Assessment of Extraction Technique Using Physics Forceps and the Conventional Method : A Comparative Study

Prasanna Shetty[1], Sharma[2], Nivya John[3]

[1]PG Resident –Department of Oral Implantology, NITTE Deemed to be University, [3]Professor Emeritus, [3]Sr. Lecturer, Department of Prosthodontics and Crown & Bridge and Oral Implantology, A.B.Shetty Memorial Institute of Dental Sciences, Mluru

Abstract

The subsequent bone loss that occurs after extraction is inevitable.The morphologic changes seen following tooth extraction is due to the body deactivating the system caused by disuse atrophy.[1]Extraction using conventional elevators and forceps involves the separation of the periodontal ligament attachments, expansion of the alveolus and lifting of the tooth out of the socket with the forcep beaks which invites unnecessary trauma including broken roots and bone, inflammation and post operative pain, loss of tissue, and stress for the patient and dental team.[2] Nevertheless, These can be easily reduced through current site preservation techniques such as using the 'Physics Forceps^{TM}' that can reduce the degree of damage and extent of resorption that physiologically occurs following tooth extraction by utilising just two opposing forces. These two forces eliminates the need for the third force (the clinician's arm) and thereby the risk of fracturing the dental structures would be dramatically reduced.In addition to this the extraction procedure can be much more comfortable to the patient.[3]

The following study aimed at assessing the amount of extraction defect caused by the conventional extraction technique and the physics forceps design which employs a new extraction technique.In this study ,100 patients indicated for extraction were categorised in two equal groups using the two techniques.

Both the extraction defects in these groups was assessed with the use of an Atraumatic Safe Extraction Score, Extraction Defect Sounding Classification System, Visual Analog Scale and the Amount Of Strain experienced by the operator.

The results showed that there was significant success with tooth extraction using the Physics forceps ^{TM} as compared with the conventional technique. Moreover the results indicated that the Physics Forceps^{TM} causes less bone defect , reduced operator strain and minimal discomfort to the patient than the conventional technique.

Key Words: *Physics Forceps, Atraumatic Extraction, EDS , VAS*

Introduction

Tooth extraction is a traumatic and unnatural procedure which evokes a cascade of biodynamic processes of cellular changes leading to physiologic alterations to alveolar bone and soft tissue architecture. Due to the loss of bundle bone there is inevitable loss of bone after extraction. However we can reduce the extent of the damage by following atraumatic extraction procedures.

One such atraumatic extraction technique using the 'PHYSICS FORCEPS^{TM}' can reduce the degree of damage and extent of resorption that physiologically occurs following tooth extraction. The Physics forceps^{TM}was developed by Dr. Richard Golden in 2004 is an innovative design that provides a simple mechanical

Corresponding author:
Dr. Nivya John
Sr. lecturer, Department of Prosthodontics and crown & bridge and Oral Implantology, A.B.Shetty Memorial Institute of Dental Sciences, Mluru
Phno: 9742024358, Email id: nivijae89@gmail.com

advantage by employing first-class lever mechanics. Utilizing the patented "beak and bumper" technique, one can simply and predictably extract virtually any tooth in any condition, while preserving the buccal bone and socket. The beak of the Physics Forceps^{TM} is designed to apply controlled pressure parallel to the long axis of the root. The bumper acts as a simple fulcrum or pivot point.(figure 1)

The extraction socket with an undamaged alveolus and well preserved soft tissues can be successfully treated with post extraction procedures like immediate implant placement ,FPD.

The evaluation of clinical presentation of alveolar defects can only be accurately made immediately following extraction,since damage often occurs during the process of tooth removal and the periodontal attachment shrouds hard tissue architecture.

A classification of the extraction defect as it presents immediately following tooth removal would be beneficial for the clinician in establishing the most appropriate plan for treatment.

The purpose of this study was to evaluate and compare the efficacy of the conventional forceps with the Physics Forceps^{TM}and to assess the amount of bone defect caused by them which will help to simplify decision making process when planning for dental implant therapy following tooth extraction.

