BMC Oral Health

RESEARCH Open Access

Evaluation of the effect of manual lymphatic drainage method on edema, pain and trismus after impacted bilateral mandibular third molar surgery: a randomized clinical trial

Murat Ulu[1], Nuri Ünal[2*], Onur Şahin[4*] and Yasemin Kayalı[3]

Abstract

Background The aim of this study was to evaluate the effect of manual lymphatic drainage (MLD) on edema, pain and trismus after impacted mandibular third molar surgery.

Materials and methods 46 patients with bilateral impacted mandibular third molar teeth were included in our study. The study was designed as a split-mouth, single-blinded, and controlled randomized clinical trial. Patients in the study group received MLD therapy, while the control group followed routine postoperative care including drug treatment. After extractions, the records were compared statistically and edema, pain and trismus parameters were evaluated on the 3rd and 7th days. The primary outcome variables was swelling and secondary outcome variables were pain and trismus. Swelling was evaluated using the 3dMD FACE SYSTEM (3dMD, Atlanta, GA). To assess pain, the Visual Analog Scale (VAS) was used and trismus was measured using with a digital caliper.

Results The present study was conducted on a total of 46 patients, aged between 18 and 26 years (18.7174 ± 1.50056), with bilaterally similar, symmetrical impacted mandibular third molars. The group consisted of 14 males (30.4%) and 32 females (69.6%). Postoperative edema, pain and trismus were found to be significantly lower in the MLD group compared to the control group ($p < 0.05$).

Conclusion MLD technique is a useful method for reducing postoperative morbidity after impacted third molar extraction. The MLD technique is a simple method free from undesirable side effects and may be more effective than classical methods in reducing edema, pain and trismus after third molar extraction.

Trial registration The trial was registered retrospectively on ClinicalTrials.gov (ID: NCT06787027, on 22/01/2025). Approved by Izmir Katip Celebi University Clinical Research Ethics Committee (Decision No: ID 19, on 15/02/2018).

Keywords Wisdom tooth, Edema, Manual lymphatic drainage, 3dMD

*Correspondence:
Nuri Ünal
dr.nuriunal@icloud.com
Onur Şahin
onursahin43@hotmail.com
[1]Department of Oral and Maxillofacial Surgery, Faculty of Dentistry, İzmir Katip Çelebi University, İzmir, Turkey
[2]Department of Oral and Maxillofacial Surgery, Private Practice, İzmir, Turkey
[3]Physiotherapist, İzmir Atatürk Training and Research Hospital, Atatürk Eğitim ve Araştırma Hastanesi, Basın Sitesi, 35360 Karabağlar/İzmir, İzmir, Turkey
[4]Deparment of Oral and Maxillofacial Surgery, Faculty of Dentistry, İzmir Katip Çelebi University, İzmir, Turkey

Background

Mandibular third molar surgery is one of the most common procedures in oral surgery [1]. Postoperatively, complications such as swelling, pain, and limited mouth opening due to muscle spasm may occur [2]. The presence and severity of these complications depend on factors such as the tooth's impaction, the patient's age, and the surgeon's experience [3]. These postoperative issues can significantly affect the patient's quality of life during the first few days following surgery [4]. The most intense pain is typically experienced within the first 4–5 h after the effects of anaesthesia wear off. Swelling generally peaks within 72 h and gradually subsides over the next 5 to 7 days. As pain and swelling diminish, trismus also resolves [5].

Numerous methods have been proposed to prevent or reduce postoperative symptoms and inflammation. Techniques such as different incision methods, postoperative corticosteroids, compression, drainage tube placement, low-dose laser therapy, cryotherapy, and Kinesio taping are frequently discussed in the literatüre [6–10].

Manual lymphatic drainage (MLD) is a technique that involves manually guiding blocked lymphatic fluid to promote drainage. This method stimulates the lymphatic system, facilitates the removal of biochemical waste from tissues, and reduces swelling by improving fluid dynamics within the body [11]. Unlike traditional massage, MLD involves minimal pressure and rhythmic, painless movements that follow the natural flow of lymph beneath the skin. Numerous physiotherapy studies have demonstrated the effectiveness of MLD in preventing postoperative pain, swelling, and trismus [12–14]. Originally introduced to manage lymphedema and reduce pain following cancer surgeries, MLD has been explored less frequently in the context of oral and maxillofacial surgery.

The aim of this study is to evaluate the effects of MLD on swelling, pain and trismus following mandibular third molar surgery. The null hypothesis of this study is that MLD application after surgery yields better results in reducing pain, swelling, and trismus compared to conventional methods.

Methods

The study was designed as a split-mouth, single-blinded, and controlled randomized clinical trial. It was conducted in accordance with the 1964 Helsinki Medical Protocol and Declaration of Ethics, as well as the Consolidated Standards of Reporting Trials (CONSORT) guidelines for clinical research. Ethical approval was obtained from the Izmir Katip Celebi University Clinical Research Ethics Committee (Decision No: ID 19, on 15/02/2018). The study was retrospectively registered on ClinicalTrials.gov (ID: NCT06787027). Informed consent was obtained from each participant, for both study participation and publication of identifying information/images.

Patients

Sample size was calculated using the data derived from a preliminary analysis on 10 subjects previously conducted by the authors in order to estimate the considered main outcome (swelling) variation. Values obtained from the preliminary analysis and used to perform the sample size calculation. In the power analysis, the sample number was determined as 44, with an error of 5% and a power of 90%.

Of the 60 patients planned to be included in the study; 14 patients were excluded from the study due to the decision by the patient or the physician to postpone the extraction of the other side after the extraction of one side of the impacted third molar, and the non-compliance with the follow-up appointments and the filling out of the forms given to the patients during the study period. The study was conducted on 46 patients, 32 female and 14 male, aged between 18 and 26 (mean: 18.717).

A total of 46 healthy patients who presented to Department of Oral and Maxillofacial Surgery, Faculty of Dentistry, İzmir Katip Çelebi University, for the extraction of impacted mandibular third molars were included in this study. An orthopantomogram (OPG) was taken for each patient. The inclusion criteria were as follows: no recent use of anti-inflammatory medications, symmetrical impactions on both sides, asymptomatic cases, and class 2, position B or C, vertical and mesioangular impactions. Impactions were classified using the Pell and Gregory classification system [15] (Fig. 1).

Exclusion criteria included patients who declined participation, pregnant or lactating individuals, patients with penicillin allergies, those with chronic diseases that could affect healing, presence of pericoronal infection and those who failed to attend follow-up visits.

