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Efficacy of hyaluronic acid infused Ab Gel on post operative sequelae in patients undergoing lower third molar surgery: A prospective clinical study

Dr. Jagtap Nikita[1], Dr. Vinod Krishna Krishnaswamy*[2], Prof. Dr. Murugesan Krishnan[3], Dr. Santhosh Kumar[4]

[1]Post Graduate Student, Department of Oral and Maxillofacial Surgery, Saveetha Dental College and Hospitals, Saveetha Institute of Medical and Technical Sciences, Saveetha University, Chennai - 600077, Tamil Nadu, India.
Email - 152304006.sdc@saveetha.com
[2]Associate Dean & Clinic Head, Associate professor, Saveetha Oral Cancer Institute, Department of Oral and Maxillofacial Surgery, Saveetha Dental College and Hospitals, Saveetha Institute of Medical and Technical Sciences, Saveetha University, Chennai - 600077, Tamil Nadu, India.
Email - vinodkrishna.sdc@saveetha.com
[3]Head of department, Department of Oral and Maxillofacial Surgery, Saveetha Dental College and Hospitals, Saveetha Institute of Medical and Technical Sciences, Saveetha University, Chennai - 600077, Tamil Nadu, India.
Email - dr.mkm70@gmail.com
[4]Professor, Research head, Department of Oral and Maxillofacial Surgery, Saveetha Dental College and Hospitals, Saveetha Institute of Medical and Technical Sciences, Saveetha University, Chennai - 600077, Tamil Nadu, India.
Email : mpsanthoshkumar.sdc@saveetha.com

*Corresponding author -
Dr. Vinod Krishna Krishnaswamy
Email - vinodkrishna.sdc@saveetha.com

ABSTRACT

Background: Surgical extraction of mandibular third molars often result in complications such as pain, swelling, and limited mouth opening, negatively impacting patient recovery. Hyaluronic acid (HA), recognized for its anti-inflammatory and tissue-healing properties, has been proposed to reduce these adverse outcomes.

Aim: This prospective clinical study evaluated the effectiveness of Hyaluronic acid-infused Ab Gel in minimizing postoperative pain and swelling following lower third molar surgery.

Materials and Methods: Twenty-eight patients requiring mandibular third molar removal were randomly allocated to two groups: Group A (Hyaluronic acid-infused Ab Gel placement into extraction socket) and Group B (no adjunctive intervention). Pain was measured using a 10-point visual analogue scale and swelling was assessed by a four-point facial measurement on postoperative days two and seven. Statistical analysis was performed using the unpaired t-test and Shapiro-Wilk test for normality; significance was set at $P<0.05$.

Results: The Hyaluronic acid-infused Ab Gel group demonstrated significantly lower postoperative pain and swelling compared to the control group. Pain scores and facial swelling were both reduced in the intervention group, with the results reaching statistical significance ($P<0.05$).

Conclusion: Placement of Hyaluronic acid-infused Ab Gel in the extraction socket during lower third molar surgery significantly alleviates postoperative pain and swelling, suggesting its utility as an adjunct in oral surgery. Larger studies are recommended to further validate these findings.

KEYWORDS: Third Molar Surgery, Wisdom Tooth Removal, Hyaluronic Acid Ab Gel, Postoperative Complications.

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INTRODUCTION

Lower third molar surgery is one of the most frequently performed dentoalveolar procedures in oral and maxillofacial surgery and is commonly associated with postoperative pain, facial swelling, and trismus, which may adversely affect patient comfort and quality of life. The severity of postoperative morbidity has been shown to correlate with several factors including patient age, depth and angulation of impaction, duration of surgery, and extent of bone removal. Increasing age has consistently been associated with increased postoperative morbidity due to reduced tissue elasticity and delayed healing responses.[1] Corticosteroids are widely used as adjuncts to minimize postoperative inflammation following third molar surgery.

