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To compare the efficacy of exomed, physics forceps and conventional forceps in extraction of teeth

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Abstract

The purpose of the article is to compare the efficacy of Exomed, physics forceps, and conventional forceps in the extraction of teeth. A total of 30 patients were divided into three groups with indicated for extraction of bilateral maxillary premolar for orthodontic reasons. Clinical outcomes in the form of time taken for extraction, soft tissue and hard tissue changes were evaluated.

Results: The mean time taken for extraction with Exomed was significantly more when compared with Physics and conventional forceps (P<0.001). The average bone loss was significantly less with Exomed when compared with conventional and physics forceps(P<0.001).

Conclusion: Exomed may be successfully used for atraumatic tooth extraction. Vertical extraction system is comparatively superior to physics and conventional forces in terms of lesser tendency to induce trauma to

hard and soft tissue. Though the Exomed kit is costly, it represents a valuable addition to armamentarium for a general dentist for routine extraction.

Keywords: Atraumatic extraction; Physics forceps; Dental extraction; Con ventional forceps, Vertical Extra ction System.

Introduction

"Atraumatic" extraction techniques have gained pro minence in dentistry as it preserves the bone integrity with minimal alveolar bone loss and tissue damage which may ultimately become the standard technique for teeth removal. It preserves the soft tissue and hard tissue architecture allows for the option of future or immediate dental implant placement. Minimal soft tissue damage and alveolar bone damage are imperative for ideal post extraction prosthesis replacement. [1] Not only for reha bilitation, but atraumatic extraction also plays important role in ortho dontic extraction.

Orthodontic treatment involves the correction of malocclusions and aims to achieve function, esthetics, and stability. Extraction of erupted teeth especially premolars is done to acquire space in the dental arch. The type of extraction procedure and complications during healing can influence the orthodontic space closure, the stability of the results achieved. Atraumatic extractions can help normal healing and prevent complications which may arise during retraction and post orthodontic treatment.[2]

Various newer innovative techniques for atraumatic extraction such as powered periotomes, ultrasonic surgery (i.e piezo surgery), lasers, physics forceps, orthodontic extrusion of the third molar are being widely used. [3]

Another renovative atraumatic extraction technique is the vertical extraction system, which works on the principle of vertical pulling only. This technique is designed specifically for single rooted tooth below the marginal gingiva. It provides an atraumatic extraction by avoiding any manipulation of alveolar bone.[4]

Exomed is a device for the alveolar extraction of roots and teeth exploiting the perpendicular forces of avulsion obtained by tension of Kevlar cord. It ensures an extraction with minimal trauma, preserving the alveolar and gingival tissues. The periodontal and alveolar tissues remain undamaged after extraction with no laceration, no huge bleeding, the neighboring tissues are practically preserved. It works on the principle of a vertical extraction system.[5]

The present study aims to evaluate the efficacy of Exomed, physics forceps and conventional forceps in nonsurgical orthodontic extractions of bilateral maxillary premolars and to compare the outcome variables between the three techniques.

Materials and methodology

The present study was done to compare the efficacy of Exomed, physics forceps and conventional forceps in extraction of teeth, in the Department of Oral and Maxillofacial Surgery, Al-Badar Rural Dental College and Hospital, Kalaburagi from December 2018 to September 2020.

Study Design

The study included a total of 30 patients requiring bilateral therapeutic extractions of maxillary premolars for orthodontic purpose consenting for the study were included and were divided into three groups.

In each group split mouth design was implemented and each patient was subjected to extraction of maxillary premolars using two different methods of extraction by the same operator.

- Group 1: Included 10 patients, extraction on the left side was done by conventional forceps and on the right side by physics forceps.

- Group 2: Included 10 patients, extraction on the left side was done by conventional forceps and on the right side by Exomed.
- Group 3: Included 10 patients, extraction on the right side was done by physics forceps and on the left side by Exomed.

