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Extraction of Upper Third Molar: A Comparison Study between two Techniques

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Abstract

Purpose: The aim of this study was to evaluate Bayonet forceps with new method of movement extraction of upper third molar.

Methods: This study was a prospective cross over and comparative analysis of two techniques for the extraction of the upper third molar. Bayonet forceps with new movement method and the Straight elevator method were used. This study was conducted at the Dental Teaching Center of Jordan University of Science and Technology.

Results: Twenty-seven teeth were extracted using the Bayonet forceps with new movement method, and 24 teeth were extracted using the Straight elevator. The age range of the patients was 21-48 years (mean 28.76 ±617), and male to female ratio was 1:1. A follow up visit was arranged one week after extraction to check the socket healing and to get information on the post-operative complications. The Bayonet forceps with new movement method was faster than Straight elevator; the duration average was (11.76 ±9.024 and 35.60 ±26.371 seconds) respectively, P value 0.001.

Conclusion: The results of this study suggest, the Bayonet forceps with new movement method has proved to be the faster, atraumatic, and uncomplicated extraction for upper third molars.

INTRODUCTION

Tooth extraction process combines the principles of surgery, physics and mechanics in a single operation. It is still considered an essential part in dentistry despite the huge development in dental disease prevention measures made through previous decades and the increased consciousness created in people on their oral health and the uprising effects of the fluoride applications [1,2]. Generally, the procedure of teeth extraction is subjected to a variety of difficulties and complications. The Dentist need to have good knowledge concerning the anatomy and morphology of the tooth, the direction and extent of the force required for each tooth type, anatomy of the area surrounding the tooth and its adjacent vital structures. Furthermore, a careful preoperative clinical and radiographic examination should be performed to anticipate the possible complications before commencing the extraction procedure [2-4]. Periapical films and Orthopantomogram give precise information on the tooth, its roots, and the surroundings bone.

Large amount of force while delivering a tooth may lead to soft tissue tearing, trauma to the bone or the adjacent teeth, increased patient's discomfort and a higher risk of complications [1]. The difficulties experienced during extracting Upper Third Molar (UTM) are anatomic and topographical conditions, such as poor access, anatomic variants of the roots, weakness of the maxillary bone at the moment of transition to the maxillary tuberosity and strong pneumatization of the maxillary sinus. The aim of this study is to compare Bayonet forceps with new method of movement extraction of (UTM) with the Straight elevator technique, to compare its ability to the degree of access difficulty, the potential intraoperative and postoperative complications.

MATERIALS AND METHODS

The study is a prospective, cross over and comparative analysis of two techniques for extracting the (UTM). This study was conducted at the Dental Teaching Center of Jordan University of Science and Technology, between September 2013 and March 2014. Patients were selected randomly from the patients referred to the Oral and Maxillofacial clinic at the Dental Teaching Center of Jordan University of Science and Technology. Approval was obtained from the Institutional Review Board (IRB), of Jordan University of Science and Technology. All the participants were informed on the objectives of the study before starting the extraction and provided informed written consent. The decision on the selected extraction method was made prior to clinical and radiographic examinations, the first half of the patients were treated by the Bayonet forceps new movement method and the second half by the Straight elevator method.

Inclusion criteria: Patients between the ages of 20 to 60 years, have at least one UTM indicated for extraction, were willing to participate in the study, and had no relevant medical history that contraindicates tooth extraction.

Exclusion criteria: Tooth indicated for surgical extraction, patients suffering from advanced periodontal disease, patients taking medications affecting bone remodeling process (i.e. bisphosphonates), patients suffering from a systemic disease and any bone disease that may affect the jaws.

The preoperative clinical data collected include the age, gender, occupation, contact information, chief complaint, history of chief complaint, dental history, medical history, medications, interincisal space and the indication for extraction. The extraction was carried out by the same surgeon under local anesthesia. Following the clinical examination, all the patients were subjected to orthopantomogram or periapical radiograph. The role of the orthopantomogram was to give the surgeon an idea on the relation of the UTM roots to the maxillary tuberosity, the size of the tuberosity and the proximity of its roots to the floor of the maxillary sinus.

After adequate anesthesia, with the patient's head slightly inclined to posterior and his mouth is wide open in order to detach the gingival tissues surrounding the tooth, the application of the extraction instrument to the tooth and the extraction procedure was started. The extraction time was measured by a stopwatch from the moment of applying the forceps or elevator till the removal of the tooth from the oral cavity.