Although short-term perioperative use (1–3 days) is generally considered safe and effective, corticosteroids may not be suitable for all patients, particularly those with metabolic disorders, immune compromise, or contraindications to steroid therapy.[2] Hence, interest has grown in identifying alternative locally applied agents that can reduce postoperative sequelae without systemic adverse effects. Hyaluronic acid (HA) is a naturally occurring glycosaminoglycan with well-documented anti-inflammatory, angiogenic, and wound-healing properties.

In oral surgery, topical and intra-alveolar application of HA has been reported to reduce postoperative pain, swelling, and trismus following dentoalveolar procedures.[3] The biological effects of HA are influenced by its molecular weight, concentration, and method of delivery. However, optimal local delivery systems that allow sustained presence of HA at the surgical site remain under investigation.

Absorbable gelatin sponge (Ab Gel) is a biocompatible hemostatic material commonly used in oral surgical procedures. When used as a carrier for hyaluronic acid, it may act as a scaffold enabling localized retention and controlled release of HA within the extraction socket, thereby enhancing its therapeutic effects.[4] Despite the availability of multiple studies evaluating HA in third molar surgery, limited literature exists on the efficacy of hyaluronic acid-infused absorbable gelatin sponge in extraction socket as a delivery system.

Therefore, the present study was designed to evaluate the efficacy of hyaluronic acid-infused Ab Gel in reducing postoperative pain and facial swelling following mandibular third molar surgery, compared with conventional socket closure without adjunctive intervention.

MATERIALS & METHODS

Design of the study

This was an in vivo study that was conducted in the Department of Maxillofacial Surgery, Saveetha Dental College and Hospital, Saveetha Institute of Medical Technological Sciences, Chennai. This study was conducted in the time frame of from May 2023 to May 2024. Institutional Ethical Committee clearance was obtained before we began the study (IHEC/SDC/OMFS-2306/23/102). Sample size estimation was performed using G*Power software (version 3.1.9.4), considering an effect size of 0.9 based on previous studies evaluating postoperative pain and swelling following hyaluronic acid application in third molar surgery, with a power of 80% and alpha error of 0.05. The calculated minimum sample size was 12 participants per group. To compensate for potential dropouts, 14 participants were included in each group. The duration of surgery was recorded from the initial incision to completion of suturing. The mean surgical time was comparable between both groups. After obtaining informed consent from the patients, they were allocated into respective groups by a simple random allocation technique. Allocation was followed by using an opaque envelope system. Surgical technique was done by the same principal surgeon and assessment was carried out by the same principal investigator in both groups. Double blinding was followed to prevent bias.

Inclusion criteria

All patients requiring All impacted mandibular third molars included in the study were classified using Pell and Gregory classification and Winter's classification. Only moderately difficult impactions (Class II, Position B) were included to minimize variability. The duration of surgery was recorded from the initial incision to completion of suturing. The mean surgical time was comparable between both groups. Lower third molar impaction surgery irrespective of gender, Patients with age ranging from 20 to 45 years, patients with no systemic diseases are included in the study.

Exclusion criteria

Patients with existing systemic illnesses and pregnancy, mental disability, or bleeding problems, also patients with acute infection in the lower third molar and Having a history of allergies or adverse effects to antibiotics, analgesics, or local anesthetics, patients who use contraceptives or corticosteroids which can affect the postsurgical healing phase and amount of swelling on the face, patients who have difficulty with cooperation, patients with Tobacco use were excluded from the study. cases requiring prolonged operative time (>45 minutes) were excluded from the study.

