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Comparison of Various Measurement Methods in the Evaluation of Swelling After Third Molar Surgery

Üçüncü Molar Diş Cerrahisi Sonrası Şişlik Değerlendirilmesinde Çeşitli Ölçüm Yöntemlerinin Karşılaştırılması

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Abstract

Objective: This study aimed to examine the differences between 12 metric swelling evaluation methods in patients undergoing impacted lower third molar surgery.

Material ve Methods: This study was conducted on the patients indicated for the extraction of impacted lower third molar teeth due to orthodontic reasons. Twenty-six patients aged between 18-40 were included in the study. Swelling levels after surgery were measured using anatomic landmarks used for the methods, and the distances between landmarks were measured before the operation, and on days 2 and 7 afterward. The measurements were done using thread and a millimeter ruler while patients were seated. The distances between the anatomical landmarks were evaluated by 12 different methods.

Results: According to the results of the measurements performed on twenty-six patients, (15 male and 11 female) with a mean age of 23.85±6.06 years, male had more swelling than female and the difference was statistically significant ($p<0.05$) although age, and measurement methods had no significant effect on swelling ($p>0.05$).

Conclusion: As a result of the present study; twelve swelling evaluation methods showed significantly similar results and the authors recommended using Method 1 and 5 for convenient clinical evaluation which could be performed with a smaller number of anatomical points.

Key Words: swelling evaluation, impacted third molar, metric method

Özet

Amaç: Bu çalışmanın amacı, gömülü alt yirmi yaş dişi operasyonu geçiren hastalarda eş zamanlı olarak farklı 12 çevresel şişlik değerlendirme yöntemi kullanılarak, bu yöntemler arasında fark bulunup bulunmadığının tespit edilmesidir.

Gereç ve Yöntem: Bu çalışma, gömülü alt üçüncü molar dişlerin ortodontik nedenlerle çekilme endikasyonu olan hastalarda yapılmıştır. Çalışmaya 18-40 yaş arasındaki 26 hasta dahil edilmiştir. Operasyondan sonra şişlik seviyeleri anatomik noktalar arasındaki mesafeler, operasyondan önce ve operasyondan sonra 2. ve 7. günlerde ölçülmüştür. Değerlendirmeler milimetrik cetvel ile hastalar otururken yapılmıştır. Anatomik noktalar arasındaki mesafeler 12 farklı yöntemle değerlendirilmiştir.

Bulgular: Yaş ortalaması 23,85±6,06 yıl olan 26 hastada (15 erkek ve 11 kadın) yapılan ölçüm sonuçlarına göre, daha fazla ödem görülürken($p<0,05$); yaş ve şişlik ölçüm yönteminin şişlik üzerinde anlamlı bir etkisi olmadığı görülmüştür ($p<0,05$).

Sonuç: Bu çalışmada, 12 farklı çevresel ödem değerlendirme yönteminin benzer sonuçlar verdiği görülmüştür. Bu sebeple bu yöntemler arasında, daha az sayıda anatomik nokta arasındaki mesafenin ölçülmesini içeren yöntem 1 ve yöntem 5 klinik kullanım için daha kolay değerlendirme tekniği olarak önerilmektedir.

Anahtar Kelimeler: şişlik değerlendirme, gömülü üçüncü molar, metrik yöntem

Objective

Nowadays, impacted third molar surgery, with various degrees of complications, is one of the most common surgical procedures in clinical practice. Swelling is the most common complication after surgery and postoperative swelling reaches its maximum in 1-2 days, begins to decrease in 3 days, and often disappears in 5-7 days (1-6). Post-surgical edema is associated with the inflammatory response due to tissue trauma. After tissue injury, vasodilation occurs, and blood flow to the wound area increases. Increased