The straight elevator method

The conventional method was carried out using the Straight elevator. The elevator's blade was guided carefully but positively. The mesial side of the tooth was inserted in the interdental space from buccal side to the contact point, perpendicular to the long axis of the tooth, and horizontally positioned between the root and its supporting bone. Next, a controlled rotation along the long axis of the elevator with slight distally directed force was applied to push the tooth downward and backward. When complete tooth luxation is achieved, the tooth was removed from the patient's mouth by fingers, extraction forceps, or needle holder (Figure 1).

The bayonet forceps with new movement method

The new technique was started by forcing the blades of the Bayonet forceps with strong pressure towards apical, into the periodontal space to gain sufficient grip on the root of the tooth parallel to the long axis of the tooth. At the same time, the thumb and index finger of the left hand are engaged around the UTM. After engaging the root properly, a rotational movement around the long axis of the tooth was applied via the forceps. This was done with slight rotational movements around the longitudinal axis of the tooth. The direction of the rotation depends on the side in which the tooth is situated, a clockwise rotation for the right UTM, and counter clockwise rotation for the left UTM (always towards the palate in both teeth) (Figure 2). After the tooth was luxated, it pulled downwards to compensate for the distal inclination of the root tip (Figure 3).

When the tested extraction method did not succeed in achieving complete luxation of the tooth, it was considered as an unsuccessful case. Finally, the postoperative care instructions were given to the patient. Access difficulties included the followings: Coronoid process proximity to the surgical site, crown malposition, limited mouth opening (≤38mm), cheek flexibility; particularly with patients suffering from obesity, whose cheek is covering the extraction site and is difficult to be properly gag reflex, isolated tooth.

When an extraction complication is evident during the procedure, it was carefully assessed and recorded, and the

Figure 1 The direction of the rotation force applied on the upper third molar using the Bayonet forceps new movement method.

Figure 2 The application of the Bayonet forceps and the steps of applying the extraction movements.

management was performed according to the complication and its severity. Finally, even with the cases that were not associated with complications, a careful visual and digital examination of the delivered tooth, its adjacent second molar and the surrounding soft and hard tissue were performed to confirm the integrity of maxillary tuberosity; which was examined while looking for any bone mobility, using visual examination and palpation.

The collected data was: The pre-operative clinical records, access difficulties, procedure duration (seconds), the extraction method end result, intra-operative complications, roots number, fusion, shape, and configuration, then a photograph of the tooth was taken for documentation. Additionally, any UTM that had single root or whose roots were partially fused was considered as a tooth with fused roots, post-operative complications and socket healing; a follow up visit was arranged one week after extraction to check the socket healing status and to get information about any probable postoperative complications, patients who did not come to the clinic seven days post-operatively were contacted by phone and the required information was collected.

Our data analysis was implemented by using Microsoft excel 2007 and IBM SPSS software package (Version 17). Microsoft excel 2007 was used for data collection and was transformed into SPSS format for further statistical analysis. We used descriptive analysis, Cross tabulation, mean, standard deviation

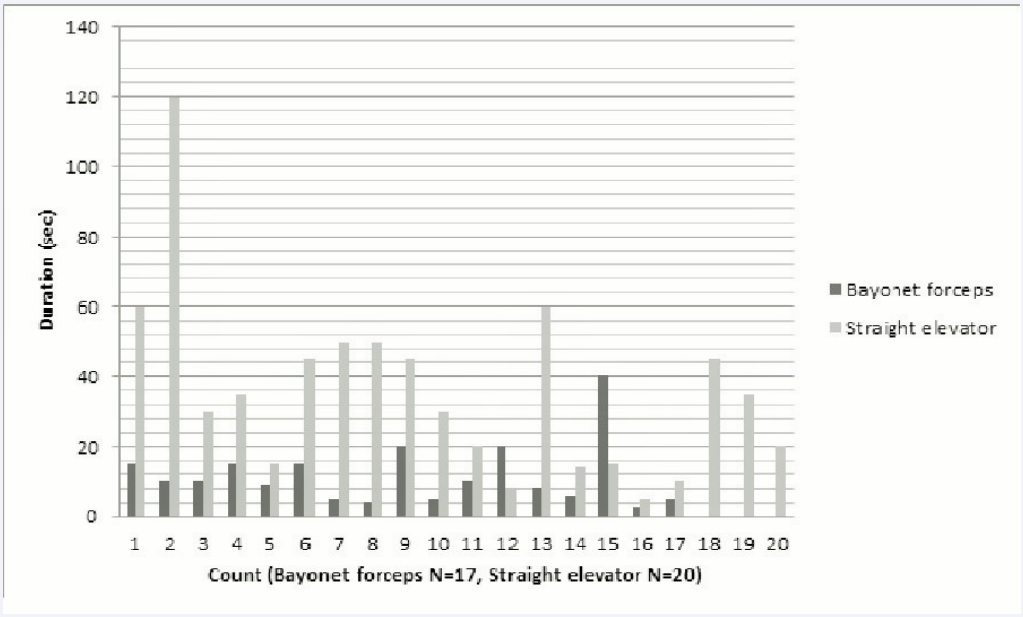

Figure 3 Distribution of the procedures duration for the Bayonet forceps and straight elevator case..