Surgical procedure

After proper clinical and radiographic examination and diagnosis, under sterile aseptic conditions, standard scrubbing and draping were performed, and the intraoral site was irrigated with povidone-iodine solution. Lignocaine 2% with 1:80,000 adrenaline was administered as an inferior alveolar nerve block, lingual nerve block and long buccal nerve block on the side planned for third molar removal. A modified Ward's incision was placed, and a full-thickness mucoperiosteal flap was elevated, followed by bone guttering using the Moore and Gilbey collar technique. The tooth was elevated and extracted, followed by a standardized quantity of 1 ml of commercially available hyaluronic acid gel was infused into a 1 × 1 cm absorbable gelatin sponge (Ab Gel), which was then placed into the extraction socket prior to suturing with 3-0 silk, and postoperative medications were provided according to the protocol followed at our institution. While in group 2 after removal of lower third molar extraction socket closure was done using 3-0 silk without any intervention.

FIGURE 1: Commercially available Hyaluronic acid injection and Ab Gel

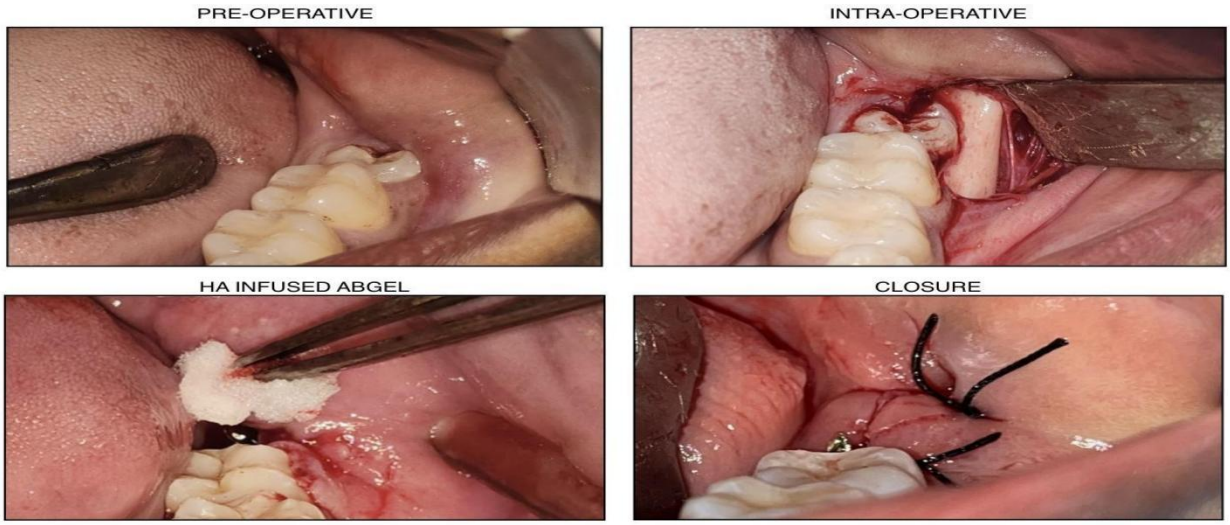

FIGURE 2: Surgical Removal of impacted third molar with placement of Hyaluronic acid infused Ab Gel

Follow-up

Two parameters that were assessed in the postoperative follow-up period were postoperative pain and postoperative swelling and they were compared between two groups. Facial measurement of swelling was done using four-point swelling measurement. As per this technique, four points were chosen, that is, A (lateral canthus of the eye), B (tragus of the ear), C (angle of the mandible), and D (corner of the mouth). The horizontal measurement was done from the corner of the mouth to the tragus (from point B to D). The vertical measurement was done from the lateral canthus of the eye to the angle of the mandible (from point A to C). (figure 3) The mean of the two measurements was taken into consideration for the measurement of the facial swelling. Postoperative pain was assessed using a 10-point visual analog scale where '0' meant "no pain" and '10' meant "worst pain imaginable on day two and day seven postoperatively. (figure 4) This postoperative assessment was done by the same investigator who had carried out the surgical procedure on the patient.

