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Evaluation of Minimally Invasive Vertical Extraction Technique of Crowded Lower Incisors: A Case Series Study

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ABSTRACT

Background and Objective: Innovations in tooth extraction techniques and instruments have evolved over time to minimize trauma to surrounding tissues. In severely crowded cases, extracting anterior teeth poses a challenge for surgeons due to the risk of traumatizing adjacent teeth and surrounding hard and soft tissues. This study aims to evaluate the applicability and popularization of a novel a traumatic vertical extraction technique, known as minimally invasive vertical extraction of lower anterior teeth.

Methods: A prospective interventional clinical study was conducted at a private clinic from November 2019 to December 2021. Fifteen patients with severely crowded lower anterior teeth, where conventional extraction was not possible without trauma to adjacent teeth and tissues, were enrolled. The surgical technique involved the administration of local anesthesia, drilling a small hole in the tooth crown, passing a surgical wire through the hole, applying vertical traction force to extract the tooth, and post-extraction care.

Results: The mean± (SD) age of the patients was 26.5±1.24 years, with an age range of 25-38 years. The patients included nine (60%) male and six (40%) females. 15 lower anterior teeth in15 patients were successfully extracted using this technique, indicating an overall success rate of 100%.

Conclusion: The results suggest that the atraumatic vertical extraction by this novel technique may be used with a high success rate for extraction of severely crowded teeth, and its use causing no any force on the adjacent teeth and hard and soft tissue investing the extracted tooth.

Keywords: Atraumatic vertical tooth extraction, Minimally invasive procedures, Tooth extraction

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INTRODUCTION

Tooth extraction, also referred to as exodontia, is the controlled surgical procedure involving the removal of a tooth from its bony socket, the dental alveolus, within the alveolar bone of the jaw. This process disrupts the periodontal ligament, which provides support and attachment for the tooth. Extractions are typically performed by dentists or oral surgeons.[1] Teeth extractions may be necessary for a variety of reasons, including decay, gum disease, dental trauma, orthodontic demands, and prosthetic concerns.[2] The conventional techniques used for tooth extraction typically involve the use of tools like elevators and forceps to carefully loosen and remove the tooth. However, these techniques can sometimes lead to some loss of bone and trauma to the surrounding tissues.[1, 3] The loss of alveolar bone following extraction might jeopardize functional and esthetic rehabilitation with detachable or fixed prostheses, including dental implants.[4] Lower anterior teeth, including the incisors and canines, present unique challenges for extraction due to their small size, conical single-rooted anatomy, and proximity to vital structures like the mental nerve.[5] Using forceps for extracting these teeth can carry risks such, as bone loss, nerve damage, or unsatisfactory aesthetic outcomes that could affect restorative treatments. Various flap designs and bone removal techniques have been proposed to improve access and minimize complications, but these can increase surgical trauma.[6, 7] Considering the drawbacks of traditional tooth extraction techniques and flap surgery in preserving the alveolar bone, alternative vertical tooth extraction methods have emerged. These innovative techniques adhere to a shared principle of minimizing direct trauma to the socket walls by applying axial force to the tooth, causing the severance of the periodontal ligament and facilitating its removal from the socket. These minimally invasive approaches aim to promote better preservation of the alveolar ridge.[6-8]

As stated, to overcome these challenges and minimize complications associated with flap surgery or bone removal techniques that increase trauma levels a new approach called Minimally Invasive Vertical Extraction of Lower Anterior Teeth (MIVELAT) has been developed in surgery practice. This technique aims to preserve as much of the bone as possible while addressing the limitations of conventional extraction methods. This method also reduce damage, to the tissues around the tooth while extracting it which helps speed up healing and preserve the structure of the jawbone. The MIVELAT technique is especially useful, for removing of lower anterior crowded teeth that cannot be easily extracted with forceps. Since this technique is new and no specific studies have been conducted on it, it was necessary to conduct this study with the aim of evaluating the applicability and popularizing of a novel atraumatic vertical extraction technique.

METHODS AND MATERIALS

Study Design and Setting

This was a prospective interventional clinical study to evaluate the applicability and effectiveness of a novel minimally invasive vertical extraction technique for lower anterior teeth.

The study was conducted at private clinic from November 2019 to December 2021.

Participants

Fifteen patients referred by orthodontists for extraction of a severely crowded lower anterior tooth were enrolled in the study. Severely crowded teeth were defined as those with insufficient space buccolingually or mesiodistally for conventional forceps extraction without trauma to adjacent teeth and tissues. Informed consent was obtained from all participants.