for categorical and two independent samples t-test to describe the explanatory and outcome variables. Statistical significance was determined by p≤ 0.05.

RESULTS

The collected sample was anchored in 51 patients (25 males and 26 females) from a Jordanian population. The age ranged between 21 to 48 years, and mean (SD) 28.76(6.617) years. No significant difference in age between males and females (p<0.935). A total number of 51 UTMs were extracted, 26 from the left side and 25 from the right side no significant difference in sides (p<0.882). Twenty-seven teeth were extracted using the Bayonet forceps new movement method, while the remaining 24 teeth were extracted using the straight elevator method (Table 1). Unsuccessful cases and patients who did not come to the follow up visit or could not be reached by phone were excluded from the study.

The Indications for Extraction were that dental caries in 28(54.9%) cases were the most dominant reason to extract the UTM, next was the prophylactic reasons in 22(43.1%) cases and pain was evident in one (2%) case only. Access difficulties was encountered in 15(29.4%) cases, of which 7(13.7%) cases were within the Bayonet forceps new movement method, and 8(15.7%) cases were within the Straight elevator method. Also, only six access difficulty conditions were evident throughout the study, and they were recorded 23 times, since some cases came across multiple conditions at the same time. Moreover, the coronoid process position showed the highest incidence and was recorded 10 times; while gag reflex and the isolated tooth were the least to encounter and each condition was recorded once only.

Although access difficulties showed an insignificant relation neither to the success rate of both extraction methods nor to the recorded complications, the procedures duration of the cases associated with access difficulties was longer than that of the cases without difficulties, and this finding was more obvious with the straight elevator method. No significant difference in mean duration between cases with and without access difficulties for Bayonet forceps (p<0.955). There is significant difference in mean duration between cases with and without access difficulties for Straight elevator (p<0.021) (Table 2).

Additionally, the mouth opening measurements for all the patients recruited in this study ranged between 34 to 60mm, mean (SD) 45.55 (6.31)mm. For the patients treated by the Bayonet forceps new movement method, the mouth opening mean (SD) was 46.04 (6.37)mm, while for the patients treated with the straight elevator method, the mean (SD) was 45 (6.33) mm.

Table 1: Patients distribution according to age group, gender and side.

Age group (Years)	Males	Females	Total (%)	p-value
≤30	19	19	38 (74.5)	0.935
>30	6	7	13 (25.5)	
Tooth side	**Bayonet forceps**	**Straight elevator**	**Total (%)**	
Right	14	11	25 (49.0)	0.882
Left	13	13	26 (51.0)	

Duration of the Extraction Procedures were the cases in which the specified extraction method was successful in delivering the tooth completely out of the patient's mouth were considered when the statistical analysis of the procedures duration was performed. Moreover, the Bayonet forceps new movement method was clearly a faster extraction method compared to the straight elevator method. The success rate of the Bayonet forceps new movement method reached 63%, whereas the straight elevator method success rate was 83.3%, ($p<0.104$) which revealed an insignificant difference between the two methods. It should be noted that the specified extraction method was considered a failed technique whenever another extraction movement and/or instrument was employed to aid in the successful delivery of the tooth.

Several factors that may have an influence on the success rate of the extraction procedures were recorded and analyzed, these factors include; roots fusion, roots morphology, roots number and access difficulties. However, roots fusion and access difficulties had no influence on the success rate of both methods, while roots number and morphology showed a significant relation to the success rate of the Bayonet forceps new movement method only (Table 3).

The extraction methods examined in the present study were similar in their predisposition to cause intra-operative complications. However, the significant difference was evident in the type of complication associated with each method. Moreover, root tip fracture was the most dominant complication recorded in the study (Table 4). The only post-operative complication recorded in this study was a prolonged pain which disappeared spontaneously within the first week of extraction. Prolonged pain was significantly more common when straight elevator was used and this complication was associated with 3 cases, whilst the Bayonet forceps cases were free of any post-operative issue, the difference was statistically insignificant (Table 4). Furthermore, only 26 cases were considered when performing the statistical calculations of both the post-operative complications and socket healing progress, given that the tested techniques failed in 14 cases and 11 patients did not come for the follow up visit were excluded. On the other hand, socket healing was spontaneous and identical for both methods.