The procedure to be performed was explained, followed by informed written consent was taken

Figure 1: Exomed extraction kit

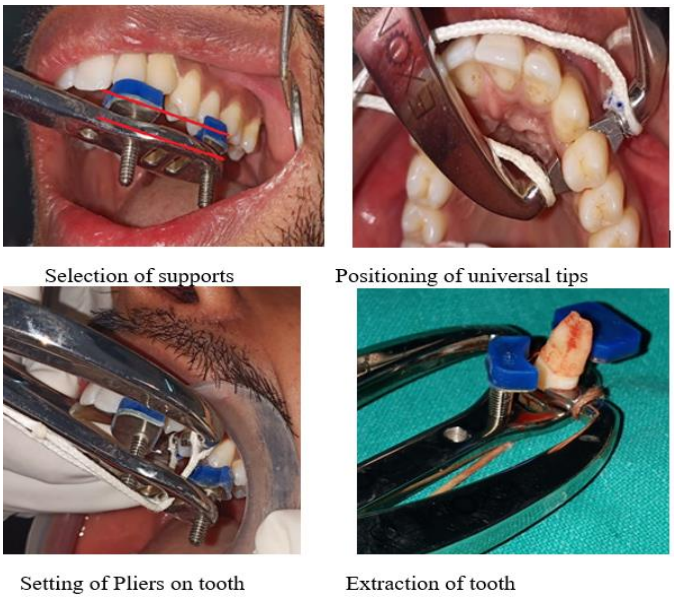


Figure 2: Steps involved in extraction using Exomed extraction technique.

Criteria for selection of subjects

Inclusion criteria

1. Maxillary bilateral premolars.
2. Patients who are in need of orthodontic extractions.
3. Subjects of both the gender.
4. Subjects consenting to study protocol.
5. ASA I and II category patients
6. Age group between 14-25 years

Exclusion criteria

1. Tooth associated with periodontitis and periapical pathology.
2. Pregnancy and lactating mothers.
3. Any systemic condition that would place the patients at risk during surgical procedure.
4. Grossly decayed teeth.
5. Teeth which require trans alveolar extractions were excluded from the study.

Methodology

Preoperative evaluation of patients

- Informed/ written consent were taken from patients. The study protocol was approved by the Institutional Ethics Committee.
- Routine pre-treatment investigations were done which includes CBC, CT, BT, RBS, HBsAg and HIV
- OPG radiographs were taken to rule out presence of any pathologies.
- Pre-operative intraoral photographs were taken
- All patients underwent oral prophylaxis and received oral hygiene instructions as

necessary to provide an more favourable oral environ ment to promote uneventful wound healing.

Duration of study

The study was designed for six month follow up which was carried out from December 2018 to September 2020 Under all aseptic precautions and standard patient pre paration, procedure was performed under local anesthesia (2% lignocaine Hydrochloride with 1:80,000 adrenaline) without raising muco-periosteal flap. Extraction was carried out in each group with assigned forceps. The patients were prescribed NSAIDs, if

required post extraction SOS. A simple Yes or No format was used for the intraoperative assessment of gingival laceration, fracture of root and buccal cortical plate.

Clinical evaluation

Soft tissue evaluation

a. Gingival laceration: A simple yes/no format was used for the assessment. [6]

b. Healing of extraction socket: Assessment of Healing was done on 7th post-operative day using a 5-point VAS scale. [6] (Fig.3 and 4)

Normally Pink, not edematous	0
Pink red, slightly edematous	1
Red edematous	2
Red edematous, bleed easily when touched	3
Frank pus discharge	4
Dry socket	5

Figure 3: Wound Healing of extraction socket Physics forceps (right side), Conventional forceps (left side)

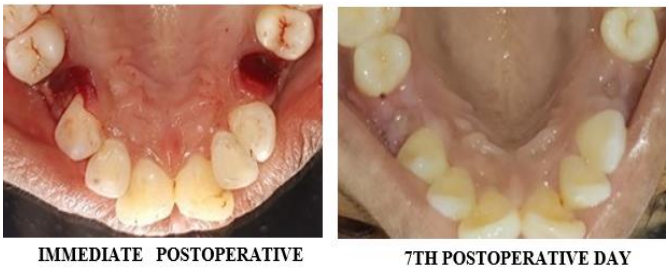


Figure 4: Wound healing of socket Exomed- Right side, Conventional- Left side

Hard tissue evaluation

a. Fracture of Root: A simple yes/no format was used for assessment.[6] (Fig. 5)

b. Fracture of Buccal cortical plate: A simple yes/no format was used for assessment.[6] The buccal cortical plate integrity was assessed by manual palpation externally and also by running a dental explorer on the lingual accept of the buccal plate from inside the socket in all directions (from apical to occlusal and from mesial to distal) to check for discontinuity of bone.[7]

Figure 5: Gingival laceration and fracture of root by Physics forceps.

