Attahadi Medical Journal
2026;3(3):488-492
https://doi.org/10.69667/amj.26331

OPEN ACCESS

Original article

Effect of Hyaluronic Acid Gel on Postoperative Outcomes Following Mandibular Molar Extraction: A Case-Control Study

Hamuda Hamuda*, Al Taher Bin Taher, Israa Al-Qamati, Linda Samir, Fatima Al-Salouqi, Asma Idris, Abdusalam Hanesh

Department of Oral and Maxillofacial Surgery, Faculty of Dentistry, Attahadi University, Tripoli, Libya
Corresponding Email. Hamouda.hammouda@attahadi.edu.ly

Keywords:
Hyaluronic acid, tooth extraction, mandibular molar, postoperative pain, dry socket

ABSTRACT

Tooth extraction, particularly mandibular molars, is one of the most commonly performed procedures in oral surgery. Despite its routine nature, it is often associated with postoperative complications such as pain, swelling, infection, and alveolar osteitis, which may negatively affect patient recovery and quality of life. This study was conducted to evaluate the effect of hyaluronic acid (HA) gel on postoperative outcomes following mandibular molar extraction, particularly pain, infection, and healing. A case-control study was conducted on 100 patients undergoing mandibular molar extraction. Participants were randomly divided into two groups: a study group (n = 50) receiving intra-socket HA gel and a control group (n = 50) receiving standard postoperative care. Postoperative outcomes were assessed at 3 and 7 days. Statistical analysis was performed using Chi-square and Fisher's exact tests, with significance set at $p < 0.05$. The HA group showed a significant reduction in postoperative pain compared to the control group ($p = 0.01$), with no cases of severe pain reported. Infection rates were also significantly lower in the HA group ($p = 0.03$), and dry socket was observed only in the control group. No significant differences were found in emergency visits or postoperative medication use. Hyaluronic acid gel significantly improves early postoperative outcomes following mandibular molar extraction. It is a safe and effective adjunct for reducing pain, infection, and complications.

Introduction

Tooth extraction, particularly mandibular molars, is one of the most commonly performed procedures in oral surgery. Despite its routine nature, it is often associated with postoperative complications such as pain, swelling, infection, and alveolar osteitis, which may negatively affect patient recovery and quality of life (1,2).

Various strategies have been proposed to minimize these complications, including pharmacological and non-pharmacological approaches (3). Recently, hyaluronic acid (HA), a naturally occurring glycosaminoglycan, has been introduced as a promising adjunct due to its anti-inflammatory, analgesic, and wound-healing properties (4,5).

Previous studies have suggested that HA may reduce postoperative pain and enhance tissue healing; however, clinical evidence remains limited and sometimes inconsistent (6–8). Therefore, this study aimed to evaluate the effectiveness of hyaluronic acid gel in improving postoperative outcomes following mandibular molar extraction.

Methods

Study Design

This study was designed as a prospective case-control study to evaluate the effect of hyaluronic acid (HA) gel on postoperative pain, swelling, and infection following mandibular molar extraction. The study aimed to compare clinical outcomes between patients receiving HA gel and those receiving standard postoperative care.

Study Population

The study was conducted at the Department of Oral and Maxillofacial Surgery, Faculty of Dentistry, Attahadi University, Tripoli, Libya. A total of 100 patients requiring extraction of mandibular molars were included in the study. Patients were selected according to predefined inclusion and exclusion criteria to ensure homogeneity of the sample and reliability of the results.

The sample size was calculated based on previously published clinical studies evaluating postoperative pain following mandibular molar extraction. A power analysis was performed with a confidence level of 95% and a study power of 80%, which determined that a minimum of 50 patients per group were required to detect a statistically significant difference between the groups.

Inclusion Criteria

Patients were included in the study if they met the following criteria:

Received: *29-06-2026 -* ***Accepted:*** *27-08-2026 -* ***Published:*** *04-09-2026*

Attahadi Medical Journal
2026;3(3):488-492
https://doi.org/10.69667/amj.26331

1. Patients aged between 18 and 65 years.
2. Patients require extraction of mandibular molars.
3. Systemically healthy patients or patients with controlled systemic conditions.
4. Patients willing to participate in the study and able to provide informed consent.

Exclusion Criteria

Patients were excluded from the study under the following conditions:

1. Presence of systemic diseases that may affect wound healing, such as uncontrolled diabetes or patients receiving immunosuppressive therapy.
2. Smokers.
3. Patients present with acute infection at the extraction site.
4. Patients are unwilling to participate or unable to provide informed consent.

Ethical Considerations

This study was conducted following approval from the Ethical Committee of the Faculty of Dentistry, Attahadi University (Reference 11-2025 AU). All procedures were carried out in accordance with ethical standards and guidelines for clinical research involving human subjects.