Randomization

Randomization was conducted with a table of casual numbers by an investigator who was not part of the study and who was blind to the identity of the procedures. The patients were followed-up with manual lymphatic drainage in study group (MLD) and in control group followed by routine post-operative recommendations and drug treatment, and the teeth were extracted at 2-week intervals. The same surgeon (N.Ü) and physiotherapist (Y.K) performed all the procedures and was blinded to previously recorded data. The participants were evaluated by outcome assessors (M.U, O.Ş). Outcome assessors were not aware of the MLD side. For the determination of the standard and individual reliability of the outcome assessors, the intra-rater reliability and inter-rater reliability were calculated.

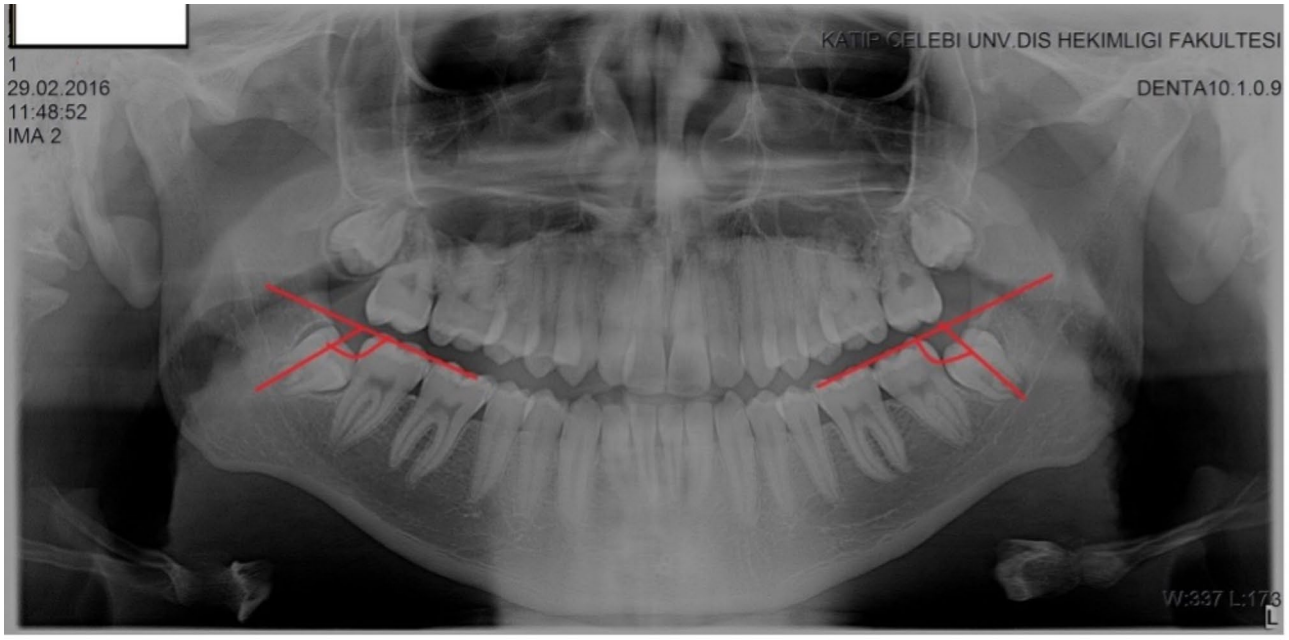

Fig. 1 Orthopantomogram image of a patient with bilateral, symmetrically impacted third molars in the lower jaw

Surgical procedure

Each patient underwent two surgical procedures, spaced two weeks apart. To keep the study unbiased in regard to surgical expertise, only one surgeon (N.Ü) performed all the cases in the present study.

For inferior alveolar and buccal nerve blocks, articaine with 1:200,000 epinephrine (Maxicaine®, VEM İlaç San. ve Tic. Ltd. Şti., Ankara, Türkiye) was administered. A standard triangular mucoperiosteal flap was reflected during both procedures. A sulcular incision was made from the mesial aspect of the second molar and extended posteriorly. From the distal aspect of the second molar, the incision was continued posteriorly and laterally, maintaining contact with the bone. A vertical incision was made at the mesial aspect of the second molar to facilitate reflection of the triangular mucoperiosteal flap. Buccal osteotomy was made using low speed surgical handpiece with round and fissure burs (xhm 244 – 243; Meisinger, Neuss, Germany) under sterile saline cooling with 20.000 rounds per minute. After the extraction, the socket was inspected and curetted to remove granulation tissue, followed by irrigation with sterile saline solution. The flap was sutured using 3/0 silk suture material (3/0, 16 mm, 3/8 circle; Doğsan®, Türkiye). The total surgical time included both incision and suturing. Sutures were removed on the 7th postoperative day.

Postoperatively, patients were prescribed antibiotics (amoxicillin with clavulanic acid, 1 g, twice daily), analgesics (paracetamol, 500 mg, twice daily), and mouthwash (chlorhexidine gluconate, three times daily) for five days. Additionally, the manual yymphatic drainage (MLD) technique was applied by a professional physiotherapist during the postoperative period.

MLD procedure

Following the morning surgery, MLD therapy was administered in the afternoon of the same day by a professional physiotherapist (Y.K) using the "Vodder" technique [16]. The therapy began with the supraclavicular lymph nodes, where edema from the extraction site was expected to drain. Progression towards the extraction area was achieved through step-by-step circular stroking, stationary circles, pumping, and pushing techniques.The direction of lymphatic flow was guided from proximal to distal. This subdermal massage increased capillary lymph flow, facilitating the rapid movement of edema fluid from high-pressure zones to low-pressure zones. As a result, the edema fluid drained first to the submandibular lymph nodes and then to the supraclavicular lymph nodes at a faster rate than normal.

As demonstrated in Figs. 2 and 3, each patient received 40 min of MLD therapy on the day of surgery, followed by two additional sessions over the next two days, with 24-hour intervals between treatments. Patients were provided with a Visual Analog Scale (VAS) and instructed to complete the form as directed. Follow-up appointments were scheduled, and patients were discharged.

