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RESEARCH ARTICLE

Tooth Extraction using Vertical, Conventional, and Surgical Techniques in Sebha Dental College: A Descriptive “Cross-sectional Study”

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Abstract:

Objective:

This study aimed to describe different techniques (vertical, conventional, and surgical) used in routine exodontia as well as the most teeth extracted per procedure.

Methods:

A descriptive cross-sectional study using data collected at the Department of Oral Maxillofacial Surgery, the Faculty of Dentistry, Sebha University, from March to December 2021, included 509 participants. The patient's age and gender, techniques of extraction, and tooth type were recorded.

Results:

The study included 509 participants aged 16 to 90. About 38.1% of the participants were male, and 61.9% were female. The conventional technique was the most performed (70.0%), followed by vertical (elevator) (26%), and then the surgical technique. The third molar was the most common tooth extracted by conventional technique. The vertical approach was the most successful for single and multirrooted teeth.

Conclusion:

The result of this study suggests that the vertical extraction method may be used with a high success rate for the extraction of teeth unsuitable for conventional techniques. Therefore, the effectiveness of the exodontia technique is influenced by root morphology, position, and type of tooth.

Keywords: Extraction technique, Vertical extraction, Conventional extraction, Single and multirrooted teeth, Exodontia technique.

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1. INTRODUCTION

Tooth extraction is one of the most common operations performed by general dentists. People have one or more teeth extracted at some point in their lives for a variety of reasons [1]. The process for tooth extraction is mostly determined by the causes of tooth extraction. Patient's permission, x-ray, good light vision, anesthetic, tooth extraction, and socket closure are all required steps in tooth extraction. Single-rooted teeth can be withdrawn directly, but multi-rooted teeth may need to be separated and removed in the same manner as single-rooted

teeth [1, 2]. Teeth with mobility can only be removed with forceps, whereas a decayed bodily tooth requires the use of forceps. Choosing an appropriate approach for safe tooth extraction is a major problem for dental practitioners [3]. The extraction operation is influenced by the instrument and technique used. Converting from a simple extraction to a complicated extraction might be due to selecting the wrong instrument or using the improper technique for extraction [3].

As a result, the transition from easy extraction to difficult extraction affects alveolar bone integrity. Furthermore, excessive instrumentation and poor technique result in bone loss, regardless of postoperative socket treatment [4]. Teeth are typically retrieved 'per forceps' without the use of tooth elevators [5]. According to Boering *et al.* (1976), tooth extraction with a dental elevator is only advised when

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extraction 'per forceps' is impossible. The dental forceps are initially softly grabbed on the crown of the tooth, just above the gingiva, almost subgingivally. The instrument is then gradually introduced apically, utilizing rotational movements until it reaches the alveolar rim and is firmly set on the crown. In a buccolingual or bucco-palatal extraction, the extraction pressures are increased in a buccolingual or bucco-palatal direction. Except for the maxillary central incisors and mandibular premolars, which have round or cylindrical roots, utilizing rotating forces at the start of the tooth extraction technique is not recommended to avoid dental breakage. Once the tooth is partially luxated, rotational maneuvers with the forceps will further weaken the periodontal ligament, allowing for full extraction [6]. The non-extracting hand's thumb and index finger should be used to maintain the alveolar process during this phase [5]. Maximum contact between the tooth and the extraction instrument is required for 'per forceps' extraction.

On the other hand, human teeth have relatively short roots, and diverging roots in multirooted teeth are rare, allowing intact extraction using typical elevator and/or forceps techniques [7, 5]. Tooth sectioning has been recommended for the removal of two or three-rooted molar teeth, and it is frequently initiated by removing the complete crown, followed by subsequent sectioning into single-rooted pieces [6]. For tooth removal in situations of comprehensive dental decay with a higher risk of crown fracture [8, 5] and surgical management of impacted third molar teeth [9], sectioning procedures and the use of more intrusive techniques are more frequently documented. Tooth sectioning is often performed using high speed, a dental handpiece, and a bur [10]. The size and type of bur are determined by the size of the tooth. In human teeth, a fissure bur should be used to make an incomplete cut from the crown level to the furcation [5]. The incompletely cut tooth parts are then separated by introducing a small dental elevator that is torqued.