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vascular permeability leads to the spreading of protein-rich fluid between the tissues, causing swelling (5,7-9). Intraoperative factors such as insufficient irrigation, prolonged operation time, difficulty extracting the impacted tooth, excessive retraction of the flap, and insufficient surgical technique, and individual factors such as age, sex, and the presence of a systemic disease leading to increased postoperative edema (10-13). The literature reports the use of subjective (e.g., Verbal Rating Scale, and Visual Analog Scale) and objective (e.g., Stereophotography, MRI, and metric measurements) methods to measure swelling after impacted third molar tooth surgery (2,14-16). The metric measurement method (circumferential, craniometric, or plethysmographic) is used frequently for being simple, easy, inexpensive, time efficient. It is based on measuring the soft tissue contours between reference points on the face before and after surgery. These reference points are often the angulus mandibula, tragus, ala nasi, corner of the mouth (lip), lateral canthus, the point where the earlobe meets the cheek, and the soft tissue chin tip (pogonion) (2,17-22). According to our literature review, researchers often use only one metric method when evaluating swelling by these reference points. There is no study comparing two or more metric methods in the evaluation of swelling. Therefore, this study aimed to examine the differences between 12 metric swelling evaluation methods simultaneously in patients undergoing impacted third molar surgery.

Material ve Methods

This study was conducted on the patients that indicated the extraction of impacted lower mandibular third molar teeth due to orthodontic reasons. This study was carried out at the Department of Oral and Maxillofacial Surgery Clinic of Van Yuzuncu Yil University, with approval from the Clinical Research Ethics Committee (No: 2020/04-35). All experiments were conducted in line with the Declaration of Helsinki. Also, written informed consent forms were obtained from all included patients.

Study Sample: The sample for the research consisted of 30 healthy individuals undergoing impacted lower third molar surgery for orthodontic reasons from July to September 2020. Patients, aged 18-40 years, with no pregnancy, no systemic disease (ASA Class I), no drug allergies, with impacted lower third molar with similar angulation position based on Winter's classification (mesioangular or vertical) and similar impaction degree based on Pell and Gregory's classification (Class I, Level C) with bone retention and the necessity to lift bone for extraction, and no medication 1 week before surgery, were included to the study. Patients, with not regularly coming to the controls, using any additional medication that may affect the outcome of the study, the presence of swelling due to infection or allergies to using any drug in the study, and whose operation took more than 30 minutes were excluded from the study.

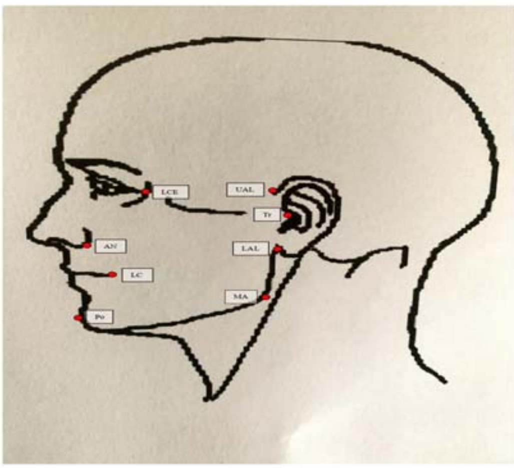
Surgical Procedure: All procedures were carried out by the surgical team. Two ml articaine hydrochloride and 40 mg/ml epinephrine 0.01 mg/ml was used as local anesthesia (Maxicaine Fort, VEM Drug, Istanbul, Turkey). A full-thickness three-cornered mucoperiosteal flap was raised, and abundant irrigation was performed for all surgical procedures. After extraction, granulation tissues were removed. Then, the extraction cavities were irrigated using a sterile 0.9% saline solution. Following bleeding control, mucoperiosteal flaps were repositioned by using 3.0 silk sutures. The patients were prescribed 25 mg dexketoprofen trometamol with a maximum of 2 doses a day postoperatively (Arveles, Ufsa Pharmaceutical Industry, and Trade Co. Ltd. Istanbul, Turkey). All patients were given instructions to follow a soft diet and to avoid mouth washing, brushing, and flossing for the first day. Finally, all patients were prescribed chlorhexidine gluconate 4% mouthwash (Klorhex 200 ml, Drogsan Pharmaceuticals, Ankara, Turkey) with instructions to rinse their mouth 3 times a day for 7 days after surgery.