Data collection methods

In our study, measurements were conducted by two researchers. Swelling and trismus values were recorded preoperatively (T0), on the 3rd postoperative day (T1), and on the 7th postoperative day (T2). To assess pain, the

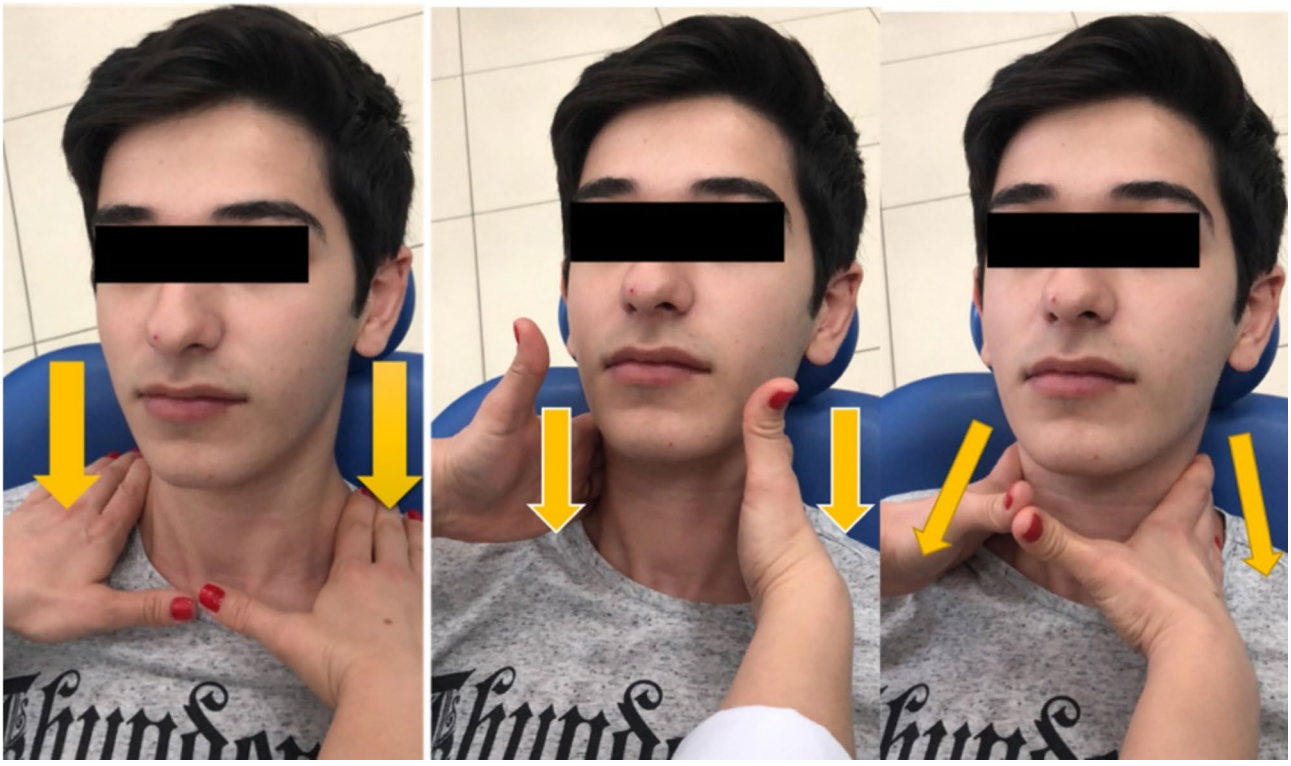

Fig. 2 Stimulation of the supraclavicular lymph nodes, which will drain the edema that will occur in the extraction area, with pumping and pushing techniques. With a pressure of 30–40 mm-Hg from proximal to distal in the direction of lymphatic flow thanks to the applied massage; circulation in the subcutaneous lymph capillaries is increased and edema to drain the liquid faster into this cavity formed from high pressure to low pressure

VAS was used and values were recorded 1, 2, 3 and 7 days postoperatively.

Swelling measurement

In this study, edema was evaluated using the 3dMD FACE SYSTEM (3dMD, Atlanta, GA), which virtually transfers the patient's face into 3D, allowing for the calculation of volume changes. The images were analyzed using 3dMD Vultus software (3dMD), which enables the alignment of six different images on a selected surface. To measure changes in facial volume, all patients were photographed according to the same guidelines for frontal facial images, ensuring that their heads were aligned to the Frankfort horizontal plane, parallel to the ground. Patients sat on a self-adjustable stool and were instructed to look at a mirror displaying simulated standard horizontal and vertical lines, with a red cross mark at the center (Fig. 4).

Linear and volumetric data were measured between the adjusted images. The evaluations were based on the data recorded for each patient at T0, T1, and T2, stored in.tsb file format and transferred to the Vultus application (3dMD). Similar data were recorded for the opposite side of each patient. In total, six images—of the forehead, nasofrontal space, and mentum—were aligned for evaluation.

Following this procedure, anatomical landmarks, including the subnasal, tragion, gonion, and menton, were marked as reference points. A central facial line was drawn, and surface volumes were calculated for both sides of the face.

Pain assessment

To assess pain, the Visual Analog Scale (VAS) was used. A straight line was drawn, where (1) indicated no pain and (10) represented unbearable pain. Patients were instructed to record the level of pain they experienced on postoperative days 1, 2, 3 and 7 on the VAS form provided to them.

Trismus measurement

To determine the effect of MLD therapy on postoperative trismus, the distance between the upper and lower incisors was measured using a digital caliper immediately before the operation, as well as on the 3rd and 7th postoperative days (Fig. 5).

Statistical analysis

The data were analyzed using IBM SPSS Statistics 25.0 (IBM Corp., Armonk, New York, USA). Descriptive data were reported as frequency, percentage, mean ± standard

Fig. 3 Circular stroking, pumping and pushing movements are applied to accelerate lymphatic circulation in the extraction area. The edematous fluid drains first to the submandibular and then to the supraclavicular lymph nodes faster than normal

deviation, minimum and maximum values, median, and 25th percentile.

The normal distribution of numerical variables was assessed using the Shapiro-Wilk normality test and Q-Q plots. For two measurements, paired t-tests were used to compare the differences if the data followed a normal distribution. In cases where the data did not exhibit normal distribution, the Wilcoxon test was applied.

To evaluate the swelling values, t-test was performed twice to see if there was a significant difference between the means of the groups and to compare the means. A p-value of <0.05 was accepted to show a statistically significant difference. The VAS values of the experimental and control groups were compared using Friedman analysis. The Student-Newman-Keuls test was used for multiple comparisons.

Results

Demographic analyses and operative time

The present study was conducted on a total of 46 patients, aged between 18 and 26 years (18.7174 ± 1.50056), with bilaterally similar, symmetrical impacted mandibular third molars. The group consisted of 14 males (30.4%) and 32 females (69.6%). The duration of the operation, from the first incision to the final suture, was recorded. Care was taken to ensure that the time difference between the first and second operations did not exceed 5 min. At the beginning of the study, it was decided that if such a difference occurred, the patient would be excluded from the study; however, no such differences were observed in any patient. The baseline characteristics of the groups, including age, gender, and operation time, There were no differences among the groups regarding of baseline characteristics ($p>0.05$). No complications were evident during study.