The inclusion criteria were: Severely crowded lower anterior teeth where conventional extraction with forceps or elevators was not possible due to lack of space; Sound teeth with no destructive caries; Patients with good systemic health and no contraindications for tooth extraction; and having informed consent. The exclusion criteria were: Teeth with severe dental caries and medically compromised patients.

Surgical Instruments and Materials

The following instruments and materials were used: High speed turbine handpiece; Small round bur or fissure bur (≤0.5 mm diameter); 0.5 mm diameter stainless steel wire or orthodontic ligature wire; Wire twister or surgical wire holder; And local anesthetic (2% lidocaine with epinephrine 1:100,000).

Surgical Technique

The novel minimally invasive vertical extraction technique involved the following steps: Administration of local anesthesia (2% lidocaine with

epinephrine 1:100,000) via an inferior alveolar nerve block and local infiltration was performed to achieve profound anesthesia. A small hole was drilled in the middle of the clinical crown using a small round bur or fissure bur (with a diameter of ≤0.5 mm) in a high-speed handpiece. This hole allowed for the passage of a 0.5 mm stainless steel wire or orthodontic ligature wire. A 0.5 mm surgical stainless steel fixation wire or orthodontic ligature wire was inserted through the access hole and engaged into the tooth structure using a surgical wire twister. With the mandible stabilized by the operator's non-dominant hand, a steady vertical traction force was applied using the dominant hand to gradually extract the tooth, ensuring that the socket did not expand. The force was directed along the long axis of the tooth. The extraction process was considered complete when the tooth was fully dislocated from the socket, typically within seconds. Care was taken to avoid any torque or rocking motions during the extraction. Following the removal of the tooth, the tooth socket was carefully examined for any residual spicules of bone or sharp edges that could hinder the healing process or lead to postoperative complications. Post-extraction instructions were provided to the patient, which included the application of ice packs, a soft diet, proper oral hygiene, and medication as necessary to manage pain and swelling.

Data collection

Data collection for this study involved the following steps: Preoperative Assessment: The patients' demographic information, including age and sex, was recorded. Clinical examination and radiographic evaluation were performed to assess the severity of crowding and determine the suitability of the MIVELAT technique for extraction. Intraoperative Data: During the extraction procedure, the following data were collected: the duration of the extraction procedure, any intraoperative complications or difficulties encountered, and the need for additional interventions or modifications to the technique.

Statistical Analysis

Statistical analysis was performed using SPSS Version 26.0 (Armonk, NY: IBM Corp). Descriptive statistics were used to summarize the demographic and clinical characteristics of the study participants.

Ethical Considerations:

Ethical approval was obtained from the college of dentistry Hawler Medical Univerty prior to the commencement of the study. Informed consent was obtained from all participants before their inclusion in the study. The study protocol ensured the privacy and confidentiality of patient information. Patients were informed about the nature and purpose of the study, and they had the right to withdraw their participation at any time without facing any consequences. The study was conducted in compliance with relevant data protection regulations and the Declaration of Helsinki.

RESULTS

The mean±(SD) age of the patients was 26.5±1.24 years, with an age range of 25-38 years. In this study, 15 lower anterior teeth belonging to 15 patients were extracted by minimally invasive vertical extraction of lower anterior teeth (MIVELAT). The patients included nine (60%) males and six (40%) females (table 1) (figure 1). Ethnicity all patients were Kurdish. All parties have no history of any medical problems and not on any medications. All teeth were lower central incisors half of them right side and another half-left side. Teeth did not have root canal fillings.

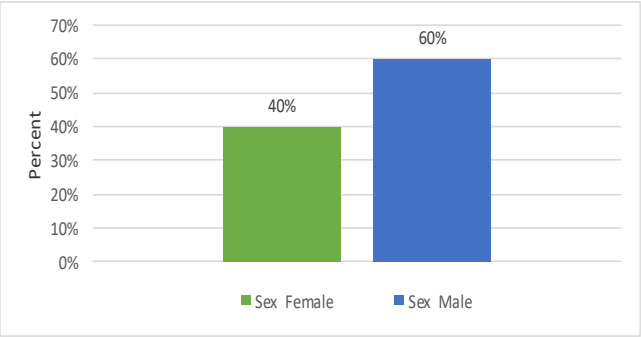

Fig 1. Sex distribution in patients

In Figure 2 (A-G) the position of the teeth from the front view is shown in Figure 1. In these pictures, it is clear that the teeth that were chosen to be pulled are front teeth and their disordered condition is well shown in the figures.

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Figure 2. Front view of teeth

Figure 3. top view of teeth

Tooth preparation for extraction to the Saeed Tutmayi Technique is shown in Figure 4 (A-D). In this method, a groove is first created in front of the tooth (A-C), and in the next step, the wire is placed inside the groove (D) and the tooth is ready to be extracted.