Assessment of

a. Time taken for extraction: The duration of the extraction was calculated between the time elapsed from placement of forceps till the time tooth will be completely out. The time was recorded in minutes.[8]

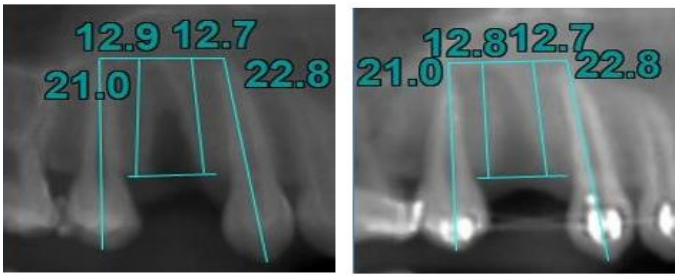
All the cases were operated by the same surgeon, monitored and evaluated by the single observer.

Radiographic evaluation

a. Alveolar bone height: It was measured on CBCT immediately on 1st postoperative day (Base line), followed by another CBCT at the end of 6 months following extraction. Two reference lines were drawn, one at root apices of adjacent teeth and second line at the level of the interdental bone on the both sides of socket, mesial and distal sides for measuring bony changes around the socket. A tangent was drawn connecting the reference points. The perpendicular line drawn on mesial and distal side between these two tangents was recorded as alveolar bone height on respective sides. The difference in value between the immediate postoperative

and at the end of 6 months postoperative suggests the alveolar bone loss on mesial and distal side. (Fig.6 and7)

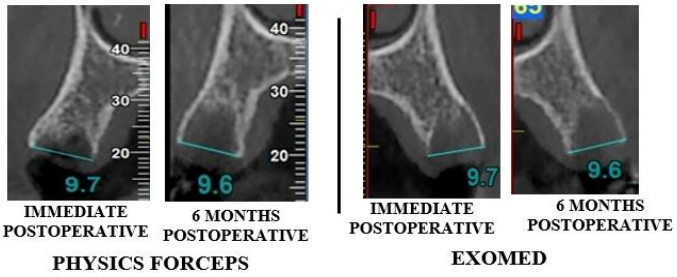
Figure 6: Loss in alveolar Bone height & Figure 7: Loss in alveolar Bone height.



Immediate postoperative **6 Month postoperative**

b. Bucco palatal width: It was measured on CBCT immediately on 1st postoperative day (Baseline), followed by another CBCT at the end of the 6 months following extraction. A reference line was selected in axial section on CBCT. The distance between the buccal and palatal cortex bone was taken as Bucco palatal width. The difference between the immediate post operative and at the end of 6 months postoperative values suggests bone loss. (Fig.8)

Figure 8: Bucco palatal width Radiographic evaluation



Follow Up Plan

The patients were followed up regularly for oral hygiene maintenance. Wound healing of socket evaluation was done on 7th post-operative day using VAS scale. Assess ment of Alveolar bone height and Bucco palatal width was done on CBCT immediate post-operatively and at the end of 6 months.

Statistical analysis

Statistical data was analyzed by IBM SPSS 20.0 version software. Collected data were spread on excel sheet and prepared master chart. For quantitative data analysis unpaired t-test and ANOVA tests were applied and for qualitative data analysis chi-square test and Fisher exact test were applied for statistical significance. If P-value was less than 0.05 considered as significant.

Results

Out of the total 30 patients, 70% patients were below the age of 20 years. 23.3% of patients were in the age group between 21-25 years. The mean age range of the patients was 19.6 years with age range between 17- 24 years. Twenty-four patients were female (80%) and six patients were male (20%).

No cases of gingival laceration seen were with Exomed, while with physics and conventional forceps 4 and 2 cases were observed respectively.