DISCUSSION

The extraction of UTM is considered as one of the most common procedures performed in oral and maxillofacial surgery, and despite the fact that it is regarded as an easy procedure, it is possible to be associated with difficulties and complications which can jeopardize the patient's health and challenge a management. After reviewing the literature to find a similar or a comparable study for UTM extraction, the review revealed that this is the first study comparing the UTM extraction using the Bayonet forceps with the new movement method and the Straight elevator. The Bayonet forceps with new movement method is significantly faster than the Straight elevator method

Table 2: A comparison between access difficulties influence on the duration average of both extraction methods.

Extraction Method	Number of cases	Mean (Seconds)	SD
Bayonet forceps	17	11.76	9.024
Straight elevator	20	35.6	26.371
	Duration average of cases without access difficulties (Seconds)	**Duration average of cases with access difficulties (Seconds)**	**p-value**
Bayonet forceps	11.69 ±9.852	12 ±6.782	0.955
Straight elevator	25.92 ±17.438	53.57 ±31.848	0.021

Table 3: Number and Roots morphology correlated to the success rate of the Bayonet forceps new movement method (N=27).

Roots morphology	Succeeded Cases	Unsucceeded Cases	Total (%)
Conical shape	9	0	9 (33.3%)
All roots are fused but separated apically	2	0	2 (7.4%)
All roots separated	5	4	9 (33.3%)
All fused except one root	1	5	6 (22.2%)
All fused except two roots	0	1	1 (3.7%)
Number of roots			
One root	4	0	4 (14.8%)
Two roots	6	1	7 (25.9%)
Three roots	6	8	14 (51.8%)
Four roots	1	1	2 (7.4%)
Total (%)	**17 (63%)**	**10 (37%)**	**27 (100%)**

Table 4: The intra-operative complications associated with each method of extraction.

Extraction Method	Intra-operative complications (N=12)			Total (%)	p-value
	Crown fracture	Root fracture	Bone fracture		
Bayonet forceps	2	4	0	6 (50%)	0.035
Straight elevator	0	2	4	6 (50%)	
Total (%)	2 (16.7%)	6 (50%)	4 (33.3%)	12 (100%)	
	Post-operative complications(N=26)			Total (%)	0.047
	None	Prolonged pain			
Bayonet forceps	14	0		14 (53.8%)	
Straight elevator	9	3		12 (46.2%)	
Total (%)	23 (88.5%)	3 (11.5%)		26 (100%)	

in delivering the UTM (p=0.001), given that access difficulties in addition to some other factors may not work in favor for the time aspect of Straight elevator method. For both methods, the gender is almost equally distributed with a male to female ratio of 1:1, and this coincide with Lim et al. [1] and Rothamel et al. [2] reports. Whereas in Mexico, Morales-Trejo et al. [3] and Del Rey-Santamaria et al. [4], studies reveal that females are more prevalent than males as regards third molar extraction. This is possible because females have better opportunity for getting dental care in those communities compared to ours. The mean age of the patients in this study was 28, 76 years, and it is similar to that reported by Rothamel et al. [2] and Morales-Trejo et al. [3]. While Contar et al. [5] and Lim et al. [1] reported a relatively lower mean age of the patients requiring third molar extraction, which were 26,14 and 24,5 years respectively.

The most prevailing age group in the present study is 21-25 years (39%) Morales-Trejo et al. [3] reported similar age group ranging between 18-25 years. While, Alesia and Khalil [6] reported a wider age, ranging from 21-30 years with regards to UTM extraction. However, this age range is also in agreement with our data if the study sample is divided into 10 years' groups, hence the group aged 21-30 years will record the highest percentage (74.3%). Rothamel et al. [2] stated that the people aged 25-40 years are dominant on the subject of the third molar extraction.