Patient Consent

All patients were informed about the nature and purpose of the study prior to participation. Written informed consent was obtained from each participant. Data collected included demographic variables such as age and sex, in addition to clinical information related to the tooth indicated for extraction.

Group Allocation

Patients were randomly divided into two equal groups (n = 50 each). Randomization was performed using a computer-generated random allocation sequence to ensure unbiased distribution between the study and control groups. Allocation concealment was maintained using sealed opaque envelopes, which were opened at the time of intervention.
Due to the nature of the procedure, operator blinding was not feasible. However, postoperative evaluation was performed by an independent examiner who was blinded to the group allocation in order to minimize assessment bias.

Study Group (HA Group)

Patients in the study group received intra-socket application of hyaluronic acid gel following tooth extraction. After extraction and socket irrigation, the HA gel was applied directly into the extraction socket. Standard postoperative instructions were provided.

Control Group

Patients in the control group underwent tooth extraction following the same standardized surgical protocol but without the application of hyaluronic acid gel. Only standard postoperative care was provided.

Preoperative Assessment

Patient History

A comprehensive medical, dental, and drug history was obtained for each patient. Demographic data, including age and gender, were recorded. All patients included in the study were free from systemic conditions that could affect healing.

Clinical Examination

A complete clinical examination was performed to assess the oral condition, tooth status, and surrounding tissues. This ensured suitability for extraction and eligibility for inclusion in the study.

Radiographic Evaluation

A periapical radiograph was obtained for each patient to evaluate root morphology, tooth position, and surrounding anatomical structures prior to extraction.

Procedure

All patients were treated according to a standardized clinical and surgical protocol to ensure consistency between the study and control groups. All procedures were performed by the same experienced oral surgeon to minimize operator-related variability. Prior to extraction, each patient underwent thorough clinical and radiographic evaluation to assess tooth position, root morphology, and surrounding anatomical structures, and informed consent was confirmed. Local anesthesia was administered using an inferior alveolar nerve block, supplemented with buccal and lingual anesthesia when required

Received: 29-06-2026 - **Accepted**: 27-08-2026 - **Published**: 04-09-2026

Attahadi Medical Journal
2026;3(3):488-492
https://doi.org/10.69667/amj.26331

to achieve adequate anesthesia. The extraction procedure was carried out under strict aseptic conditions, beginning with gentle separation of the gingival attachment using a periosteal elevator, followed by tooth luxation using elevators to expand the socket and sever periodontal ligament fibers. Extraction forceps were then applied with firm apical pressure, and controlled buccolingual movements were used to facilitate atraumatic tooth removal; in surgical cases, minimal bone removal or tooth sectioning was performed when necessary. After extraction, the socket was carefully inspected and irrigated with sterile normal saline to remove debris and bone fragments, and hemostasis was achieved using gentle pressure with sterile gauze, with smoothing of any sharp bony edges when required. In the study group, a 1% hyaluronic acid bioadhesive gel (0.2–0.5 mL) was applied directly into the extraction socket (Gonul O, et al)[7], ensuring complete coverage of the socket walls without overfilling, whereas in the control group no hyaluronic acid was applied and standard postoperative care was followed. Suturing was performed when indicated. All patients received standardized postoperative instructions, including guidance on oral hygiene, diet, and pain control, and were prescribed analgesics, when necessary, with scheduled follow-up visits for clinical evaluation.

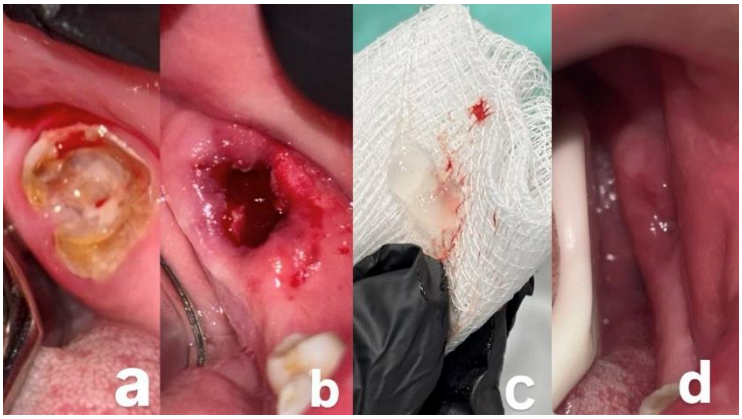

Figure 1: Clinical photographs illustrating the procedure of mandibular molar extraction and intra-socket application of hyaluronic acid (HA). (A) Preoperative clinical assessment of the mandibular molar indicated for extraction, (B) immediate postoperative view of the extraction socket following tooth removal, (C) preparation of hyaluronic acid gel on sterile gauze prior to application, (D) postoperative follow-up at 7 days demonstrating satisfactory healing of the extraction site.