To enhance tooth/root exposure and assist extraction, surgical methods include the formation of mucoperiosteal flaps and/or the removal of cortical bone [11 - 14]. For the removal of more complex multirooted teeth, these more intrusive procedures are described [15].

As a result, the purpose of this study was to determine the technique of different types of tooth extraction performed at a dental clinic in the Faculty of Dentistry and to give additional data on this topic.

2. METHODS

This is a descriptive cross-sectional study carried out at the Department of Oral and Maxillofacial Surgery in the faculty of Dentistry of Sebha University from March to December 2021. The sample size was estimated, and 509 participants from 16 to 90 years of age were included. The inclusion criteria were as follows; healthy patients, controlled diabetes and hypertension, and permanent teeth, whereas the exclusion criteria included the subjects with oro-facial cancer or under chemotherapy or head and neck radiotherapy and any subjects contraindicated for a radiograph. All patients gave informed consent for the treatment and gave permission to use their information data. The department's ethical committee approved the study

(1/2022). Data were analyzed by the Statistical Package of Social Science (SPSS version 22). A descriptive analysis was performed to calculate the participants' demographic characteristics, frequency, and percentage of types of tooth extraction techniques.

For this analysis, we divided the extraction procedures into; (1) Conventional tooth extraction, defined as the use of forceps, elevators, luxators, and periostomes for tooth extraction. (2) Vertical extraction technique or Elevator instrument technique (remaining root), defined as the success of completely removing the root by using only elevators with a clear protocol for all cases to avoid excessive damage to the dental socket. If there is technique failure, the conventional method may be used, or, if necessary, flap surgical techniques may be employed. (3) Surgical extraction technique (flap surgery): a reflection of the mucoperiosteum flap by using a modified envelop flap (with or without subsequent root removal with a bur). Every patient underwent an appropriate pre-exodontia preparation consisting of an adequate case history report, radiographic examination, and blood test whenever indicated. Then each patient had an intra-oral periapical x-ray and/or panoramic radiograph to assess root length, direction, curvature, decay, periapical pathology, the approximation of vital structures (like maxillary sinus, and inferior alveolar canal), roots fusion in case of multirooted teeth, and other findings like root ankylosis. Following the standard and academic surgical protocol in each extraction technique, the extraction technique was carried out under local anesthesia. Local anesthesia was injected in traditional techniques (IANB for mandibular molars and premolars and infiltration for maxilla and remaining teeth). In addition, patients received one cartridge of lidocaine 2% with adrenalin 1:100000. Subjects were given strict instructions after complete extraction and followed for 3 to 7 days to evaluate tooth socket healing and treat any complication that may occur later, especially in surgical and complicated extraction. All procedures and selection of technique were done by 1 of 5 clinicians with 3 or more years of experience in oral surgery and under the supervision and control of 2 surgeon specialists.

3. RESULTS

The study included 509 participants aged 16 to 90 with a mean age of 41.353 (14.173). About 38.1% of the participants were male at the mean age of 43.850 (14.76), and 61.9% were female at the mean age of 39.815 (13.590). Most participants underwent the conventional extraction technique (70.73%), while the vertical extraction technique (elevator technique) was 26.32%. Surgical extraction (flap surgery) was performed at the Department of Oral and maxillofacial surgery; 2.95% of the participants had surgical extraction (Table 1).

Surprisingly to our result, the third molar was the most teeth extracted by conventional technique, with 123 teeth out of 360 (34.16%), followed by the first molar (25.6%), the least extracted teeth were the lateral incisors (1.94%). In contrast, the first molar was the most extracted tooth by vertical (elevator) technique (23.9%), followed by the first premolar (22.39%), where the last teeth similar to the conventional technique were the lateral incisor teeth with the same

percentage (1.94%). The surgical technique was only used in the third molar extraction in this survey (Table 2).

About 134 of 509 teeth (26.32%) were extracted using the vertical (elevator) technique. The success rate of the vertical extraction technique showed a slight difference between single-rooted teeth (50.7%, 68 of 134 teeth) and multirooted teeth (49.3%, 66 of 134 teeth). On the other hand, the conventional technique revealed significant variances in the success rate between single-rooted and multirooted teeth (24.2% and 75.8%, respectively). However, the surgical technique was

only performed for the extraction of multirooted teeth in this study (Table 3).

