

## Original Research

### Comparative Evaluation of Efficacy of Physics Forceps versus Conventional Forceps in Therapeutic Extractions of Maxillary Premolar: A Prospective Randomized Split Mouth Study

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#### ABSTRACT:

**Introduction:** Tooth extraction is one of the most commonly performed procedures in dentistry. It is usually a traumatic procedure often resulting in immediate destruction and loss of alveolar bone and surrounding soft tissues. Various instruments have been described to perform atraumatic extractions which can prevent damage to the periodontal structures. Recently developed physics forceps is one of the instruments which is claimed to perform atraumatic extractions. **Aim:** The aim of the present study was to compare the efficacy of physics forceps with conventional forceps in terms of prevention of marginal bone loss & soft tissue loss, postoperative pain and postoperative complications following bilateral maxillary premolar extractions for orthodontic purpose. **Materials and methods:** In this prospective split-mouth study, outcomes of the 2 groups (n = 32 premolars) requiring extraction of premolars for orthodontic treatment purpose using Physics forceps and Conventional forceps were compared. Clinical outcomes in form of loss of buccal soft tissue and buccal cortical plate based on extraction, postoperative pain and other complication associated with extraction were recorded and compared using Choi criteria. **Results:** Statistically significant reduction in the operating time was noted in physics forceps group. Marginal bone loss and soft tissue loss was also significantly lesser in physics forceps group when compared to conventional forceps group. However, there was statistically significant difference in severity of postoperative pain between both groups. **Conclusion:** The results of the present study suggest that physics forceps was more efficient in reducing operating time and prevention of marginal bone loss & soft tissue loss when compared to conventional forceps in orthodontically indicated premolar extraction

**Keywords:** Atraumatic extractions, Bone loss, Cortical plate, Exodontia instrumentation, Extraction complications, Soft tissue loss.

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#### INTRODUCTION:

We are who we are just because we have ability to use tool in profound way. Physics forceps, an era of least invasive and atraumatic extraction a phenomena

waiting.<sup>1</sup> The extraction of tooth is considered as a very traumatic procedure by any layman due to the horrifying experiences associated with the tooth extraction in the past. Dental forceps are two first-

class levers, connected with a hinge. The forces applied to the handles are the long side of the lever, the beaks on the tooth are the short side of the lever, and the hinge acts as a fulcrum.<sup>2</sup> Hence, the force on the handles is magnified to allow the forceps to grasp the tooth with great force. The handles of the forceps allow the doctor to grasp the tooth, but do not assist in the mechanical advantage to remove it. This is similar to attempting to pull a bottle cap off a bottle using a pair of pliers vs using the advantage of a lever to remove the cap, as with a standard bottle cap opener. The Physics Forceps was developed by Golden and Misch in 2004.<sup>3</sup> Implementation of a first-class lever, creep, and the type of force provides the mechanical advantages necessary to make this dental extraction device more efficient. One handle of the device is connected to a "bumper," which acts as a fulcrum during the extraction. The beak of the extractor is positioned on the lingual or palatal root of the tooth and into the gingival sulcus. The bumper is placed on the facial aspect of the dental alveolus typically at the mucogingival junction.<sup>4</sup> No squeezing pressure is applied to the handles or to the tooth. Instead, the handles (once in position) are rotated as one unit for a few degrees, and then the action is stopped for approximately 1 minute. The torque force generated on the tooth, periodontal ligament, and bone is related to the length of the handle to the bumper (8 cm), divided by the distance from the bumper to the forceps beak (1 cm). As a result, a force on the handle connected to the bumper will increase the force on the tooth, periodontal ligament, and bone by 8 times. No force is required to be placed on the beak, which is only on the lingual aspect of the tooth root. Therefore, the tooth does not split, crush, or fracture. According to Dym and Weiss, there is no need to raise a mucoperiosteal flap or use an elevator before attempting extraction with the Physics Forceps.<sup>5</sup> This is a major advantage, particularly in cases that require atraumatic extraction. These differences could be attributed to the unique design of the Physics Forceps, which reduces the time frame as it allows building up internal force or creep within 60 to 90 seconds, allowing the bone to slowly expand and the periodontal ligament to release at the point at which the tooth will disengage from its socket.