FIGURE 3: Facial measurement of swelling using the four-point technique

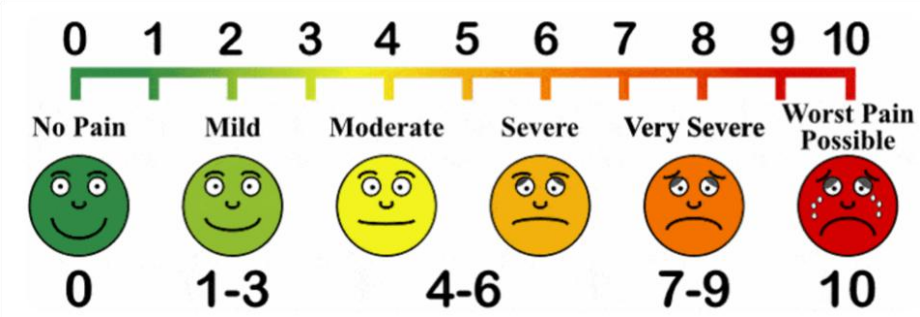

FIGURE 4: Pain assessment using a 10-point visual analog scale

STATISTICAL ANALYSIS

The individual patient data for pain scores and facial measurements were recorded at each follow-up visit and Mean values and standard deviations were used for statistical analysis. The data was collected and analyzed using the IBM SPSS Statistics for Windows, Version 23 (Released 2015; IBM Corp., Armonk, New York, United States) with means and standard deviations with a 95% confidence interval. Since the participants in group A were completely independent of the participants in group B, the unpaired student's t-test was used to compare the independent groups. Shapiro-Wilk test was used to calculate the normality of the data Results were considered statistically significant if the p-value was less than 0.05. Baseline facial measurements were recorded preoperatively to serve as reference values; none of the patients presented with facial swelling prior to surgery.

RESULTS

Our study population consisted of 16 males and 12 females with a mean age of 28 ± 5.3 years. The present study includes two groups: Group 1 (N = 14), in which Hyaluronic acid -infused Ab Gel placement was done into third molar extraction socket and Suturing was performed with 3-0 silk, and Group 2 (N = 14), in which extraction socket closure was done using 3-0 silk without placement of any adjunctive intervention. All measured parameters in both groups showed normal distribution as determined by the Shapiro-Wilk test ($p > 0.05$). Pain and swelling were assessed on postoperative day two and seven in all the patients included in the study at regular follow-up intervals.

Pain measurement -

Pain amongst the participants was assessed via the 10-point visual analog scale. It was found that Hyaluronic acid infused Ab Gel provided consistent pain reduction in the immediate (day 2) with statistically significant difference of 0.001 and value was statistically non-significant on later (day 7) i.e. 0.233 postoperative phases. The values obtained are depicted in

Table 1.

Parameter	Ab Gel (Mean ± SD)	Control (Mean ± SD)	p-value
VAS Preop	4.36 ± 0.74	4.45 ± 0.56	0.234
VAS Day 2	4.76 ± 0.74	5.90 ± 1.12	0.001*
VAS Day 7	2.04 ± 0.74	2.89 ± 1.12	0.233

TABLE 1: Comparison of pain scores among the two study groups * - statistically significant