Swelling

In the measurements conducted using the 3dMD Face System to evaluate edema, the edema values in the group that received MLD therapy were significantly lower on the 3rd (T0-T1) and 7th (T0-T2) days compared to the control group ($p<0.001$) (Table 1) (Fig. 6). When the average of all measurements was considered, the volumetric changes in the MLD group were found to be significantly lower on both the 3rd and 7th days. These results are consistent with the 3dMD data.

Trismus

On the 3rd day, the maximum mouth opening (MMO) measurements in the MLD group were statistically significantly greater than those in the control group ($p<0.001$). Similarly, on the 7th day, the MMO measurements in the

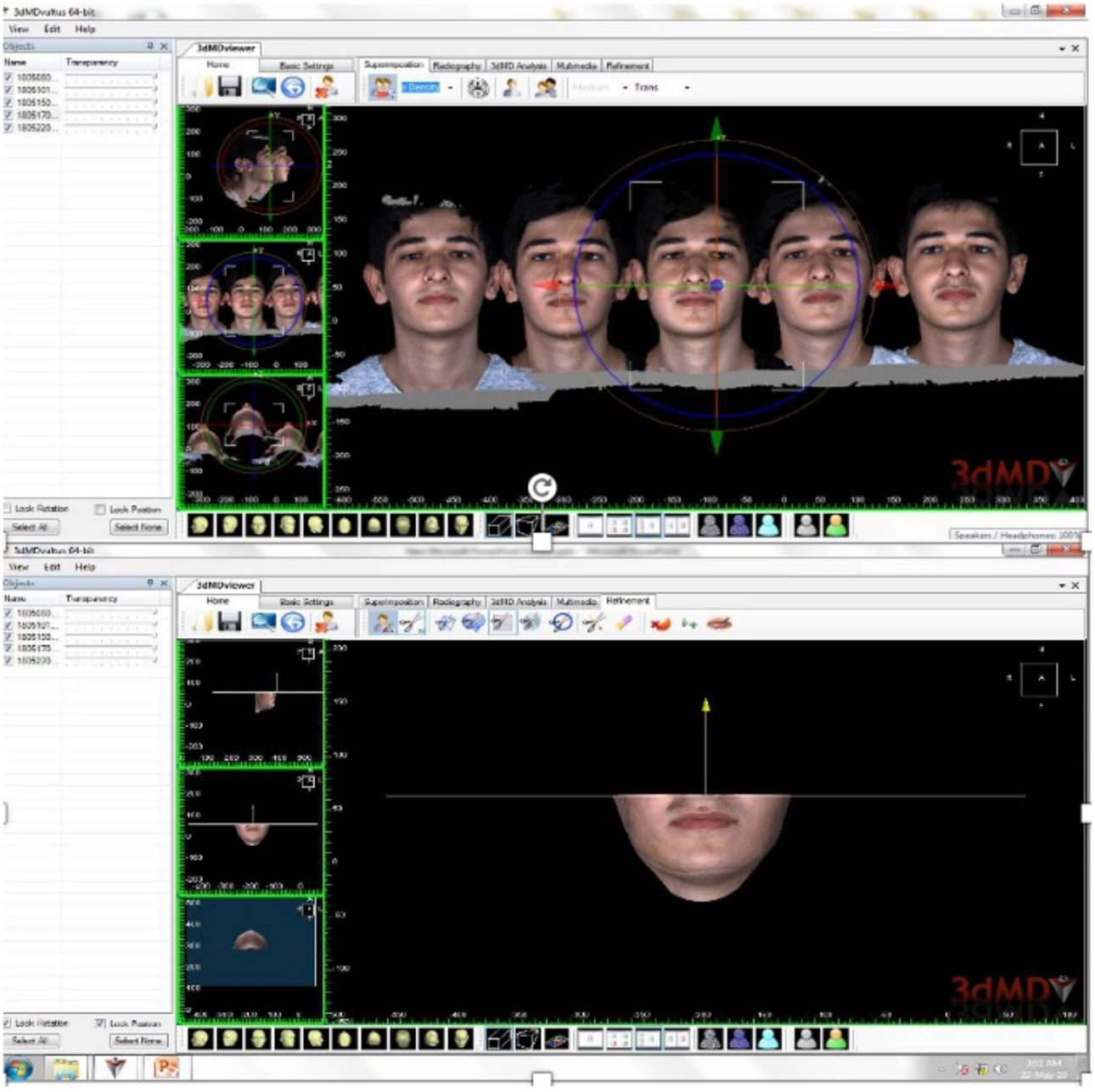

Fig. 4 Calculation of the volumetric differences between the surfaces

MLD group were significantly greater than in the control group ($p < 0.001$). The increase in mouth opening from the 3rd to the 7th day in the MLD group was also found to be statistically significant ($p < 0.001$) (Table 2) (Fig. 7).

Pain

When comparing postoperative pain levels between the groups, the pain levels in the MLD group were observed to be significantly lower on postoperative days 1, 2, 3, and 7 compared to the control group ($p < 0.001$) (Table 3) (Fig. 8).

Discussion

In this study, the effects of the MLD technique on edema, pain and trismus were evaluated in patients who underwent surgery for bilateral impacted mandibular third molars. According to the Pell and Gregory classification, both groups had similar levels of surgical difficulty.

The most common complications associated with third molar surgery include swelling, pain, and trismus [4]. Various methods have been proposed to reduce or limit postoperative inflammation and symptoms. Previous studies have demonstrated that the use of corticosteroids,

