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Effectiveness of Hyaluronic Acid Local Application in the Socket after Surgical Extraction of Impacted Lower Third Molars. A Prospective Randomized Controlled Clinical Study

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ABSTRACT

Background: Hyaluronic Acid (HA) has been investigated for a long time in various applications. It has been found practically in multiple tissues in humans and other animals. HA is a versatile material. These unusual physicochemical features have been used for various medical objectives.

Aims: Evaluate effectiveness of the local application of Hyaluronic Acid (HA) gel in reducing pain and edema after impacted mandibular third molars removal.

Materials and methods: Fifty patients who met the inclusion criteria whose mean age (25.28) years were randomly allocated to one of two groups. Patients in Group I (study group) had hyaluronic acid gel inserted in the socket after surgical removal of the mandibular third molar (N=25). Group II (control group) had no H.A. put in the socket after surgical removal of the mandibular third molar (N=25). Pernambucco index was used as difficulty scoring to evaluate the cases, decrease bias of results and to give fact results. Type of impaction in our study (62% vertical and 38% mesioangular). Preoperative measurements and postoperative measurements (1st, 3rd and 7th days) for swelling was taken using (Gabka and Matsumara method), and postoperative pain (1st, 3rd and 7th days) was recorded subjectively by (visual analogue scale). The statistical analysis of results was done using the Mann-Whitney U test.

Results: Fifty patients (39 female and 11 male) contributed to this study. No Significant difference has been found between the two groups in pain and facial swelling at different days of assessment during the study (day 1, day 3 and day 7) (p>0.05).

Conclusion: Hyaluronic acid gel decreases pain clinically but is non-significant statistically and has no effect on facial swelling after surgical extraction of impacted lower third molars.

Key words: Hyaluronic acid, Pain, Swelling, Impacted mandibular third molar

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INTRODUCTION

The most prevalent procedure in oral and maxillofacial surgery has been surgical removal of impacted teeth. However, complications such as discomfort, oedema, trismus, nerve injury, bone fractures, adjacent tooth damage, delayed healing, and inflammation can occur during and after surgical extraction of impacted mandibular third molars [1-3]. Multiple factors, including the patient's age, sex, health status, tooth impaction level, surgeon's experience, operation time, smoking, contraceptive medication use, oral hygiene, and surgical technique, may influence the complication rates associated with impacted mandibular third molar extraction. Compared to older people, the amount of discomfort experienced following an operation is more diminutive in younger people. If the surgical procedure is prolonged, the intensity of pain, oedema, and trismus will all rise. In general, the occurrence and severity of these consequences are most closely related to the depth of the impaction and the patient's age [4,5].

All of these issues harm the patient's quality of life. Corticosteroids are commonly used to reduce oedema and trismus associated with third molar surgery. However, if used for a long time, corticosteroids can cause delayed wound healing, increased susceptibility to infection, and adrenal suppression [6,7].

Hyaluronic Acid (HA) is one biomaterial proven to be an effective option for hastening wound healing and

preventing or reducing postoperative inflammation [8]. In all living species, HA is found in synovial fluid, embryonic mesenchyme, skin, and a range of other organs and tissues [9]. In addition, HA interacts with growth factors and regulates osmotic pressure and tissue lubrication. HA binds to a variety of receptors involved in mitosis, cell motility, tumour metastasis, and inflammation. It also contains antibacterial, antifungal, anti-inflammatory, anti-edematous, osteogenic and pro-angiogenetic characteristics, causing wound healing to improve in a range of tissues. HA has been used in dentistry to speed up the healing process in tooth sockets following tooth extraction [10].

Hyaluronic acid has been used to decrease complications after surgical extraction of impacted mandibular third molars. However, there are minor works of literature on evaluating the effect of hyaluronic acid after surgical removal of the third mandibular molar tooth.

MATERIALS AND METHODS

In a prospective randomized clinical study from March 2021 to August 2021, fifty patients were treated in the oral surgery department at the bauquba specialist centre to remove an impacted mandibular third molar. The ethical committee of the university of baghdad's college of dentistry approved the study according to reference number (237 in 20/3/2021 research code 237120). Patients who met the inclusion criteria were randomly assigned into one of two groups. After surgical extraction of the mandibular third molar, patients in Group I (study group) had hyaluronic acid gel placed in the socket (N=25). After surgical extraction of the mandibular third molar, Group II (control group) had no H.A. placed in the socket (N=25). Patients randomization was done using microsoft excel program (excel 2007) where simple random sampling was used to choose the management method (code 1) was assigned to HA group and (code 2) was assigned to control group.