Methodology

100 patients were categorized into two groups of 50 patients each:

GROUP I : Extraction using the conventional extraction technique which was considered as control group for the study.

GROUP II : Extraction in 50 patients using the Physics Forceps.^{Tm}

Every patient underwent an adequate pre-surgical preparation consisting of adequate case history, gross scaling, blood test and radiographic examination wherever indicated . Following the standard surgical protocol, the extraction procedure was carried out under local anesthesia.

Inclusion Criteria: Healthy patients (17-60 yrs) who are indicated for extraction with Severely decayed tooth with a minimum of 3mm tooth structure above the crestal bone with 1/4th surface intact.Failed root canal treated tooth,Orthodontic extractions & immediate implant placements.

Exclusion Criteria

1. Subjects with oro-facial cancer or under chemotherapy or head and neck radiotherapy.

2. Tooth associated with periodontitis / periapical pathology.

3. Any subject who is contraindicated for radiograph.

4. Pregnant and lactating mothers.

5. All conditions which are contraindicated for tooth extraction.

6. Primary tooth, 3rd molar and teeth with greater than grade 1 mobility.

7. Root stumps with soft caries at the coronal third.

1 .Atraumatic Safe Extraction Score The success of extraction will be based on the atraumatic safe extraction score which is based on the following criteria:

I. Complete success: extraction without crown and root fracture

II. Limited success with root tip fracture: extraction involving partial root tip fracture.

III. Limited success with osteotomy: fracture-free extraction but associated with buccal or interdental fracture.

IV. Failure to extract.[4]

2. A Verbal Rating Scale :Visual analog scale was used to assess the pain experienced by the patient . Patient was told to rate his/her pain experience on a scale of 1 to 10 at time of extraction. 1-3(Mild)4-6(Moderate)7-10(Severe).

3.The Extraction Defect Sounding classification system (EDS): Following tooth extraction, EDS was

performed using the tip of a conventional periodontal probe.Initially, the crest of the extraction defect was evaluated, noting the position of the crestal bone in relationship to the gingival margin, as well as to the future prosthetic gingival margin using the prefabricated surgical template. Any discrepancies between these two relationships was noted. Sounding of the bony crest includes the buccal and palatal plates as well as the interproximal bone peaks.Further examination of the buccal plate was then performed. This evaluation was done to uncover any fenestration or dehiscence-type defects. In addition, when sounding the inner aspect of the socket with a probe, any vibrations felt digitally will indicate a thin alveolar plate. A similar evaluation was also performed on the palatal plate.A thin buccal alveolar plate often leads to partial or complete buccal plate loss following healing. When inadequate socket bleeding is present, perforations of the cribriform plate with a periodontal curette or rotary instrument was performed to facilitate wound healing.

Assessment Of Defect: The EDS, extraction defect sounding, classification describes the condition of the hard as well as soft tissues immediately following tooth removal, prior to healing and remodeling of the extraction socket and provides basic treatment guidelines to achieve predictable implant integration and esthetics. This classification only applies after the treatment decision has been made to remove a tooth and an objective evaluation of the extraction defect is made.[5](figure 2)

4.**The amount of wrist discomfort** experienced by the operator during extraction using the forceps was also assessed similar to the Visual Analog Scale.

Statistical Analysis

Chi Square test was applied to find out the difference in the amount of defect caused by the physics forceps and the conventional forceps.

Results

A total of 100 patients (51 males and 49 females) had undergone extraction.

1.The EDS score is depicted below (Table 1)

2. In the ASE score , the results analyzed showed that in the conventional group showed poorer scores of ASE THAN physics forceps driven extraction.(Table 2).There was a significant difference on statistical analysis.