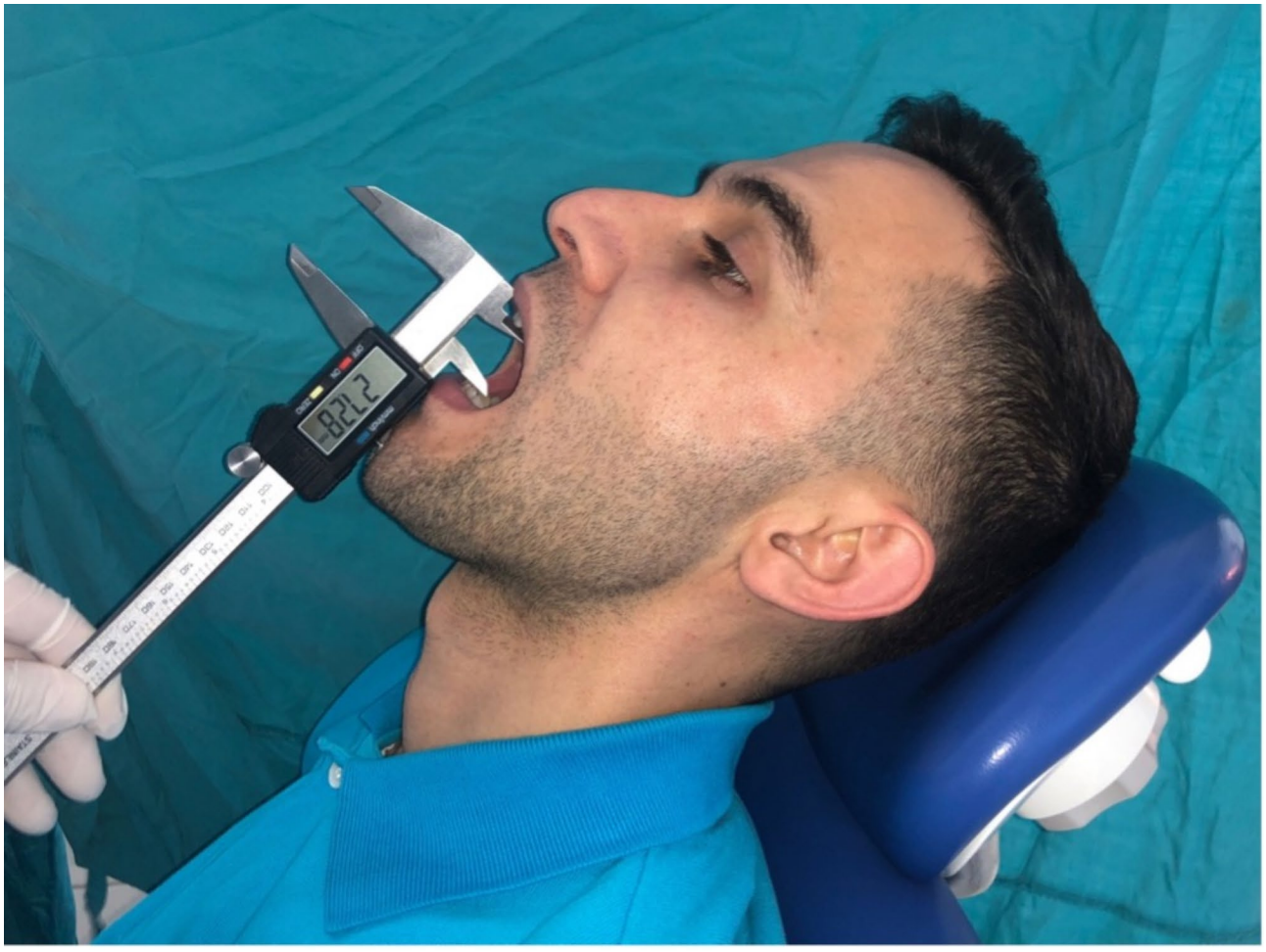

Fig. 5 Measurement of the interincisal distance

Table 1 Comparison of the difference in swelling amounts in matches between and within groups (MLD: manual lymphatic drainage group C: control group T0-T1: first 3 days postoperatively T0-T2: first 7 days postoperatively)

	Mean	*N*	Standart deviation	3dMD (volumetric change)	*P* value
MLD. T0-T1	16,92550	46	1,167812	14,138761	< 0.001*
MLD. T0-T2	2,78674	46	,447,380		
C. T0-T1	26,33267	46	1,565622	15,724109	< 0.001*
C. T0-T2	10,60857	46	,814,075		
MLD. T0-T1	16,92550	46	1,167812	-9,407174	< 0.001*
C. T0-T1	26,33267	46	1,565622		
MLD. T0-T2	2,78674	46	,447,380	-7,821826	< 0.001*
C. T0-T2	10,60857	46	,814,075		

*statistically significant ($p < 0.05$)

NSAIDs, and antibiotics can effectively reduce swelling and pain [7]. However, these medications are known to potentially cause adverse effects on the gastrointestinal system, allergic reactions, and increased bleeding tendencies. As a result, alternative methods are gaining attention, particularly for patients who experience such side effects or have allergies to conventional medications [17].

It is well known that any surgical intervention can alter lymphatic drainage, leading to inflammation and local edema, thereby contributing to the insufficient components of lymphedema dynamics. This aspect of inflammation highlights the need for a method that can enhance the carrying capacity of the lymphatic system [18].

Manual lymphatic drainage (MLD) is a specialized massage technique that promotes lymph flow, improves microcirculation, enhances tissue oxygenation, and reduces swelling and pain. This method can be applied to various parts of the body, including the head and neck region, to alleviate different forms of swelling. In this region, conditions such as lymph stasis encephalopathy, post-cervical trauma lymphedema, trauma-induced increased intracranial pressure, and surgery-related edema are candidates for MLD [19]. Although the use of MLD in oral and maxillofacial surgery remains limited,

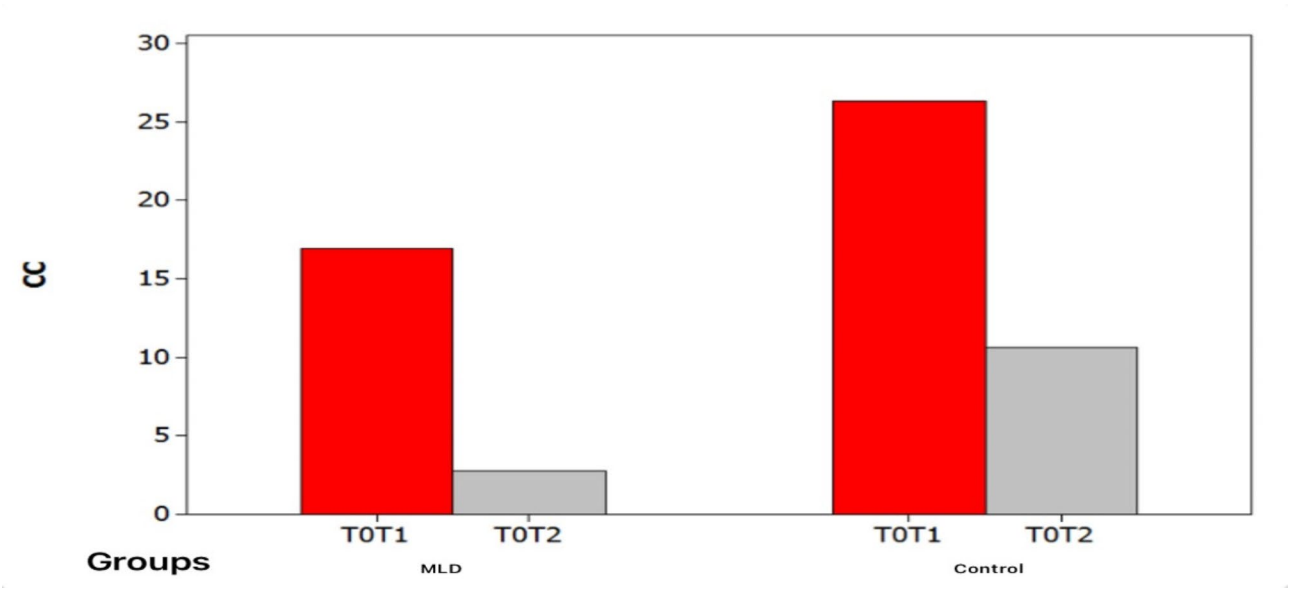

Fig. 6 Comparison of postoperative edema amount in between groups according to 3dMD data