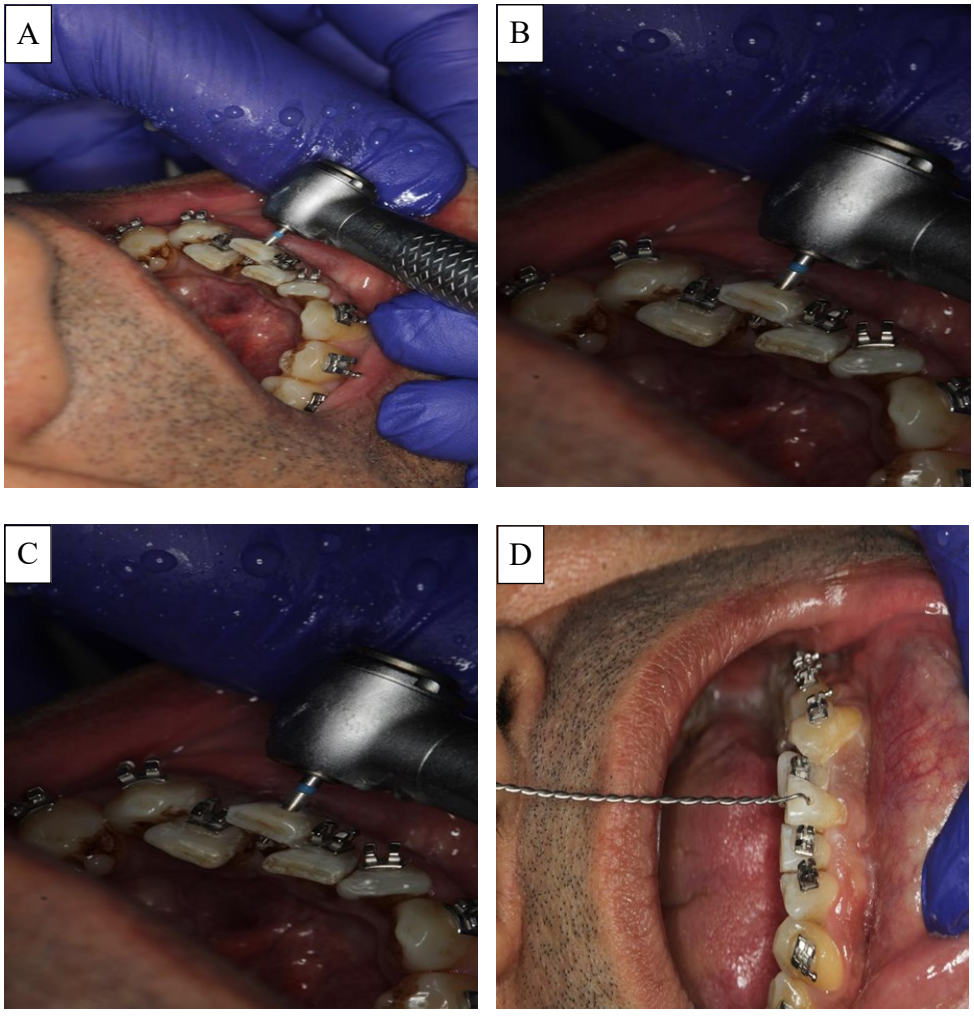

Figure 4. Tooth preparation for extraction to the Saeed Tutmayi Technique

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And finally, the tooth is extracted in this way vertically and with the least invasiveness. The shape of the extracted tooth is shown in Figure 5

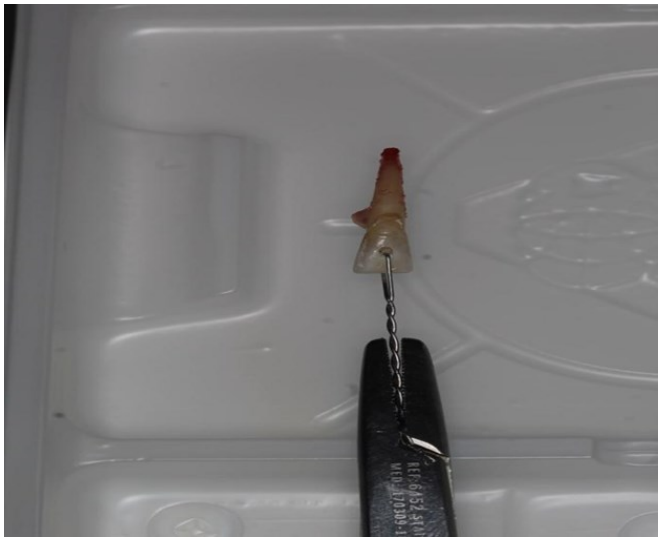

Figure 5. Tooth extracted with Saeed Tutmayi Technique

The proposed atraumatic extraction was performed easily in all cases without any unwanted complications and problems. This atraumatic extraction in 8 (53.3%) related Left Central Incisor and in 7 (46.7%) also related to it was Right Central Incisor.