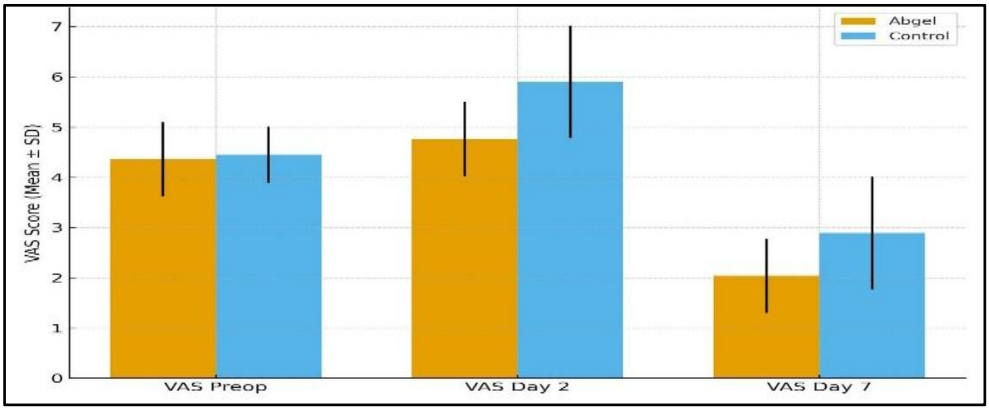

FIGURE 5 : Comparison of VAS score between two groups.

Measurement of swelling -

Baseline Facial measurements were taken pre-operatively and then postoperatively on day two and day seven. This was done using a four-point measurement scale. The mean of the two assessments was considered for assessment. It was found that early postoperative swelling (day 2) differed significantly between groups with statistically significant difference of 0.002 and also by day 7 patients receiving Ab Gel showed a marked reduction in swelling compared to controls with statistically significant difference of 0.001. The values obtained are depicted in Table 2.

Parameter	Ab Gel (Mean ± SD)	Control (Mean ± SD)	p-value
Baseline facial measurements Preop	1.86 ± 0.66	2.29 ± 0.73	0.141 (NS)
Swelling Day 2	8.36 ± 0.39	9.61 ± 0.52	0.002*
Swelling Day 7	2.56 ± 0.51	3.01 ± 0.46	0.001*

TABLE 2: Comparison of swelling values among the two study groups * - statistically significant

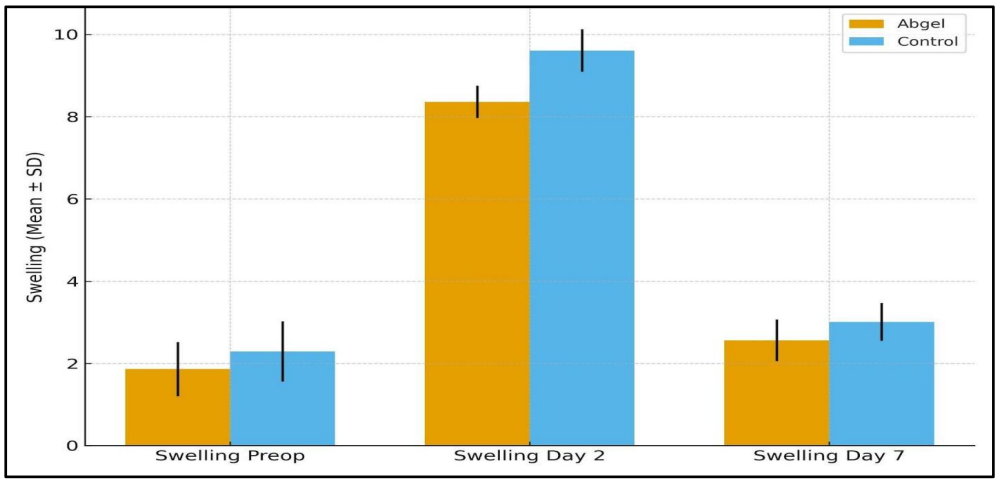

FIGURE 6: Comparison of swelling measurements.

The intervention group reported lower scores for both pain and swelling compared to the control group on both assessment days, with statistically significant differences (pain: $P = 0.001$; swelling: $P < 0.002$). The findings suggest that hyaluronic acid infused Ab Gel is effective in reducing both pain and late postoperative swelling following surgery, highlighting its role as a beneficial adjunct in wound healing and patient comfort.

DISCUSSION

The present randomized clinical study investigated the effectiveness of intra-alveolar placement of hyaluronic acid (HA)–infused absorbable gelatin sponge (Ab Gel) in reducing postoperative sequelae after mandibular third molar surgery. Hyaluronic acid has been widely studied in oral surgical procedures for its anti-inflammatory, anti-edematous, and wound healing properties; however, most previous investigations have evaluated it in the form of topical gels, sprays, or submucosal injections. The current study differs in that it utilized an absorbable gelatin sponge as a localized carrier system, potentially allowing sustained release and prolonged retention of HA at the surgical site.