3. While assessing the amount of strain to the wrist ,Physics forcep users showed lower values of strain levels.(figure 3)

4. While assessing the visual pain analog scale ,physics forceps user showed lower values of VAS scores. (Figure 4)

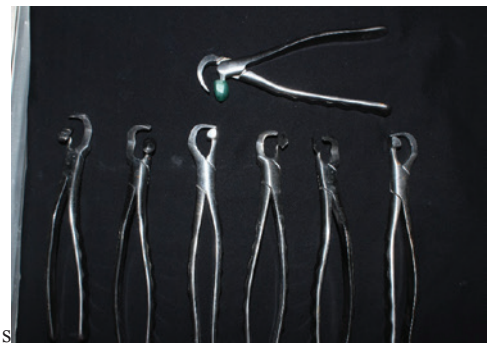

FIGURE 1: Physics Forceps Instruments

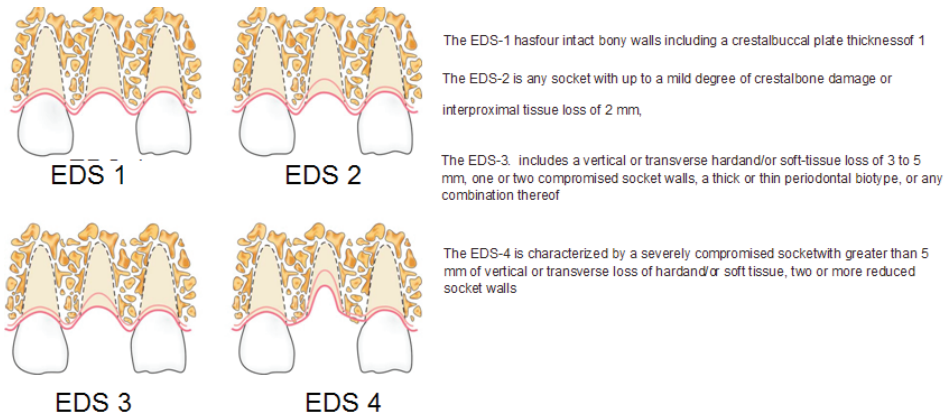

FIGURE 2:EDS classification

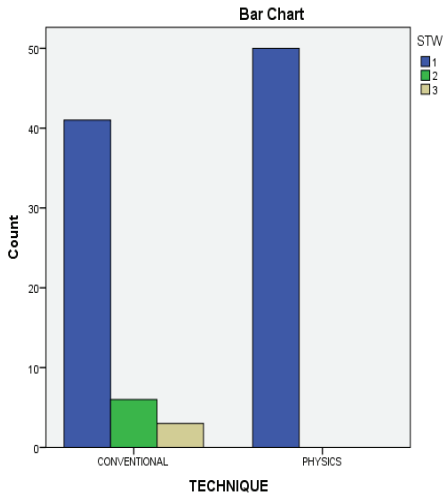

Figure 3:bar chart showing readings of strain to wrist

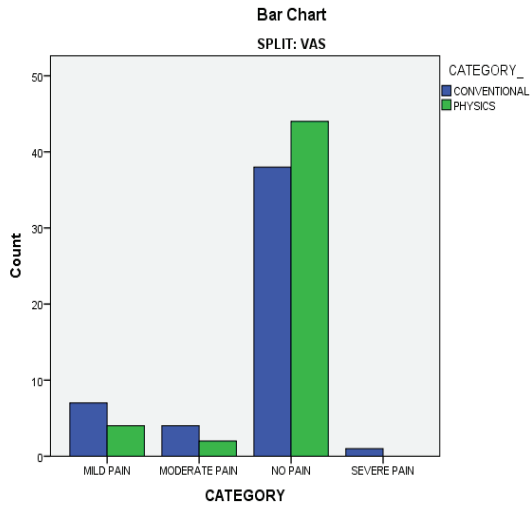

Figure 4: Visual analog scale for conventional and physics forceps extraction

Table 1:Comparison of EDS SCORE

			TECHNIQUE		Total
			CONVENTIONAL	PHYSICS	
EDS SCORE	1	Count	6	31	37
		% within EDS SCORE	16.2%	83.8%	100.0%
		% within TECHNIQUE	12.0%	62.0%	37.0%
	2	Count	12	15	27
		% within EDS SCORE	44.4%	55.6%	100.0%
		% within TECHNIQUE	24.0%	30.0%	27.0%
	3	Count	18	4	22
		% within EDS SCORE	81.8%	18.2%	100.0%
		% within TECHNIQUE	36.0%	8.0%	22.0%
	4	Count	14	0	14
		% within EDS SCORE	100.0%	0.0%	100.0%
		% within TECHNIQUE	28.0%	0.0%	14.0%
Total		Count	50	50	100
		% within EDS SCORE	50.0%	50.0%	100.0%
		% within TECHNIQUE	100.0%	100.0%	100.0%
		Value	df	Asymp. Sig. (2-sided)	
Pearson Chi-Square		40.134a	3	<0.001	
N of Valid Cases		100			
0 cells (0.0%) have expected count less than 5. The minimum expected count is 7.00. There is a significant difference found.					

Table 2: comparison ASE technique

			ASE				Total
			1	2	3	4	
TECHNIQUE	CONVENTIONAL	Count	39	6	3	2	50
		% within TECHNIQUE	78.0%	12.0%	6.0%	4.0%	100.0%
		% within ASE	45.3%	85.7%	75.0%	66.7%	50.0%
	PHYSICS	Count	47	1	1	1	50
		% within TECHNIQUE	94.0%	2.0%	2.0%	2.0%	100.0%
		% within ASE	54.7%	14.3%	25.0%	33.3%	50.0%
Total		Count	86	7	4	3	100
		% within TECHNIQUE	86.0%	7.0%	4.0%	3.0%	100.0%
		% within ASE	100.0%	100.0%	100.0%	100.0%	100.0%

Chi-Square Tests		
	Value	Exact Sig. (2-sided)
Fisher's Exact Test	5.498	.099
N of Valid Cases	100	

Discussion