Table 2. atraumatic extraction in patients

Atraumatic Extraction	Frequency (%)
Left Central Incisor	8 (53.3%)
Right Central Incisor	7 (46.7%)

DISCUSSION

The present technique (study) demonstrated a high success rate for the atraumatic extraction of severely crowded lower anterior teeth not suitable for forceps and elevator extraction with the use of a novel atraumatic vertical extraction technique. 15 teeth were successfully extracted with this technique without fracturing the crown through a small hole created for the passage of the wire, indicating an overall success rate of 100%. All extractions were done by the author.

Minimally Invasive Vertical Extraction of Lower Anterior Teeth (MIVELAT), offers a unique scaapproach to tooth extraction that differs from the conventional technique. Unlike traditional methods that rely on applying force and expanding the socket, MIVELAT focuses solely on vertical traction forces to remove the tooth. By pulling the tooth in an axial direction, these forces sever the periodontal ligaments, making this technique highly plausible and effective. One of the significant advantages of MIVELAT is its versatility. While other extraction techniques may be limited to teeth that are not suitable for elevator and forceps extraction, MIVELAT can be used to extract any single-rooted tooth. This versatility is particularly valuable when the goal is to minimize trauma to the bone and associated soft tissues during the extraction process. The central principle and foundation of the MIVELAT technique revolve around achieving atraumatic extraction. This is accomplished by avoiding any manipulation of the alveolar bone, which is a crucial aspect of the technique. By minimizing bone manipulation, MIVELAT aims to reduce the potential for post-operative complications and promote faster healing. Because this technique is new there is no study and techniques in the literature exactly of the same method to be compared. Only we can compare our results with the Benex system and it is superior to it because not exerting any force on the adjacent teeth.

In a study conducted by Mohamed et al., various techniques (vertical, conventional, and surgical) were examined for tooth extractions and routine exodontia. Data were collected from 509 patients at the Sebha Faculty of Dentistry's Oral and Maxillofacial Surgery department in Libya. Among the methods employed for extracting various teeth, the vertical extraction technique was found to be the most successful and least complicated, proving to be an appropriate method for extracting all types of teeth.[7] Another study by Muska et al. investigated a new non-traumatic tooth extraction technique. This study included 72 patients with decayed teeth who underwent vertical tooth extraction. It was found that vertical extraction yielded very positive outcomes, could be used for all types of teeth, and resulted in minimal side effects for patients.[9]

In recent years, conventional tooth extraction

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methods have faced many challenges due to significant limitations. A study by Hong et al. compared vertical extraction to traditional extraction methods. The success rate for vertical extractions was 85%, with 276 out of 323 teeth successfully extracted. The findings suggest that vertical extraction, with its high success rate, could be utilized for severely compromised teeth and might significantly reduce the need for surgery and other dental procedures.[6]

The removal of functionally obsolete teeth that could potentially cause complications has always been a focus in dentistry. The goal has been to remove teeth in a way that minimizes patient discomfort and trauma to the root and surrounding tissues,[10] as well as to ensure that the method is atraumatic and preserves the jawbone for future dental interventions.[11,12] Consequently, the Minimally Invasive Vertical Extraction of Lower Anterior Teeth (MIVELAT) technique has been shown to result in non-traumatic extractions. This method prevents significant manipulation of the alveolar bone, which is crucial, and minimizes bone handling, leading to fewer complications and faster recovery.

The results from the use of MIVELAT highlight the important fact that this technique can be applied to various teeth, particularly proving highly successful for single-rooted teeth, which demonstrates the technique's adaptability. Unlike other extraction methods that may be limited to specific teeth and unsuitable for forceps and other instruments.[13,14] MIVELAT has shown its effectiveness for different teeth while preserving bone and soft tissue integrity.

Also, the results of this study showed that atraumatic extraction was easily performed in all cases without any complications or unwanted problems. The results of this study showed that atraumatic extraction was easily performed in all cases without any complications or unwanted problems. In other studies,[15,16] similar to the results of this study, it has been shown that atraumatic extraction can be used with the least problems and complications and can be used for tooth extraction in most cases.

CONCLUSION

The study indicates that the MIVELAT is a successful and cost-effective method for atraumatic extraction of severely crowded lower anterior teeth, suggesting the need for further validation through randomized clinical trials.

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CONFLICT OF INTEREST

The authors declare no conflicts of interest regarding the publication of this article.

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