During the routine care period, 27 anterior teeth were extracted by conventional technique, and only 15 teeth were extracted by vertical technique. Sixty pre-posterior teeth were extracted by conventional and 35 by vertical technique. At the same time, the three mentioned techniques were used for posterior tooth extraction. The most used technique was conventional (237 teeth), vertical (66 teeth), and surgical (15 teeth) (Table 4).

Table 1. Distribution frequency of procedure types.

| Type of Procedures | Frequency | Percent |
|--|-----------|---------|
| Conventional extraction | 360 | 70.73% |
| Using forceps only | 170 | 47.5% |
| Using elevator only | 100 | 27.5% |
| Using both | 90 | 25% |
| Total | 360 | 100% |
| Vertical extraction technique (remaining root) | 134 | 26.32% |
| Surgical extraction | 15 | 2.95% |
| Partially impacted | 10 | 66.67% |
| Totally impacted | 5 | 33.33% |
| Total | 15 | 100% |
| Total | 509 | 100% |

Table 2. Distribution of tooth type per extraction technique.

| Type of Tooth | Conventional Technique | - | Vertical (elevator) Technique | - | Surgical Technique | - |
|------------------|------------------------|--------|-------------------------------|--------|--------------------|------|
| Central incisors | 8 | 2.23% | 4 | 2.99% | - | - |
| Lateral incisors | 7 | 1.94% | 2 | 1.94% | - | - |
| Canine | 12 | 3.33% | 9 | 6.72% | - | - |
| First premolar | 27 | 7.5% | 30 | 22.39% | - | - |
| Second premolar | 33 | 9.16% | 23 | 17.16% | - | - |
| First molar | 92 | 25.6% | 32 | 23.9% | - | - |
| Second molar | 58 | 16.11% | 24 | 17.91% | - | - |
| Third molar | 123 | 34.16% | 10 | 7.62% | 15 | 100% |
| Total | 360 | 100 | 134 | 100 | 15 | 100 |

Table 3. Distribution of morphology of roots and techniques.

| Morphology of Root | Conventional Technique | % | Vertical (elevator) Technique | % | Surgical Technique | % |
|--------------------|------------------------|-------|-------------------------------|-------|--------------------|------|
| Single-rooted | 87 | 24.2% | 68 | 50.7% | - | - |
| Multi-rooted | 273 | 75.8% | 66 | 49.3% | 15 | 100% |
| Total | 360 | 100% | 134 | 100% | 15 | 100% |

Table 4. Distribution of teeth technique.

| - | Anterior Teeth (Incisors and Canine) | Pre-posterior Teeth (Pre-molars) | Posterior Teeth (Molars) |
|-------------------------------|--------------------------------------|----------------------------------|--------------------------|
| Conventional Technique | 27 | 60 | 237 |
| Vertical (elevator) technique | 15 | 53 | 66 |
| Surgical technique | - | - | 15 |

4. DISCUSSION

The study described the common tooth extraction technique practiced at the Department of Oral and Maxillofacial Surgery. Most patients who underwent tooth extraction were female with multirooted teeth. This is inconsistent with another study which was conducted in the Surgery Department of Khyber College of Dentistry, Peshawar, in which 61.5% of patients were females compared to males [16]. Furthermore, the difference from our study was found in a South American study where the gender ratio was similar across all age groups [17]. On the other hand, our findings were consistent with a cross-sectional study of dental trainee tooth extraction [18]. The dental student used many techniques. In this study, vertical (elevator) extraction outperformed conventional extraction for both single and multirooted teeth. Hong *et al.* (2018) carried out a prospective study to compare the vertical and traditional approaches. When compared to the usual extraction approach, vertical extraction had a higher success rate [19]. This outcome was strikingly comparable to our findings. Vertical extraction has a high success rate, indicating that it can be applied for removing decayed teeth, particularly multirooted teeth. Root fractures or cavities that extend to the root, on the other hand, may reduce the success probability of vertical root extraction using merely an elevator. Only severely decayed teeth or residual roots and root shapes were recruited to determine the failure risk. It revealed considerable differences between single and multirooted teeth (depending on root morphology), with single-rooted teeth outperforming multirooted ones [20]. This could be due to the thickness of the alveolar bone in some areas as well as the close proximity of the essential structure to the extraction socket. Failure to extract a root or roots using a traditional strategy, that is, utilizing luxators or elevators, often occurs because no point of application can be discovered, and, as a result, significant lateral and extrusive forces cannot be obtained. As a result, standard tooth extraction procedures are more likely to fail in the dense and more compact mandible than in the maxilla [21, 22].