Ideal tooth `extraction is defined as 'Painless removal of whole tooth or tooth root with minimal trauma to investing tissues',so that wound heals uneventfully and postoperative prosthetic problems are minimal. A tooth can be atraumatically and successfully extracted out of the socket depending upon the normality of technique used,morphology of the tooth,its position in the dental arch and condition of the surrounding bone.However simply removing the entire tooth is no longer the only goal of exodontia;in the present scenario of implant dentistry the ultimate goal is presentation of alveolar bone following tooth removal.

Scull p Et al[1]reviewed the Physics Forceps ™ describing the method of extraction using these forceps. The article also highlights the method of extraction using the physics forceps and also describes the disadvantages of the conventional method of extraction.

Harry Dym Et al[2]reviewed and highlighted exodontia tips as well as new techniques to make simple and complex exodontia more predictable and with improved patient outcomes. This article has a brief discussion on physics forceps, a highlights the uses of class 1 lever mechanics to extract teeth without having to use excessive force or squeezing motion, on basic and complex exodontias.

Carl E. Misch et al [3]presented a paper about biomechanical rational for atraumatic tooth extraction. An extraction device physics forceps has been developed to apply a biomechanical rational to the extraction process of a tooth using a class 1 lever, creep and shear component of force. The physics forceps is really a dental extractor than a forceps and uses first-class lever mechanics. Creep is a phenomenon whereby a material continues to change shape over time under a constant load. In tooth extraction, creep may occur in bone and periodontal ligament

Andersen KL Et al[7] conducted a study which was undertaken to investigate the stress-strain levels and distribution within the periodontal ligament for various types of physiological and orthodontic force systems, assuming that the bone resorption process, leading to tooth movements, is partly controlled by those conditions.

During extraction procedures using conventional forceps,the beaks were seated as far apically as possible without compression of the soft tissues. This is expedited by adequately reflecting the cervical gingiva. This also contributes to the efficient use of force and its proper direction,thereby reducing the possibility of root fracture.