After taking history and clinical examination. All patients before surgical procedure sent for OPG radiography for assessment of third molar eruption preoperatively regarding angulations versus the adjacent second molar, form of the roots, relation with inferior dental canal, depth of impaction and detection of other pathological entities if present elsewhere in the jaws. Some of patients were sent for CBCT scan when there was close relationship between root of impacted mandibular third molar and inferior alveolar nerve seen in OPG film. To determine accurate position of inferior alveolar nerve against roots of impacted mandibular third molar, CBCT is mandatory to reduce risk of nerve injury during surgical extraction.

A Visual Analogue Scale (VAS) was used to assess pain on the first, third, and seventh days after surgery. Swelling assessment five points on the face is used: most posterior point at midline on tragus (A), lateral canthus of eye (B), most lateral point on corner of mouth (C), soft tissue pogonium, which is the most prominent point at midline on chin (D), and most inferior point on the angle of the mandible (E) (Figure 1). The author performed all the clinical assessments, however, the measurements for these three lines, (A to C), (B to E) and (A to D), were recorded three times, then the average will be taken. All measurements were taken preoperatively. The measurement considered as base line data.

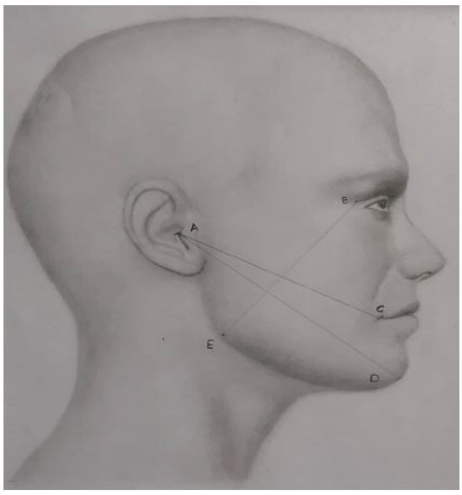

Figure 1: Showing points and lines to measure swelling before and after surgery.

Inclusion criteria

Patients aged 16-40 who necessitate impacted lower wisdom tooth extraction that is free of inflammation and infection.

Exclusion criteria

If any of the following conditions present, patients were excluded:

Smoking more than 10 cigarettes a day, pregnancy, uncontrolled diabetes mellitus, use of bisphosphonate and patient treated with radiotherapy, antibiotics or NSAIDs during the 14 days preceding surgery, patient with bleeding disorders, Patient under immune suppressing drugs.

Surgical procedure

Lidocaine 2% with epinephrine 1:80,000 is used to block the inferior alveolar nerve and infiltrate the long buccal nerve. After that, a full-thickness incision (two-sided flap) was made to access the affected teeth and allow visualization.

After that, the mucoperiosteal soft tissue flap was reflected laterally by a periosteal elevator to expose the impacted tooth and surrounding bone. After flap reflection, osteotomy was done using carbide round bur in straight hand piece under abundant irrigation with normal saline to prevent heat generation and bone damage, odontosection was done if needed by a high speed hand piece with straight fissure bur to section the crown from the root of the tooth.

The socket was inspected for any sharp bone and removed with a bone file after the extraction. After haemostasis was achieved, the socket was irrigated with normal saline to remove all bone particles and debris from the wound. In the study group, 0.8% HA was inserted in the post-extraction socket until it was filled before suture placement and stayed in the socket postoperatively (Figure 2). Nothing was done in the control group. The flap was then replaced and sutured using silk 3.0. After seven postoperative days, all patients had their sutures removed. It is worth noting that the same hands carry out all operations for standardization.

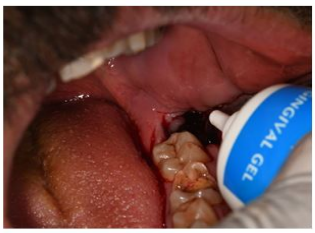

Figure 2: Insertion of hyaluronic acid to socket.

Statistical analysis

The statistical analysis was carried out using IBM SPSS (Statistical Package for Social Sciences) software version 26. To check for normalcy, compare two groups using the Shapiro–Wilks test and the Mann–Whitney U test. It was judged significant when the P-value was less than 0.05.

RESULTS

Fifty patients contributed to this study, including 39 females and 11 males (78% *vs* 22%). All of the pain indices have no significant difference between the two groups on different days of assessment through the study (p>0.05), as shown in (Table 1). Day 1 (p=0.846), day 3 (p=0.689), and day 7 (p=0.845) demonstrate no significant difference in swelling ratings between the two groups (Table 2).

Table 1: Pain parameters of the two groups on different days.

	Study group			Control group			p	Sig
Pain (days)	Mean score	Median score	Mean rank	Mean score	Median score	Mean rank		
P1	2	2	25.2	2.04	2	25.8	0.878	N
P2	0.84	1	23.42	1.2	1	27.58	0.287	N
P3	0.2	0	22.46	0.52	0	28.54	0.061	N

Table 2: Swelling parameters of the two groups on different days.