Prasanna *et al.* conducted the prospective study which was obtained from 100 patients (50 for each technique). It showed that the Physics Forceps had a 94% success rate in extraction, caused minimal discomfort to the operator and the patient, and caused the alveolar bone defect. In contrast, the conventional technique had a 78% success rate in extraction and caused mild discomfort to the operator and the patient [23].

The conventional technique often causes damage ranging from mild gingival tissue lacerations to complete loss of the buccal bony plate and interdental bone crest [24]. Some other complications include trismus, dry socket, postoperative pain, and if bony dehiscence exists apical to the free gingival margin or the labial bone is very thin, it may lead to significant bone resorption during the natural healing process of the dental socket [25]. These complications cause postoperative discomfort to the patient and lead to bone defects, difficulty in prosthetic replacement, and aesthetic and functional problems.

The literature on the incidence of flap surgery for tooth extraction is scarce but still in a considerable proportion for the exodontia technique. For instance, a retrospective study

reported that 17% of non-impacted single-tooth extractions required flap surgery [26]. However, our study found that flap surgery was only needed in 15 (2.95%) impacted the third molar. Interestingly, our result indicates that conventional and vertical (elevator) techniques are used only in tooth extraction, whether badly decayed or remaining root, without flapping surgery. On the opposite, another study reported that flap surgery was needed in the extraction (22%) of anterior teeth and premolars and also in the vertical extraction system (6%) of teeth [19]. These results indicate that the proper use of the conventional and vertical (elevator) technique may be associated with a marked reduction in the need to perform flap surgery in cases unsuitable for forceps extraction.

To effectively consider the extraction technique and operation, a surgeon should avoid any excessively traumatic extraction that leads to increased bone remodeling and, eventually, bone loss. Whatever technique is chosen, the surgeon should go into all exodontia treatments prepared and confident, with the essential clinical skills, surgical equipment, and knowledge to make the procedure less traumatic for both the patient and the surgeon. Fortunately, newer systems and techniques for dental extraction have evolved in the recent few decades, making simple, complex, and surgical extraction more predictable and efficient with improved patient outcomes [27]. This includes physics forceps, powered periostomes, piezosurgery, benex extractors, lasers, and sonic instruments for bone surgery. Unfortunately, the majority of these revolutionary treatments are not currently available to all internship students and dental professionals at Libya's Faculty of Dentistry. As a result, we continue to teach exodontia at dental school using the old method.

The risk ratio is not investigated to reflect the variations between the indicated methodologies, which is one of our limitations. Furthermore, the case definition in this study may be more precise, such as noting single and multirooted teeth to explain whether they are entire teeth or remaining roots. Furthermore, the absence of comparable studies in the literature allows us to compare our findings with the results of other studies.

CONCLUSION

To summarize, the findings of this study indicate that the vertical extraction approach can be utilized successfully for tooth extraction that is inappropriate for conventional techniques. Due to this, the efficiency of the exodontia approach is determined by root architecture, tooth position, and tooth type. However, additional research is required to confirm the conclusion of this study.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

The department's ethical committee approved the study (1/2022). Data were analyzed by the Statistical Package of Social Science (SPSS version 22).

HUMAN AND ANIMAL RIGHTS

No animals were used in this research. All procedures performed in studies involving human participants were in

accordance with the ethical standards of institutional and/or research committee and with the 1975 Declaration of Helsinki, as revised in 2013.

CONSENT FOR PUBLICATION

Informed consent was obtained from all participants of this study.

AVAILABILITY OF DATA AND MATERIALS

The data and supportive information are available within the article.

STANDARDS OF REPORTING

STROBE guidelines were followed.

FUNDING

None.

CONFLICT OF INTEREST

The authors declare no conflict of interest, financial or otherwise.

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