Table 2 Distribution of min. Max. And mean VAS scores by groups

		MLD Group VAS Scores				Control Group VAS Scores			
		1. day	2. day	3. day	7. day	1. day	2. day	3. day	7. day
VAS	Min.	0	0	0	0	1	0	0	0
	Max.	10	7	7	2	10	10	10	7
	Mean	5	2	1	0	7	5	3	0

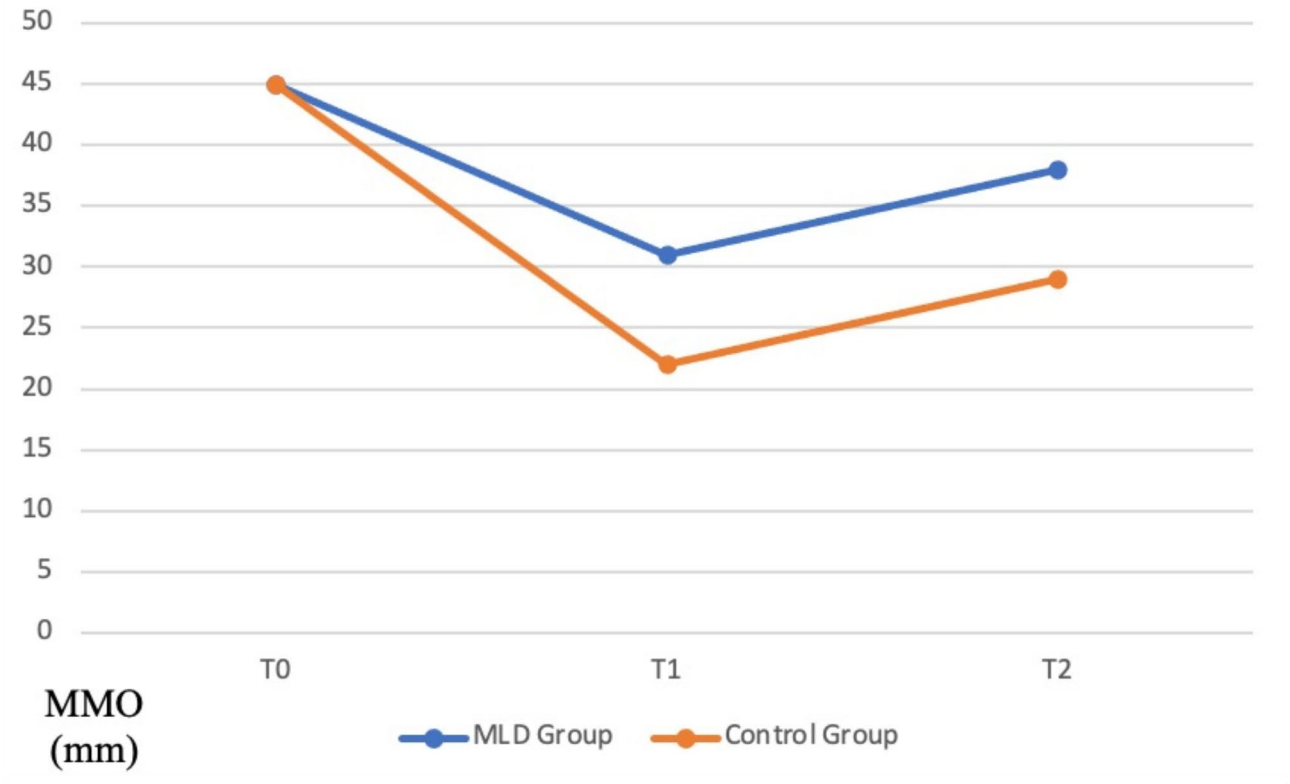

Fig. 7 Postoperative mean maximum mouth opening (MMO) comparison of groups

Table 3 Comparison of the difference in maximum mouth opening amounts in matches between and within groups (MLD: manual lymphatic drainage group control: control group, T0-T1: first 3 days postoperatively, T0-T2: first 7 days postoperatively). *statistically significant ($p < 0.05$)

	Mean	N	Standart deviation	Pvalue
MLD T0-T1 MMO	31,6957	46	9,57977	< 0.001*
MLD T0-T2 MMO	38,5652	46	9,11568	
Control T0-T1 MMO	22,3478	46	6,95131	<0.001*
Control T0-T2 MMO	29,4783	46	8,88379	
MLD T0-T1 MMO	31,6957	46	9,57977	
Control T0-T1 MMO	22,3478	46	6,95131	<0.001*
MLD T0-T2 MMO	38,5652	46	9,11568	
Control TO-T2 MMO	29,4783	46	8,88379	<0.001*

recent studies have shown its application in post-cancer surgeries, traumatic orthopedic conditions, sports injuries, fibromyalgia, and reflex sympathetic dystrophy [20]. The theoretical bases for using the MLD therapy are founded on the following concepts; stimulating the lymphatic system via an increase in lymph circulation, expediting the removal of biochemical wastes from body tissues, enhancing body fluid dynamics, thereby facilitating edema reduction, decreasing sympathetic nervous system responses while increasing parasympathetic nervous tone yielding a nonstressed body framework state.

To our knowledge, this study is the second to evaluate the clinical use of MLD following the surgical extraction of third molars. The aim of this study is to investigate whether the application of MLD in third molar extraction can effectively reduce postoperative edema, pain and mouth opening limitation.

In the postoperative period, MLD therapy has been used in some cases, particularly following the resection of head and neck tumors. In all studies where MLD was applied, it was proven that edema regressed more rapidly compared to control groups [21].