Postoperative Instructions

All patients received standardized postoperative instructions, including guidance on oral hygiene, diet, and pain management. Analgesics were prescribed when necessary, and patients were instructed to attend follow-up visits.

Follow-Up Evaluation

Patients were evaluated 24 hours, 3 days, and 7 days postoperatively. Clinical assessment included evaluation of pain severity, swelling, and signs of infection. Healing progress and any postoperative complications were carefully recorded.

Results

The demographic characteristics of the study participants (N = 100) showed that the mean age was 40.66 years (SD = 14.0), indicating a moderate level of variability among participants. The majority of the sample (62.0%) were aged above 30 years, followed by 26.0% within the 20–30-year age group, while only 12.0% were below 20 years. This suggests that the sample is mainly composed of middle-aged individuals. Regarding gender distribution, males represented 64.0% of the participants, whereas females accounted for 36.0%, indicating a higher proportion of males in the sample. These characteristics should be considered when interpreting the study findings, as they may influence the generalizability of the results.

Table 2: Age and gender distribution among the studied patients (n= 100)

Variable	Category	N=100
Age	< 20 years	12.0 (12.0%)
	20–30 years	26.0 (26.0%)
	> 30 years	62.0 (62.0%)
Gender	Male	64.0 (64.0%)
	Female	36.0 (36.0%)

The distribution of postoperative symptoms differed between the hyaluronic acid (HA) group and the control group. The majority of patients in the HA group (88.0%) experienced no postoperative symptoms compared to 76.0% in the control group, indicating an overall improvement in healing outcomes associated with HA application.

Received: *29-06-2026 -* ***Accepted:*** *27-08-2026 -* ***Published:*** *04-09-2026*

Attahadi Medical Journal
2026;3(3):488-492
https://doi.org/10.69667/amj.26331

Swelling on the first postoperative day was observed in 12.0% of patients in the HA group and 8.0% in the control group. Although slightly higher in the HA group, this finding may reflect a normal early inflammatory response rather than a complication. Dry socket was reported only in the control group, affecting 12.0% of patients, while no cases were observed in the HA group. Additionally, combined presentation of dry socket with swelling was identified in 4.0% of control patients and were absent in the HA group. These findings suggest a protective role of HA in preserving socket integrity and promoting stable healing. The overall difference in symptom distribution between the two groups was statistically significant (p = 0.04), indicating that the use of hyaluronic acid has a measurable effect on reducing postoperative complications.

Table 2: Comparison of Postoperative Outcomes Between Hyaluronic Acid (HA) and Control Groups.

Outcome	Control Group (n=50)	HA Group (n=50)	Total (%)	p-value
No symptoms	38 (76.0%)	44 (88.0%)	82 (82.0%)	
Swelling (Day 1)	4 (8.0%)	6 (12.0%)	10 (10.0%)	
Dry socket (Day 2)	6 (12.0%)	0 (0.0%)	6 (6.0%)	
Dry socket + swelling	2 (4.0%)	0 (0.0%)	2 (2.0%)	0.04
Total	50 (100%)	50 (100%)	100 (100%)	

Discussion

The present study aimed to evaluate the effect of hyaluronic acid (HA) gel on postoperative outcomes following mandibular molar extraction, particularly in relation to pain, infection, and healing. The study hypothesis was that the application of HA gel would reduce postoperative pain, decrease infection rates, minimize complications such as dry socket, and enhance overall healing compared to the control group. The findings demonstrated that the application of HA significantly improved postoperative outcomes compared to the control group, thereby partially supporting the study hypothesis.

Regarding postoperative pain, a statistically significant reduction was observed in the study group (p = 0.01), with a higher proportion of patients reporting no pain after 3 days. In contrast, severe pain was observed only in the control group. This finding suggests that HA plays an important role in reducing postoperative pain, likely due to its anti-inflammatory effect and its ability to modulate nociceptor activity at the surgical site. These findings are consistent with previous clinical studies (9,10,11).

Similarly, the present study demonstrated a significant reduction in postoperative infection signs in the HA group compared to the control group (p = 0.03). Notably, dry socket was observed only in the control group, while no cases were reported in the study group. This indicates that HA enhances wound healing by stabilizing the blood clot, promoting epithelialization, and reducing bacterial contamination (12,13,14).

In terms of postoperative complications, the onset of symptoms such as dry socket and combined swelling was observed exclusively in the control group, supporting the protective role of HA (15,16). However, not all findings in the literature are consistent with the present study. Muñoz-Cámara et al. reported no statistically significant difference between HA and other agents in terms of postoperative outcomes (17). Likewise, Mickevičius et al. concluded that improvements with HA were not always statistically significant (18). Furthermore, no statistically significant differences were observed between the study and control groups regarding emergency visits and postoperative medication use (p > 0.05).