The statistically significant reduction in early postoperative swelling observed in the intervention group may be explained by the biological role of HA in modulating inflammation. Hyaluronic acid is a naturally occurring glycosaminoglycan present in the extracellular matrix and plays a crucial role in tissue hydration, cellular migration, and angiogenesis.[8] It has been shown to regulate inflammatory mediators such as prostaglandins and cytokines, thereby limiting tissue edema and promoting repair. Additionally, its hygroscopic nature enables it to bind water molecules and stabilize the extracellular matrix, contributing to improved wound healing dynamics. Several studies evaluating topical HA following third molar extraction have demonstrated a reduction in postoperative edema and improved mucosal healing compared

with controls.[9]

The gelatin sponge scaffold used in this study likely enhanced these effects by functioning as a biocompatible hemostatic matrix and controlled-release vehicle. Absorbable gelatin sponges are well known for promoting clot stabilization and providing a temporary framework for tissue in-growth.[10] When impregnated with HA, the sponge may allow gradual diffusion of the bioactive compound, thereby maintaining a therapeutic concentration at the extraction socket for a longer duration than conventional topical application.[11] This method may offer a clinical advantage over simple gel placement, which is susceptible to dilution by saliva and mechanical displacement during mastication and oral function.

Pain intensity was assessed using the Visual Analogue Scale (VAS), while swelling was evaluated using a standardized four-point scale at baseline, second postoperative day, and seventh postoperative day.[12] Although the reduction in swelling was statistically significant in the HA group, pain scores showed significant improvement only on the second postoperative day, with no statistically significant difference by day seven. This pattern aligns with the understanding that HA primarily exerts its effect during the acute inflammatory phase, which peaks within the first 48–72 hours after surgery. Previous randomized studies have similarly reported early reduction in postoperative discomfort and swelling with HA application, though long-term differences often diminish as natural healing progresses.[13]

Interestingly, certain reports have suggested that high concentrations of HA may transiently prolong bleeding time or contribute to early postoperative edema due to its interaction with platelet aggregation and fibrin stabilization.6 However, such effects appear to be dose-dependent and clinically insignificant at therapeutic concentrations commonly used in oral surgical practice.[14] In the present study, no clinically significant increase in bleeding or adverse healing response was observed, indicating that intra-alveolar HA delivered through a gelatin sponge is safe and well tolerated.

Overall, the findings of this study add to the growing body of evidence supporting the beneficial role of hyaluronic acid in oral surgical wound management. By employing an absorbable gelatin sponge as a delivery scaffold, this study demonstrates a practical and effective approach for enhancing local drug retention and improving early postoperative outcomes, particularly in terms of swelling control following mandibular third molar surgery. Further studies with larger sample sizes and biochemical inflammatory markers could provide deeper insight into the mechanistic benefits of this delivery system.

LIMITATION OF STUDY

Though the results were statistically significant, more sample size can help to improve reliability and validity of the findings. Long term follow up is also necessary in order to determine definitive results. Further studies with a larger sample size and specific type of impacted teeth difficulty index to avoid bias has to be done for better treatment.

CONCLUSION

Within the limitations of this study, intra-alveolar placement of hyaluronic acid-infused Ab Gel following mandibular third molar surgery resulted in a significant reduction in early postoperative pain and facial swelling compared to conventional socket closure. The use of Ab Gel as a carrier provides a simple and effective method for localized HA delivery without systemic exposure. Further randomized controlled trials with larger sample sizes and stratification based on impaction difficulty are recommended to validate these findings.

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Conflict of Interest:
The authors declare that there is no conflict of interest in the present study.

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None

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