Ferreira et al. [22] applied MLD to 51 patients who underwent alveolar grafting after cleft lip and palate surgery and reported that edema and pain were significantly lower in the MLD group compared to the control group. In a study conducted by Szolnoky et al. [23] on

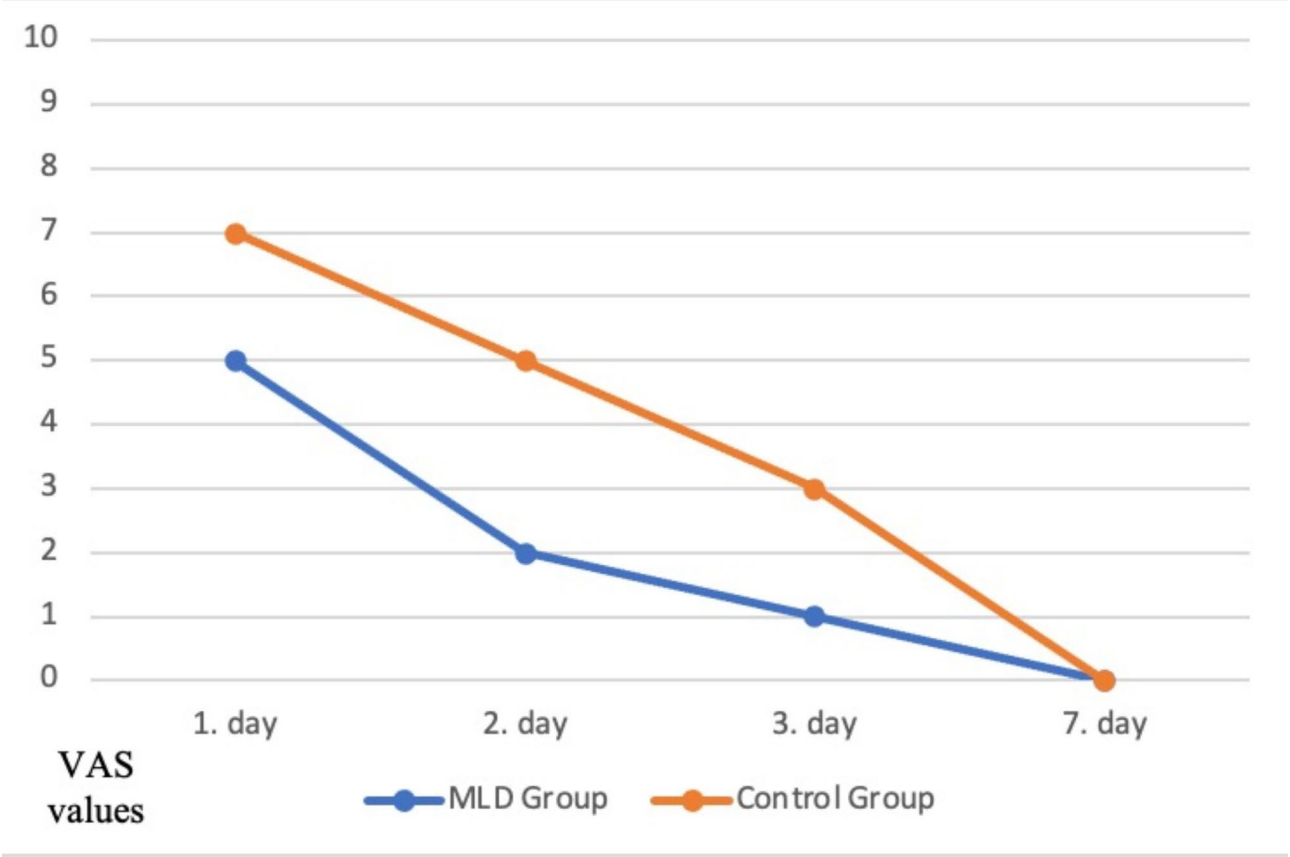

Fig. 8 Comparison of postoperative pain levels according to mean VAS scores of the groups

the impacted third molar of 10 patients, edema and pain in the MLD group were found to be significantly lower compared to the other group. However, in that study, MLD was applied for 3 days after the surgery, and facial measurements were only taken on the 6th postoperative day.

In our study, MLD therapy was applied for 3 days following impacted third molar surgery in 46 patients. To evaluate edema through three-dimensional assessment of facial volumetric changes and ensure standardization, the 3dMD facial scanning system was used. 3dMD images were taken preoperatively, on the 3rd postoperative day, and on the 7th postoperative day, and compared with the control group. When comparing both the edema that formed in the first 3 days and the reduction in edema by the 7th day, it was observed that MLD not only reduced the formation of edema but also facilitated the faster dispersal of existing edema from the area.

In studies investigating the effectiveness of MLD on pain and trismus, Yaedu et al. [24] conducted a study on 30 patients who underwent double jaw surgery and found no significant differences in pain levels between the groups. However, Ferreira et al. [22], in patients with cleft lip and palate undergoing alveolar grafting, and Szolnoky et al. [23], in patients undergoing impacted third molar surgery, found that pain was significantly lower in the MLD group compared to the control group.

In this present study, when the average VAS values on days 1, 2, 3, and 7 were examined, it was observed that MLD significantly reduced pain. Mouth opening was measured using a digital caliper. In the MLD group, mouth opening was found to be statistically significantly higher on both the 3rd and 7th days. This finding is consistent with the VAS and edema values.

Many studies in the literature have shown that steroids and NSAIDs are effective in reducing edema, pain, and trismus. However, considering the potential adverse effects of these drugs, it can be concluded that MLD therapy is a safe and cost-effectiveness method to treat complications after third molar surgery.

Conclusion

Traumatic injuries alter lymph circulation, causing local edema. We believe that MLD indirectly reduces trismus due to its general relaxing effects in the applied area, increased circulation, reduced pain by alleviating pressure on nociceptors, prevention or reduction of protective muscle contractions, and decreased movement restrictions resulting from less or no edema. MLD increases transport capacity of lymph vessels and got a beneficial effect on the soft tissues after surgical removal of impacted third molars.

When discussing the limitations of our study, we cannot overlook the potential effects of placebo and the role of patient perception. The MLD technique is a simple method free from undesirable side effects and may be more effective than classical methods in reducing swelling, pain, and trismus after third molar extraction. The MLD technique reduces the need for all medications such as NSAIDs, steroids, muscle relaxants, analgesics, or antibiotics, as well as the side effects associated with these drugs. Further controlled studies are needed to compare the effectiveness of MLD with other methods and medical agents.

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12903-025-05817-6.

Supplementary Material 1

Acknowledgements
Not applicable.

Author contributions
M.U: Concept and design of the study, review of the literature, data analysis/interpretation, writing the manuscript. N.Ü: Concept and design, critical and scientifc revision of the manuscript, data analysis/interpretation. O.Ş: Concept and design, critical and scientifc revision of the manuscript, data analysis/interpretation Y.K: Concept and design, critical and scientifc revision of the manuscript, data analysis/interpretation. All authors reviewed the manuscript.

Funding
Not applicable.

Data availability
The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request. Data are located in controlled access data storage at İzmir Katip Çelebi University.