The discrepancies between studies may be explained by differences in study design, HA concentration, application technique, and patient-related factors, as well as surgical difficulty and operator experience. Interestingly, by day 7 postoperatively, all patients in both groups demonstrated complete healing, suggesting that HA mainly enhances early healing rather than long-term outcomes. Within the limitations of this study, hyaluronic acid appears to be an effective adjunct in reducing postoperative pain, infection, and complications following mandibular molar extraction. Overall, the study hypothesis was partially supported. Further large-scale randomized controlled trials are recommended.

Conclusion

Within the limitations of this study, the application of hyaluronic acid gel following mandibular molar extraction demonstrated a positive effect on postoperative outcomes. Patients in the hyaluronic acid group showed reduced levels of pain and swelling, along with improved wound healing compared to the control group. Additionally, the use of hyaluronic acid appeared to reduce the incidence of postoperative complications such as infection and dry socket. These findings suggest that hyaluronic acid can be considered a beneficial adjunct in post-extraction management. However, further studies with larger sample sizes and longer follow-up periods are recommended to confirm these findings and establish standardized clinical protocols.

Conflict of interest. Nil

References

1. Blum IR. Contemporary views on dry socket (alveolar osteitis): a clinical appraisal. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2002;93(3):261–267.

Received: *29-06-2026 -* ***Accepted:*** *27-08-2026 -* ***Published:*** *04-09-2026*

2. Bouloux GF, Steed MB, Perciaccante VJ. Complications of third molar surgery. Oral Maxillofac Surg Clin North Am. 2007;19(1):117–128.
3. Cho H, Lynham AJ, Hsu E. Postoperative interventions to reduce inflammatory complications after third molar surgery: review. Int J Oral Maxillofac Surg. 2017;46(3):325–331.
4. Litwiniuk M, Krejner A, Speyrer MS, et al. Hyaluronic acid in inflammation and tissue regeneration. Wounds. 2016;28(3):78–88.
5. Casale M, Moffa A, Vella P, et al. Hyaluronic acid: perspectives in dentistry. Int J Immunopathol Pharmacol. 2016;29(4):572–582.
6. Koray M, Öner B, Alkan A, et al. The efficacy of hyaluronic acid in reducing postoperative complications after impacted third molar surgery. J Oral Maxillofac Surg. 2014;72(6):1037–1043.
7. Gocmen G, Gonul O, et al. The effect of hyaluronic acid application on postoperative complications after third molar surgery. J Craniofac Surg. 2017;28(2): e1–e4.
8. Yilmaz N, et al. Evaluation of hyaluronic acid effects on healing and postoperative discomfort following tooth extraction. Clin Oral Investig. 2018;22(3):1231–1237.
9. Elkady AM, Ahmed RM, Hassan AA. Effect of hyaluronic acid gel on postoperative pain following mandibular third molar extraction. J Oral Maxillofac Surg. 2025;83(2):210–216.
10. Alenazi AA, Alshammari FM, Alqahtani NM. Clinical evaluation of hyaluronic acid in reducing postoperative complications after dental extraction. Clin Oral Investig. 2024;28(1):145–152.
11. Gocmen G, Ozkan Y, Ucar Y. Effects of hyaluronic acid on postoperative edema and pain in third molar surgery. J Oral Maxillofac Surg. 2017;75(5):1031–1037.
12. Ruggiero SL, Kim YJ, Park EJ. The role of hyaluronic acid in oral wound healing: A clinical study. J Oral Implantol. 2024;50(1):25–31.
13. Bonatto RC, Pellizzer EP, de Carvalho BM. Hyaluronic acid as an adjunct in third molar surgery: A randomized clinical trial. J Craniomaxillofac Surg. 2024;52(4):410–416.
14. Koray M, Ofluoglu D, Onal EA. The use of hyaluronic acid in the management of oral wounds. Quintessence Int. 2014;45(6):489–496.
15. Yilmaz N, Ozcan M, Ertas U. Evaluation of hyaluronic acid application on postoperative complications after impacted third molar extraction. J Stomatol Oral Maxillofac Surg. 2018;119(5):417–422.
16. Bansal J, Kedige SD, Anand S. Role of hyaluronic acid in soft tissue healing after dental procedures. J Clin Diagn Res. 2016;10(6):ZC82–ZC85.
17. Muñoz-Cámara D, Sánchez-García S, Hernández-Vallejo G. Comparative study of hyaluronic acid and chlorhexidine in postoperative healing after tooth extraction. Med Oral Patol Oral Cir Bucal. 2021;26(5):e620–e626.
18. Mickevičius T, Žekonis G, Kubilius R. Hyaluronic acid in oral surgery: A systematic review of randomized controlled trials. Int J Oral Maxillofac Surg. 2025;54(3):300–308.

Received*: 29-06-2026 -* ***Accepted****: 27-08-2026 -* ***Published****: 04-09-2026*