	Study group			Control group			p	Sig
swelling (days)	Mean score	Median score	Mean rank	Mean score	Median score	Mean rank		
P1	12.55	12.5	25.9	12.57	12.5	25.1	0.846	N
P2	12.29	12.3	26.32	12.32	12.3	24.68	0.689	N
P3	12.05	12	25.9	12.03	12	25.1	0.845	N

Pain parameters in different days regarding to preoperative difficulty according to pernumbucco difficulty scoring system.

There no significant difference between two groups in pain regarding preoperative difficulty in day 1, day 3, except day 7 there is significant difference in low degree between two groups (Table 3).

Table 3: Pain parameters of the two groups on different days according to pernumbucco difficulty scoring system.

			Pain				
Days			Mean	Median	Mean Rank	P*	Sig
P1	Low	Study	1.71	2	11.79	0.882	N
		Control	1.67	2	11.37		
	Moderate	Study	2.19	2	12.25	0.461	N
		Control	2.44	3	14.33		
	High	Study	2	2	1.5	0.157	N
		Control	3	3	3		

P2	Low	Study	1.14	1	13.71	0.217	N
		Control	0.47	0	10.47		
	Moderate	Study	1.31	1	12.91	0.93	N
		Control	1.33	1	13.17		
	High	Study	0.5	0.5	1.5	0.221	N
		Control	2	2	3		
P3	Low	Study	0.43	0	13.71	0.034	S
		Control	0	0	10.47		
	Moderate	Study	0.56	0	13.44	0.65	N
		Control	0.44	0	12.22		
	High	Study	0.5	0.5	1.75	0.48	N
		Control	1	1	2.5		

Swelling parameters in different days regarding to preoperative difficulty according to pernumbucco difficulty scoring system.

There no significant difference between two groups in pain regarding preoperative difficulty in day 1, day 3 and day 7 (Table 4).

Table 4: Swelling parameters of the two groups on different days according to pernumbucco difficulty scoring system.

			Swelling				
Days			**Mean**	**Median**	**Mean Rank**	**P***	**Sig**
P1	Low	Study	12.36	12.3	9.79	0.396	N
		Control	12.57	12.7	12.3		
	Moderate	Study	12.71	12.7	13.41	0.712	N
		Control	12.56	12.2	12.28		
	High	Study	12.25	12.25	2	1	N
		Control	12.3	12.3	2		
P2	Low	Study	12.11	11.8	9.64	0.358	N
		Control	12.3	12.5	12.37		
	Moderate	Study	12.47	12.3	13.63	0.569	N
		Control	12.27	12	11.89		
	High	Study	11.9	11.9	1.75	0.48	N
		Control	12.3	12.3	2.5		
P3	Low	Study	11.99	11.8	10	0.456	N
		Control	12.14	12.3	12.2		
	Moderate	Study	12.11	12	14.03	0.345	N
		Control	11.97	11.8	11.17		
	High	Study	11.6	11.6	2	1	N
		Control	11.5	11.5	2		

DISCUSSION

There was no statistically significant difference in pain scores between the control and study groups from 1 to 7 days in the current study. According to Yilmaz, et al. local application of H.A. gel into the extraction socket may result in a minor reduction in pain. This outcome could be due to several factors, including individual differences in pain thresholds and a small sample size pilot trial involving only 25 patients. This study was in agreement with our study.

In contrast to our findings [11,12], demonstrated an analgesic action of HA that includes covering bradykinin receptors in synovial tissues. The evidence suggested that HA could be used as a pain reliever. In the first, third, and seventh days following extraction, there was no statistically significant difference in postoperative oedema between the control and experimental groups.

HA appears to have a favourable effect on the control of oedema in the initial postoperative period following impacted third molar surgery, according to Merchant, et al. and can be advised for the patient's postoperative comfort. Postsurgical oedema induced by inflammatory processes triggered by surgical trauma to the underlying tissues is better controlled with HA According to Erickson and Stern and Longinotti, et al. the anti-edematous actions of HA may be connected to its osmotic buffering ability (2014) [12,13]. It was discovered that the anti-edematous properties of H.A. may be linked to its osmotic buffering ability.

In contrast, Gocmen G, et al. found that HA gel lengthened bleeding time and increased early postoperative oedema between the periods of (2-3 days) after removal of vertical half impacted lower third molars [14]. This could be because HA, at high concentrations, reduces platelet aggregation and adhesion.

CONCLUSION

1-Hyaluronic acid gel decreases pain clinically but is non-significant statistically. Hyaluronic acid may be of some benefit for pain relief following impacted third molar surgery.

2-Hyaluronic acid has no effect for decreasing swelling after surgical extraction of the impacted mandibular third molar.

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