In Exomed extraction, no cases of root and buccal cortical plate fracture were observed, while there were 2 cases of root fracture and 1 case of buccal cortical plate fracture with conventional forceps and 5 cases of root fracture, 4 cases of buccal cortical plate fracture were observed with the physics forceps. (Table.1)

Table 1: Comparison of Time taken, Gingival laceration, fracture of the root, Buccal Cortical Plate fracture between Conventional, Physics forceps and Exome extraction

	Conventional Forceps	Physics Forceps	Exomed	χ2-value	p-value
Time Taken for extraction (minutes)	0.183 ± 0.033	0.456 ± 0.052	1.930 ± 0.264	0.000	0.0 Significant
Gingival laceration					

Yes	2 (10.0%)	4 (20.0%)	0 (0.0%)	3.332	0.089 non-Significant
No	18 (90.0%)	16 (80.0%)	20 (100.0%)		
Fracture of Root					
Yes	2 (10.0%)	5 (25.0%)	0 (0.0%)	3.962	0.046 Significant
No	18 (90.0%)	15 (75.0%)	20 (100.0%)		
Fracture of Buccal Cortical Plate					
Yes	1 (5.0%)	4 (20.0%)	0 (0.0%)	2.727	0.287 Non-Significant
No	19 (95.0%)	15 (80.0%)	20 (100.0%)		

There was a statistically significant difference found in fracture of root between conventional, physics, and Exomed. (P<0.05).

The mean operative time with Exomed extraction was 1.930 minutes while with physics and conventional forceps 0.456 minutes and 0.183 minutes were observed respectively. In Exomed extraction wound healing of socket was satisfactory in 90% of patients while with physics and con ventional forceps 75% and 80% respectively. (Table. 2)

Table 2: Comparison of wound healing of socket between Conventional, Physics forceps, and Exomed extraction.

Evaluation	Conventional forceps	Physics forceps	Exomed
Normally Pink, not edematous-0	16 (80.0%)	15 (75.0%)	18 (90.0%)
Pink red, slightly edematous -1	4 (20.0%)	3 (15.0%)	2 (10.0%)
Red edematous -2	0 (0.0%)	2 (10.0%)	0 (0.0%)
χ^2 Test, P value Significance	χ^2=3.564, P=0.0791 non-Significant		

There was no statistically significant difference found in a gingival laceration, Buccal cortical plate fracture,

Postoperative wound healing of socket on 7th day between conventional, physics, and Exomed procedures (P>0.05)

In the study, the average loss in height of alveolar bone by Exomed was 0.075mm and by conventional forceps and physics forceps were 0.145mm and 0.115mm respectively.

In Exomed extraction, the average bone loss seen in Bucco palatal width was 0.055mm, while with Physics and conventional forceps was 0.15mm and 0.24mm respectively. (Table.3)

There was a statistically significant difference observed in time taken for extraction(minutes), loss of alveolar bone height, bone loss in Bucco palatal width region between the conventional, physics, and Exomed procedures (P<0.001).

Table 3: Average Bone Loss Between Conventional, Physics Forceps and Exome extraction.

Average Bone Loss	Conventional Forceps	Physics Forceps	Exomed	P value
Height of alveolar bone	0.145 ± 0.081	0.115 ± 0.069	0.075 ± 0.035	0.005 Highly Significant
Bucco palatal width	0.24 ± 0.082	0.15 ± 0.117	0.055 ± 0.057	0.000 Highly Significant

Discussion

For the better evaluation between Exomed, conventional and physics forceps the teeth extracted for orthodontic treatment were selected in the present study, Gingival laceration, fracture of root and buccal cortical plate, wound healing of socket, time taken for extraction,

differences in alveolar bone height and Bucco palatal width were evaluated. Split mouth design was imple mented to have parity in sample for better evaluation of the objectives.

The teeth are extracted for orthodontic indications to create space for orthodontic movement of the teeth to correct the crowding, the quantity and quality of the bone are important. In the event of injury to the supporting structures like the alveolar bone either by the fracture of the alveolar bone or during the surgical removal of the fractured root, the form and quality of the bone gets compromised and the subsequent orthodontic treatment becomes challenging. It may not produce favorable clinical results and thus, the extractions are required to be essentially performed with utmost care with minimum trauma and complications.[9]

With this aim the present study was carried out to compare the outcomes of the extraction using the Exomed, conventional extraction forceps, and the physics forceps to find out whether the Exomed offer any added advantage in terms of the ease of extraction, trauma to the investing tissue like alveolar bone and minimizing complications associated thereof.

