et al. (2021), in a systematic review and meta-analysis of randomized controlled trials, concluded that hypertonic dextrose prolotherapy was superior to placebo injection in reducing TMJ pain intensity at 12 weeks, with a moderate to large effect size. Therefore, the present study findings are consistent with the available evidence that dextrose prolotherapy is a safe, minimally invasive, and effective treatment modality for reducing pain and improving function in temporomandibular joint disorders.[15]

CONCLUSION

The present study showed that hypertonic dextrose prolotherapy is an effective and minimally invasive treatment option for temporomandibular joint disorders. A significant reduction in pain intensity and improvement in maximum incisal opening were observed after treatment. Tenderness, deviation during mouth opening, and clicking sound also improved markedly during the follow-up period. The procedure was well tolerated by all patients, with no serious complications reported. Therefore, dextrose prolotherapy can be considered a safe and useful therapeutic modality for selected patients with TMD.

Ethical Clearance Certificate for study was obtained from Institute Ethical Clearance Committee

REFERENCE

1. National Academies of Sciences, Engineering, and Medicine. Temporomandibular disorders: priorities for research and care. Washington (DC): National Academies Press; 2020. doi:10.17226/25652. Available from: https://www.ncbi.nlm.nih.gov/books/NBK555057/
2. Kapos FP, Exposto FG, Oyarzo JF, Durham J. Temporomandibular disorders: a review of current concepts in aetiology, diagnosis and management. Oral Surg. 2020;13(4):321-334. doi:10.1111/ors.12473. Available from: https://onlinelibrary.wiley.com/doi/10.1111/ors.12473
3. Li DTS, Leung YY. Temporomandibular disorders: current concepts and controversies in diagnosis and management. Diagnostics (Basel). 2021;11(3):459. doi:10.3390/diagnostics11030459. Available from: https://www.mdpi.com/2075-4418/11/3/459
4. Klasser GD, Goulet JP, Moreno-Hay I. Classification and diagnosis of temporomandibular disorders and temporomandibular disorder pain. Dent Clin North Am. 2023;67(2):211-225. doi:10.1016/j.cden.2022.12.001. Available from: https://pubmed.ncbi.nlm.nih.gov/36965927/
5. Khan J, Singer SR, Young A, Tanaiutchawoot N, Kalladka M, Mupparapu M. Pathogenesis and differential diagnosis of temporomandibular joint disorders. Dent Clin North Am. 2023;67(2):259-280. doi:10.1016/j.cden.2022.10.001. Available from: https://pubmed.ncbi.nlm.nih.gov/36965930/
6. Busse JW, Casassus R, Carrasco-Labra A, Durham J, Mock D, Zakrzewska JM, et al. Management of chronic pain associated with temporomandibular disorders: a clinical practice guideline. BMJ. 2023;383:e076227. doi:10.1136/bmj-2023-076227. Available from: https://pubmed.ncbi.nlm.nih.gov/38101929/
7. Sharma S, Gupta DS, Pal US, Jurel SK. Etiological factors of temporomandibular joint disorders. Natl J Maxillofac Surg. 2011;2(2):116-119. doi:10.4103/0975-5950.94463. Available from: https://pmc.ncbi.nlm.nih.gov/articles/PMC3343405/
8. Dasukil S, Shetty SK, Arora G, Degala S. Efficacy of prolotherapy in temporomandibular joint disorders: an exploratory study. J Maxillofac Oral Surg. 2021;20(1):115-120. doi:10.1007/s12663-020-01328-9. Available from: https://pubmed.ncbi.nlm.nih.gov/33584052/
9. Refai H, Altahhan O, Elsharkawy R. The efficacy of dextrose prolotherapy for temporomandibular joint hypermobility: a preliminary prospective, randomized, double-blind, placebo-controlled clinical trial. J Oral Maxillofac Surg. 2011;69(12):2962-2970.

doi:10.1016/j.joms.2011.02.128. Available from: https://pubmed.ncbi.nlm.nih.gov/21757278/
10. Louw WF, Reeves KD, Lam SKH, Cheng AL, Rabago D. Treatment of temporomandibular dysfunction with hypertonic dextrose injection prolotherapy: a randomized controlled trial with long-term partial crossover. Mayo Clin Proc. 2019;94(5):820-832. doi:10.1016/j.mayocp.2018.07.023. Available from: https://pubmed.ncbi.nlm.nih.gov/30878157/
11. Priyadarshini S, Gnanam A, Sasikala B, Elavenil P, Cheeman SRS, Mrunalini R, et al. Evaluation of prolotherapy in comparison with occlusal splints in treating internal derangement of the temporomandibular joint: a randomized controlled trial. J Craniomaxillofac Surg. 2021;49(1):24-28. doi:10.1016/j.jcms.2020.11.004. Available from: https://doi.org/10.1016/j.jcms.2020.11.004
12. Mohammed MR, Hamad SA, Al-Dawoody AD, Shehab AA, Ahmed OS. Effect of dextrose prolotherapy on internal derangement of the temporomandibular joint. Eur Rev Med Pharmacol Sci. 2023;27(11):4883-4889. . doi:10.26355/eurrev_202306_32605. Available from: https://pubmed.ncbi.nlm.nih.gov/37318462/
13. Abdulmuhsin N, AL-Kamali RK. Efficacy of dextrose prolotherapy for the management of chronic temporomandibular disorders: clinical trial study. Int J Health Sci. 2022;6(S8):2045-2056. doi:10.53730/ijhs.v6nS8.12392. Available from: https://sciencescholar.us/journal/index.php/ijhs/article/view/12392
14. Mustafa R, Güngörmüş M, Mollaoğlu N. Evaluation of the efficacy of different concentrations of dextrose prolotherapy in temporomandibular joint hypermobility treatment. J Craniofac Surg. 2018;29(5):e461-e465. doi:10.1097/SCS.0000000000004480. Available from: https://pubmed.ncbi.nlm.nih.gov/29533255/
15. Sit RWS, Reeves KD, Zhong CCL, Wong CHL, Wang B, Chung VCH, et al. Efficacy of hypertonic dextrose injection prolotherapy in temporomandibular joint dysfunction: a systematic review and meta-analysis. Sci Rep. 2021;11(1):14638. doi:10.1038/s41598-021-94119-2. Available from: https://www.nature.com/articles/s41598-021-94119-2