Our results revealed that the dental caries has the highest incidence as a sign of the UTM extraction, which is followed by the prophylactic reasons and pain as the least reason recorded. McCaul et al. [7] and Alesia and Khalil [6] results coincide with our data as regards caries being the dominant indication for extraction. Though, other reasons such as periodontal problems, infection, prosthodontic and orthodontic purposes, without using the term prophylactic in their reports were listed after caries. In contrast, Chaparro-Avendano et al. [8] and Morales-Trejo et al. [3] are considering the prophylactic reasons as the main indication for third molar extraction. While, Rothamel et al. [2] report shows that the majority of the UTM are asymptomatic when they were extracted. Susarla [9] and Dodson [10] described the access difficulties and called them the anatomical factors. Although they did not include the coronoid process, gag reflex, and the isolated tooth in their studies, they stated that these anatomical factors are of a strong association with the third molar extraction complications. In contrast, our findings reveal an insignificant relation of access difficulties on UTM extraction complications.

The mean for patients' mouth opening in the present study is 45.55mm. The reviewed literature shows an inconsistent diverse measurements ranging from 39.6-51.1mm [10, 11-14], which results in our average findings. Hirsch et al. [15] and Gallagher et al. [11] stated that age and gender have a significant impact on the diversity of people's mouth opening measurement, seeing that females and old people have a smaller mouth opening. However, there is slight disagreement between authors in determining a certain limit of the mouth opening to be considered as an abnormal or limited opening size. Hirsch et al. [15] considered a mouth opening measuring <43mm to be limited, yet this conclusion is based on the mouth opening mean found in his study (mean 51mm), while, Balthazar et al. [16] stated that a mouth opening <39.3mm is abnormal. On the other hand, Celic et al. [17] neglected the scientific border of a restricted mouth opening (40-42mm), and assumed that a limited mouth opening should be considered when its measurement is less than what was recorded in an earlier examination. However, the aim of the current study is not to define the limited mouth opening, its etiology or treatment, but rather to highlight the measurement that would negatively interfere with the proper performance of the extraction method. Hence, a maximum mouth opening ≤38mm is considered as an access difficulty in our study, since we noticed that this measurement is obviously interfering with the proper application of the instruments, proper employment of the extraction movements and obstructing adequate visualization of the extraction site.

Regarding roots fusion, the UTMs investigated in the present study have fused roots (76.5%). Although, Ng et al. [18] and Pecora et al. [19] did not give a definite number on the total fusion percentage, but their final report roughly pointed to 70-75% of fusion rate, and this is consistent with our findings. Ross and Evanchik [20] reported a higher fusion percentage of 86.9%. In

contrast, Alavi et al. [21] stated that the fusion rate did not exceed half of the examined UTMs. Additionally, almost half of the teeth extracted in the present study hold 3 roots, teeth own 2 roots (17.6%), have one root (15.7%), own 4 roots (13.7%), and hold 5 roots (2%). The findings of Ng et al. [18] are comparable to what we found. He declared that 55% of the examined UTMs possess 3 roots; hold 2 roots, 19.4%; and (19.4%) were single rooted. Sidow et al. (22) agrees but in regards to teeth with one and three roots only, which represented 15% and 45% respectively. While, Alavi et al. [21] is not in agreement with all of our findings. He stated that88% of the examined UTMs comprise 3 roots; 2 roots, (6.6%); (4%) with 4 roots, and only 1.3% are single rooted.

Alavi et al [21] Pecora et al [19] and Ross and Evanchik [20] suggested the racial differences between people as an impact factor on the number, size, fusion, and morphological variations of the UTM's roots. In addition to the lack of general guidelines to classify the number and shape of the roots, some difficulties in differentiation between single wide conical root and multiple fused roots maybe encountered. Non-fused roots will increase the tooth anchorage to the bone by the increase of their number, length, shape, and divergence [20]. Rothamel et al. [2] found that only 17% of the Oral Sinus Communication (OSC) cases are related to fully erupted UTMs. While all the cases of OSC and maxillary tuberosity fracture reported by Contar et al. [5], Chiapasco et al. [23], Arrigoni and Lambrecht [24], Del Rey-Santamaria [4], and Lim et al [1] are associated with surgical extraction of impacted UTMs.

Conversely, Chaparro-Avendano et al. [8] did not mention OSC or maxillary tuberosity fracture in his study on the complications of surgically extracted UTMs. Additionally, the UTM is not the most prevalent causative factor for OSC, given that the floor of the sinus is closer to the first or second molar than the third molar [25]. Hernando et al. [26] and Anavi et al. [27] findings revealed that the extraction of upper first and second molars is prone to cause OSC more than the UTM. While, Guven [28] considered the upper second premolar as the tooth most frequently involved with OSC, followed by the upper first molar, and the last is the UTM.

CONCLUSION

In conclusion, the technique described above using Bayonet forceps with new method of movement, has proved to be the faster, atraumatic, and uncomplicated extraction method for upper third molars.

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