While using the Physics Forceps,first class lever mechanism is used. One handle of device is connected to bumper which acts as a fulcrum, during extraction. The beak of the forceps is positioned lingual or palatal root of the teeth,and to the gingival sulcus,the bumper is most often placed in the facial aspect, typically the mucogingival junction ,making sure that there is no squeezing of the handle or teeth.The handles were rotated as one unit for a few degrees and then the action is stopped for one minute,the torque generated on the tooth,periodontal ligament ,and bone is related to length of the handle to the bumper(8cm),divided by the distance from the bumper to the forcep beak.(1cm)

As a result the a force on the handle connected to the bumper will increase the force on the tooth ,PDl ,and bone by 8 times. No force was required to be placed on the beak which was only on the lingual aspect of the tooth root, therefore,the tooth doesn't split crush or fracture.

Riley established the creep curve of bone whereby a constant load of 60 MPa, the bone over time changes shape in different stages,majority occurs in frst minute,,whereby strain of bone (change of length / original length)is modified. The higher the force that's applied the greater the deformation of the bone. This allows the tooth socket to expand and the tooth is permitted to exit the socket.[8]

A secondary creep occurs over time ,allows the bone to further deform when the force is applied during a 1-5 min period .The longer the time ,the greater the deformation, however it expresses only 10-20 pc difference compared to initial 1 min strain,,eventually the third phase of the curve causes the bone to fracture if the load is applied over a long time frame ,representing creep rupture. A similar phenomenon ,occurs in PDL complex. Mechanical forces shift lateral forces to tooth ,causing primary movement to PDL . A greater force over time causes a slight additional tooth movement and therefore the creep of the periodontal complex is similar to creep of the bone. Whereby constant load weakens PDL thus a constant load on tooth ,over time increase the tooth socket dimension and decreases the strength of PDL complex. Once creep has expanded and weakened the PDl and bone the handle of the extraction device may be slowly rotated another few degrees for 10-30 seconds ,this action contributes to the creep rupture of the ligament and usually elevates the tooth a few mm from the socket.

This randomized study obviously implies an increased awareness of a new surgical technique that may be used to render the aspect of exodontia more predictable, less trauma to the patient and less anxiety producing for the treating surgeon. In this prospective study,the results obtained from 100 patients(50 patients for each technique),showed that the Physics Forceps^{TM} had a 94% success rate in extraction ,caused less amount of discomfort to the operator as well as the patient and caused minimal amount of alveolar bone defect, whereas the conventional method had a 78% success rate in extraction and caused mild amount of discomfort to the operator and the patient

A surgeon should avoid any traumatic extraction leading to further bone remodelling and ultimately bone loss. No matter what technique is used the surgeon should approach all exodontia procedures prepared and confident,having both the necessary clinical skill,appropriate surgical equipment and knowledge to make exodontia procedures less traumatic for both the patient and the surgeon.

Conclusion

From,the results it can be concluded that the Physics Forceps ^{TM} has certain advantages over the conventional method of extraction .The significant advantages of the physics forceps over the conventional technique are:

1. It causes less trauma to the periodontal ligament and surrounding tissues.

2. It causes less amount of alveolar bone loss there by preserving bone necessary for implant therapy.

3. The amount of effort needed by the operator to extract the tooth is decreased.

4. Causes less discomfort to the patient.

However, the Physics Forceps ™ is also associated with a few limitations :

1. In cases of decreased alveolar ridge height ,placing the bumper in the lingual sulcus becomes cumbersome making it difficult in extracting the tooth.

2. The bumper which is placed in the buccal sulcus has caused ulcer in certain patients postoperatively.

3. The Physics Forceps ™ works better in cases where sufficient anatomical tooth structure is present.

Conflicts of Interests: Nil

Ethical Clearance: Taken By Instituitional Clearance Committee

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