There was no operator bias as the same surgeon operated on both sides of each patient and so used two different methods of extraction.

Time taken to extract a tooth can be considered as a time period from engaging of tooth by the forceps till the tooth is completely removed out of the socket. In the present study, the meantime taken for extraction by conventional forceps (0.183 minutes) was found to be significantly lesser as compared to physics forceps (0. 456 minutes) and Exomed (1.930minutes).

While S. Hariharan et al, in their study did not find any significant difference in time taken for extraction with mean extraction time using physics forceps was 29.4 sec and with conventional forceps being 43.5 sec.[10]

The supporting alveolar bone consists of cortical plates which hold the tooth medially and laterally. In the maxilla there is only one plate called as labial/buccal cortical plate laterally and medially there is palatal bone which is thicker as compared to lateral plate. Care must be taken with the removal of teeth to ensure that the buccal and lingual cortical bone remains intact to support the teeth orthodontically moved into the space. The Buccal cortical plate being comparatively thinner fractures commonly due to excessive or inadvertent forces applied by the operator. In present study, no cases of buccal cortical plate fracture found in vertical extraction system and we observed a single case of fracture with the use of conventional forceps while 4 cases of fracture was observed with physics forceps.

The results of the study are in agreement with Harsh Patel et al who found no buccal cortical plate fracture with the use of conventional extraction forceps while he observed two cases of buccal cortical plate fractures with the physics forceps in a sample size of 10 subjects.[11]

Conversely, el Kenway Mohammed and Wael Moh ammad in their study observed buccal cortical plate fracture in 3 patients using physics forceps and in 7 patients using conventional extraction forceps out of 100 patients, respectively [12]. Soumen Mandal also found that the buccal cortical plate fractures were in 12 patients with the use of conventional extraction forceps and no buccal cortical plate fracture was observed with the physics forceps group.[13]

The Present study suggests there was no statistical significant difference in wound healing of socket on 7th day between conventional, physics, and Exomed procedures (P>0.05) as orthodontic extraction itself is an atraumatic procedure. The results of the study are in

agreement with studies by Sonune Avinash M who observed no statistically significant difference in wound healing of socket.[8]

Most commonly the root fractures occur in extraction of maxillary first premolars, because the bifurcation of root at its apical 1/3rd.

In the present study we found that 5 cases of root fracture occurred with physics forceps while 2 cases with the application of conventional forceps. There were no cases of root fracture seen in Exomed extraction, as the tooth was extracted by gradually increasing the traction force using the extractor. The results of present study are similar with study conducted by Sonune AM who observed 2 cases of root fracture with physics forceps while one case of root fracture with conventional extraction forceps.[8]

We observed more amount of bone loss with Conventional forceps as the very principle of forceps extraction is socket expansion and also it involves stripping of periodontium around the tooth followed by luxation with elevator and removal using forceps.

In the present study the amount of bone loss was comparatively less with vertical extraction system and Physics forceps.

The results of the study are similar with the study conducted by Panchal VK, they observed that the mean bone level height difference during follow up while using physics and conventional extraction forceps was 0.82mm and 2.16mm, which denotes more bone loss when conventional extraction forceps were used.[14]

The principle of vertical extraction system minimizes the trauma to bone by applying a traction force along the long axis of root resulting in periodontal fiber rupture and removal of roots without expansion of bone.[15] In Physics forceps the tooth is released from its attachment to the alveolus by the chemical breakdown of hyaluronic acid, the more hyaluronidase released per unit time, the more efficient the release of tooth and less trauma to alveolar bone.

Conclusion

From our study we conclude that the main advantage of Exomed over physics and conventional forceps is preserving the buccal bone and cortical plates, preventing the need for flaps and removing bone to access roots, virtually eliminating root tip fracture assisting with efficient full mouth reconstructive extractions, supporting immediate implant positioning and placement.

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