Declarations

Ethics approval and consent to participate
It was conducted in accordance with the 1964 Helsinki Medical Protocol and Declaration of Ethics, as well as the Consolidated Standards of Reporting Trials (CONSORT) guidelines for clinical research. Ethical approval was obtained from the Izmir Katip Celebi University Clinical Research Ethics Committee (Decision No: ID 19, on 15/02/2018). The study was retrospectively registered on ClinicalTrials.gov (ID: NCT06787027, on 22/01/2025). Written informed consent was obtained from all participants prior to their inclusion in the study.**Consent for publication**.

Informed consent
was obtained from each participant, for both study participation and publication of identifying information/images. Participants were also informed that the study could be submitted to and published in an online open-access journal. Written and informed consent was obtained from all participants prior to their inclusion in the study.

Competing interests
The authors declare no competing interests.

Received: 10 January 2025 / Accepted: 14 March 2025
Published online: 26 March 2025

References

1. Caputo A, Rubino E, Marcianò A, Peditto M, Bellocchio AM, Nucera R, Oteri G. Three-dimensional facial swelling evaluation of piezo-electric vs conventional drilling Bur surgery of impacted lower third molar: a randomized clinical trial. BMC Oral Health. 2023;23:233.
2. Sifuentes-Cervantes JS, Carrillo-Morales F, Castro-Núñez J, Cunningham LL, Van Sickels JE. Third molar surgery: past, present, and the future. Oral Surg Oral Med Oral Pathol Oral Radiol. 2021;132:523–31.
3. Cho H, Lynham AJ, Hsu E. Postoperative interventions to reduce inflammatory complications after third molar surgery: review of the current evidence. Aust Dent J. 2017;62:412–9.
4. Steel BJ, Surendran KSB, Braithwaite C, Mehta D, Keith DJW. Current thinking in lower third molar surgery. Br J Oral Maxillofac Surg. 2022;60:257–65.
5. Falci SGM, Fernandes IA, Guimarães MTBÁ, Galvão EL, de Souza GM, Al-Moraissi EA. Complementary and alternative therapies for managing postoperative pain after lower third molar surgery: a systematic review and network meta-analysis. Clin Oral Investig. 2024;28:231.
6. Lacerda-Santos JT, Granja GL, Firmino RT, Dias RF, de Melo DP, Granville-Garcia AF, Martins CC. Use of photobiomodulation to reduce postoperative pain, edema, and trismus after third molar surgery: a systematic review and meta-analysis. J Oral Maxillofac Surg. 2023;81:1135–45.
7. Costa MDMA, Paranhos LR, de Almeida VL, Oliveira LM, Vieira WA, Dechichi P. Do blood concentrates influence inflammatory signs and symptoms after mandibular third molar surgery? A systematic review and network meta-analysis of randomized clinical trials. Clin Oral Investig. 2023;27:7045–78.
8. Falci SGM, Guimarães MTBÁ, Canarim NM, Falci SE, Martins OBL, de Souza GM, Galvão EL. Comparison of suture and sutureless techniques on postoperative complications after third molar surgery: a systematic review. Clin Oral Investig. 2024;28:115.
9. Lodi G, Azzi L, Varoni EM, Pentenero M, Del Fabbro M, Carrassi A, Sardella A, Manfredi M. Antibiotics to prevent complications following tooth extractions. Cochrane Database Syst Rev. 2021;2:CD003811.
10. Gözlüklü Ö, Ulu M, Gözlüklü HÖ, Yilmaz N. Comparison of different Kinesio taping techniques after third molar surgery. J Oral Maxillofac Surg. 2020;78:695–704.
11. Korosec BJ. Manual lymphatic drainage therapy. Home Health Care Mang Pract. 2004;17:499–511.
12. Williams A. Manual lymphatic drainage: exploring the history and evidence base. Br J Community Nurs. 2010;15:S18–24.
13. Szolnoky G, Mohos G, Dobozy A, Kemény L. Manual lymph drainage reduces trapdoor effect in subcutaneous island pedicle flaps. Int J Dermatol. 2006;45:1468–70.
14. Fischer M. 30 Jahre Manuelle lymphdrainage Nach Vodder. Eine besondere form der massage Zur Entstauung des gewebes [30 years of manual lymphatic drainage according to Vodder. A special form of massage for decompression of the tissue]. Landarzt. 1967;43:219–20.
15. Almendros-Marques N, Berini-Aytes L, Gay-Escoda C. Evaluation of intraexaminer and interexaminer agreement on classifying lower third molars according to the systems of pell and Gregory and of winter. J Oral Maxillofac Surg. 2008;66:893–9.
16. Vodder E. Vodder's lymph drainage. A new type of chirotherapy for esthetic prophylactic and curative purposes. Asthet Med (Berl). 1965;14:190–1.
17. Varvara G, Bernardi S, Cutilli T, Bianchi S, Sinjari B, Piattelli M. Anti-inflammatory steroid use in impacted third molar surgery: a systematic review. J Biol Regul Homeost Agents. 2017;31:1095–9.
18. Gradalski T, Ochalek K, Kurpiewska J. Complex decongestive lymphatic therapy with or without vodder II manual lymph drainage in more severe chronic postmastectomy upper limb lymphedema: a randomized noninferiority prospective study. J Pain Symptom Manage. 2015;50:750–7.
19. Chikly BJ. Manual techniques addressing the lymphatic system: origins and development. J Am Osteopath Assoc. 2005;105:457–64.
20. Bayat D, Hashemi M, Mahlouji K, Mohammadbeigi A, Parham M, Asghari M. Evaluation of mechanism and applications of different types of massage in current medicine and traditional medicine. Qom Univ Med Sci J. 2019;13:33–44.
21. Pavlov NV, Pechalova PF. Manual lymphatic drainage techniques reduces-postoperative facial swelling after third molar surgery. Arta Med. 2016;1:45–6.
22. Ferreira TRR, Sabatella MZ, Silva TMS, Trindade-Suedam IK, Lauris JRP, Trindade Junior AS. Facial edema reduction after alveolar bone grafting surgery in cleft lip and palate patients: a new lymphatic drainage protocol. Rev Gaúcha De Odontol. 2013;61:341–8.
23. Szolnoky G, Szendi-Horváth K, Seres L, Boda K, Kemény L. Manual lymph drainage efficiently reduces postoperative facial swelling and discomfort after removal of impacted third molars. Lymphology. 2007;40:138–42.
24. Yaedú RYF, Mello MAB, Tucunduva RA, da Silveira JSZ, Takahashi MPMS, Valente ACB. Postoperative orthognathic surgery edema assessment with and without manual lymphatic drainage. J Craniofac Surg. 2017;28:1816–20.

Publisher's note