Data Collection: Swelling levels after surgery were measured using anatomic landmarks, the distances between the landmarks used for the evaluation methods were measured before the operation, and on days 2 and 7 afterward. All measurements were done using thread and a millimeter ruler, while the patients were seated. The distances between the anatomical points were evaluated by 12 different methods that using the averages of single, double, triple, quadruple, or quintet measurements, as reported in the literature or as determined by the researchers (Figure 1, Table 1). Swelling ratios were calculated as (B-A)/A*100; where A stands for mean preoperative measurement and B refers to mean postoperative measurement (postoperative days 2 or 7) (23).

Statistical Analysis The previous researches have reported Standard deviations (σ) ranging from 0.56 to 9 for swelling; thus, the standard deviation value was determined as 5 (24,25). The effect size (d) was calculated as 2 with a Z value of 1.96 and

Table 1: Descriptions of 12 swelling evaluation methods

Group	Distance between predetermined facial anatomical landmarks
Method 1 (Two measurements)	Tragus-Labial comissura, and Tragus-Pogonion (soft tissue)
Method 2 (Three measurements)	Tragus-Labial comissura, Tragus-Pogonion (soft tissue), and Mandibular angle-Lateral corner of the eye
Method 3 (Five measurements)	Mandibular angle-Tragus, Mandibular angle-Lateral corner of eye, Mandibular angle-Ala nasi, Mandibular angle-Labial comissura, and Mandibular angle-Pogonion (soft tissue)
Method 4 (Three measurements)	Mandibular angle-Lateral corner of eye, Mandibular angle-Labial comissura, and Tragus-Labial comissura
Method 5 (One measurement)	Lower part of the auricle lobe-Pogonion (soft tissue)
Method 6 (Three measurements)	Mandibular angle-Lateral corner of eye, Lower part of the auricle lobe-Pogonion (soft tissue), and Upper part of the auricle lobe-Pogonion (soft tissue)
Method 7 (Three measurements)	Lower part of the auricle lobe-Labial comissura, Lower part of the auricle lobe-Pogonion (soft tissue), and Upper part of the auricle lobe-Pogonion (soft tissue)
Method 8 (Three measurements)	Mandibular angle-Lateral corner of eye, Mandibular angle-Labial comissura, and Upper part of the auricle lobe-Pogonion (soft tissue)
Method 9 (Three measurements)	Mandibular angle-Lateral corner of eye, Lower part of the auricle lobe-Labial comissura, and Lower part of the auricle lobe-Pogonion (soft tissue)
Method 10 (Three measurements)	Mandibular angle-Ala nasi, Lower part of the auricle lobe- Pogonion (soft tissue), and Upper part of the auricle lobe-Pogonion (soft tissue)
Method 11 (Three measurements)	Mandibular angle-Ala nasi, Lower part of the auricle lobe-Lateral corner of eye, and Upper part of the auricle lobe-Pogonion (soft tissue)
Method 12 (Four measurements)	Mandibular angle-Lateral corner of eye, Mandibular angle-Ala nasi, Mandibular angle-Labial comissura, and Mandibular angle-Pogonion (soft tissue)



LCE: Lateral corner of the eye, UAL: Upper part of the auricle lobe, Tr: Tragus,
AN: Ala nasi, LAL: Lower part of the auricle lobe, LC: Labial comissura,
MA: Mandibular angle, Po: Pogonion (soft tissue)

Figure 1. Points used in measurements

Table 2: Comparison of swelling between genders independent of methods

	N	Mean	SD	Minimum	Maximum	p
Measurements in Male	180	7.105337	3.6689659	.0000	16.8831	
Measurements in Female	132	6.256979	3.1298748	.0000	20.8333	[a]0.033*
Total	312	6,746416	3.4713687	.0000	20.8333	

[a]Oneway Anova Test; SD: Standard deviation; *p<0.05

Table 3: Swelling change rates according to methods

	2nd day				7th day			
Group	EMM (%)	SD	Min	Max	EMM (%)	SD	Min	Max
Method 1	5.815	3.818	0	13.044	1.851	2.702	0	8.7
Method 2	6.057	2.986	0	12.727	1.736	1.932	0	7.22
Method 3	6.496	2.46	1.98	11.392	1.713	1.591	0	6.45
Method 4	6.743	2.561	1.639	11.539	1.648	2.196	0	8.67
Method 5	8.704	4.853	0	20.833	2.326	2.673	0	8.33
Method 6	6.645	3.07	2.247	14.286	1.861	1.596	0	4.94
Method 7	7.208	3.693	1.191	16.883	1.85	1.858	0	5.19
Method 8	5.968	3.203	1.266	13.889	1.658	1.645	0	5.48
Method 9	8.177	3.352	2.941	14.516	1.793	1.594	0	6.45
Method 10	6.651	3.55	1.099	16.456	1.915	1.82	0	5.06
Method 11	5.849	4.054	0	16.177	1.815	1.831	0	5.88
Method 12	6.645	2.712	2.299	12.5	1.636	1.634	0	6.25
F_{Day} = 118.426; p = 0.001: F_{Method} = 0.079; p = 0.780: $F_{Day\ x\ Method}$ = 0.174; p = 0.679								

EMM: Estimated marjinal mean; SD: Standard deviation

with a type I error of 0.05 and about 80% power. The calculations for sample size yielded a size of 24 ($n=Z^2\sigma^2/d^2$). Data are presented as descriptive statistics (median, mean, standard deviation, minimum, and maximum). The normality of the data was assessed using the Shapiro-Wilks test. The data were analyzed by using Repeated Measures ANOVA and multiple-comparison tests with Bonferroni corrections (α=.05). Pearson correlation analyses were calculated to determine the relationship between methods. The statistical analysis was conducted by using software (IBM SPSS Statistics for Windows, Version 20.0; Armonk, NY: IBM Corp) and the significance level was set to .05 in calculations.

Results

Of the 30 operated patients, 4 were excluded due to not attending their follow-up appointments regularly (3 patients) or due to inconsistency in their data (1 patient). Of the 26 remaining patients, 57.7% (n=15) were male and 42.3% (n=11) were female. These patients had a mean age of 23.85±6.06 years, ranging from 18 to 40.According to swelling measurements, males (7.105±3.669) had more swelling than females (6.257±3.130) and the difference between male and female was statistically significant (p<0.05) (Table 2). Table 3 gives the results of swelling change rates using different metric methods.Examining the day 2 correlations of the methods, at least twice measurements were performed with different distances, there were significant correlations between methods 1 and 4 (r=0.63, p<0.01), methods 6 and 11 (r=0.66, p<0.01), methods 7 and 8 (r=0.63, p<0.01), methods 7 and 11 (r=0.62, p<0.01), and methods 9 and 10 (r=0.48, p<0.05) (Table 4).Examining the day 7 correlations of the methods, at least twice measurements were performed with different distances, there were significant correlations between methods 1 and 4 (r=0.68, p<0.01), methods 3 and 6 (r=0.48, p<0.05), methods 3 and 9 (r=0.48, p<0.05), methods 3 and 10 (r=0.40, p<0.05), methods 3 and 11 (r=0.46, p<0.05), methods 6 and 11 (r=0.62, p<0.01), methods 6 and 12 (r=0.43, p<0.05), methods 7

Table 4: Correlation analysis of swelling measurement methods on 2nd day

	Method 1	Method 2	Method 3	Method 4	Method 5	Method 6	Method 7	Method 8	Method 9	Method 10	Method 11	Method 12
Method 1	1											
Method 2	0.92***	1										
Method 3	0.25	0.32	1									
Method 4	0.63**	0.72***	0.46*	1								
Method 5	-0.26	-0.25	-0.03	-0.19	1							
Method 6	-0.05	0.08	0.11	-0.03	0.58**	1						
Method 7	-0.06	-0.11	0.02	-0.18	0.73***	0.84***	1					
Method 8	0.19	0.28	0.39	0.23	0.17	0.81***	0.63**	1				
Method 9	-0.16	-0.05	0.05	-0.04	0.88***	0.57**	0.72***	0.21	1			
Method 10	0.05	0.03	0.26	0.01	0.59**	0.84***	0.88***	0.84***	0.48*	1		
Method 11	0.23	0.15	0.27	0.06	0.09	0.66**	0.62**	0.88***	0.03	0.82***	1	
Method 12	0.16	0.24	0.93***	0.48*	-0.08	0.09	-0.05	0.39	-0.05	0.23	0.27	1

***$p<0.001$; **$p<0.01$; *$p<0.05$

Table 5: Correlation analysis of swelling measurement methods on 7th day

	Method 1	Method 2	Method 3	Method 4	Method 5	Method 6	Method 7	Method 8	Method 9	Method 10	Method 11	Method 12
Method 1	1											
Method 2	0.93***	1										
Method 3	-0.16	0.15	1									
Method 4	0.68**	0.86***	0.37	1								
Method 5	-0.33	-0.36	0.12	-0.31	1							
Method 6	-0.32	-0.24	0.48*	-0.18	0.76***	1						
Method 7	-0.11	-0.18	0.12	-0.28	0.76***	0.88***	1					
Method 8	-0.17	0.04	0.76***	0.12	0.30	0.79***	0.55*	1				
Method 9	-0.16	0.01	0.48*	0.10	0.75***	0.75***	0.68**	0.54**	1			
Method 10	-0.23	-0.21	0.40*	-0.22	0.74***	0.94***	0.89***	0.79***	0.64**	1		
Method 11	0.04	0.09	0.46*	0.02	0.19	0.62**	0.55**	0.84***	0.29	0.75***	1	
Method 12	-0.07	0.23	0.94***	0.48*	0.12	0.43*	0.08	0.74***	0.43*	0.39	0.46*	1

***$p<0.001$; **$p<0.01$; *$p<0.05$

and 8 (r=0.55, p<0.05), methods 7 and 11 (r=0.55, p<0.01), methods 8 and 9 (r=0.54, p<0.01), methods 9 and 10 (r=0.64, p<0.01), methods 9 and 12 (r=0.43, p<0.05), methods 10 and 11 (r=0.75, p<0.001), methods 10 and 12 (r=0.43, p<0.05), and methods 11 and 12 (r=0.46, p<0.05) (Table 5).

Discussion

Edema occurs due to tissue trauma as a result of an inflammatory reaction to surgical intervention, reducing the comfort of life (26,27).

Previous studies have found that gender has significant effect on the amount of swelling in patients undergoing impacted third molar tooth surgery, while others found no difference between genders (28,29). In this study, more swelling was observed in males compared to females (p<0.05).

Despite the many methods to measure the amount of swelling on the face after surgery, accurate measurement is difficult to achieve due to the topographic characteristics of the area. Measuring an irregular convex surface requires measurements in three dimensions to reflect the swelling in the inner and outer sections (30). However, due to the many disadvantages of using 3D measurement methods, researchers often prefer the metric measurement method, which has been accepted in the literature (20,31-34). While facial swelling can be evaluated via lateral/anteroposterior graphs and photographs, these methods have disadvantages such as not allowing 3D examination, exposure to radiation, and requiring excessive work (35). Although allowing precise 3D measurement, computed tomography has been abandoned in recent years due to its disadvantages such as high costs and unnecessary radiation exposure (36,37). Another useful method after impacted third molar tooth surgery, ultrasonography has the major disadvantage of potentially causing mechanical irritation in the tissue (31,38). While yielding reliable swelling evaluation on-demand, 3D scanners are complex, costly, and time-consuming to use and interpret (21,39). VAS swelling scales where patients carry out evaluations themselves have also been used often in previous studies (40-42). Nonetheless, some researchers find their reliability controversial for including subjective evaluations by patients (22,43). Research comparing the metric method and different methods are scarce. Ulu and Akçay compared metric measurement and 3DMD face scanning system, reporting that either could be used as an alternative to each other (21). Afat et al. examined the correlation between metric measurement and VAS swelling scale and reported that both could be used in evaluating swelling (22). To the best of our knowledge, there is no study comparing the effectiveness of different metric methods in swelling evaluation. In this study, 12 different metric measurement methods were compared in 26 patients, and postoperative day 2 and day 7 results were found to have similar effects. At least 3 lines of different anatomical points were found to be effective and sufficient in evaluating facial edema, provided they include the angulus and the masseter muscle region. In conclusion, as a result of the present study; twelve swelling evaluation methods showed significantly similar results and the authors recommended using Method 1 and 5 for convenient clinical evaluation which could be performed with a smaller number of anatomical points.

Conflict of Interests: The authors have no conflict of interest.

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