#### **AIMS AND OBJECTIVES:**

The aim of the present study was to compare the efficacy of physics forceps with conventional forceps in therapeutic extraction of maxillary premolars. To measure the marginal bone level and gingival level while using physics forceps vs conventional forceps both before extraction and after extraction. To measure the ability to perform complete extraction in terms of crown or root fracture between physics and conventional forceps. To measure postoperative pain after using physics vs conventional forceps after extraction of teeth.

#### **MATERIALS AND METHODS:**

Conventional forceps group: Consecutive patients requiring bilateral extraction of maxillary premolars for orthodontic treatment were included in the present study between the age of 12-30 years. A detailed written, informed consent were obtained from all the patients who were above 18 years of age and consent signature from parents who were below 18 years of age. Split mouth design was implemented and each patient was subjected to extraction of maxillary premolar using conventional extraction forceps (control side ) on one side. After isolating the area, Vaseline is applied on the crown of 3 teeth (tooth to be extracted and one tooth mesial and distal to the tooth to be extracted). Cold cure acrylic resin is mixed and adapted to the occlusal surface of these teeth to form an occlusal acrylic template. Acrylic template was then placed intra orally over the teeth and was used as the reference point. A Williams periodontal probe was used for measuring the distance between gingival margin and the lower edge of template, which suggested pre extraction gingival level (Peg). The probe was then inserted deep into the gingival margin to measure the distance between the edge of template and the marginal bone, which showed the pre extraction bone level (Peb). Peg and Peb were measured at three different points on mesial 1/3rd, middle 1/3rd and distal 1/3rd on the buccal side of tooth to be extracted and values were recorded. Following the extraction the template was again placed over the teeth and distance between the marginal gingiva and lower edge of template was measured which showed Post Extraction Gingival level. Post Extraction Bone level (Pob) was measured by placing the probe into extracted socket and feeling the bone margin, distance was measured from the edge of the template. The mean value of pre extraction and post extraction level at three points was then calculated and the difference between these two values suggested the amount of marginal gingiva and bone loss. Under all aseptic precautions and standard patient preparation, the extraction of maxillary premolar was done under local infiltration with 2% lidocaine hydrochloride with 1:200000 adrenaline using 26 gauge needle and 2ml syringe The extraction of premolar on the contralateral side was undertaken after the gap of 3-4 days maintaining the standard conditions in place for the previous extraction on the opposite side. Operative complications such as incomplete removal or fracture of the tooth, were assessed intraoperatively and recorded. Extracted tooth was clinically examined for root fracture and adherence of buccal plate to the root and recorded. The extraction was given success score based on the criteria given by Choi et al., Complete success (Score 5): extraction without crown and root fracture. Limited success with root tip fracture (Score 4): extraction involving root tip fracture. Limited success with root fracture (Score 3): extraction involving root one or more root fracture or crown fracture. Limited

success with osteotomy (Score 2): fracture-free extraction and partial osteotomy in case divergent roots and thick cortical bone was present. Failure (Score 1): Failure to extract. Saline soaked gauze pressure pack were placed over the extraction socket and similar post extraction instructions were given to all the patients. Patients were followed up for postoperative pain evaluation approximately after 1 hr after the effect of LA is gone by checking with a probe using 10 point VAS scale. Another VAS score recorded after 24 hours. Pain score was noted for both post extraction sites by using 10 point visual analogue scale where 0 representing absence of pain and 10 indicating the pain most severe elicited through phone call. All the patients were prescribed paracetamol 650 mg TID up to three days, post operatively. All the Patients were advised warm saline rinses twice daily.

**EXTRACTION USING PHYSICS FORCEPS**

**GROUP:** Extraction of premolar on the contralateral side (study side) was undertaken after the gap of 3-4 days. Extractions were done following standard aseptic surgical protocols. Split mouth design was implemented and each patient was subjected to extraction of maxillary premolar using physics extraction forceps (study side ) on one side after isolating the area, Vaseline is applied on the crown of 3 teeth (tooth to be extracted and one tooth mesial and distal to the tooth to be extracted). Same criteria was followed for evaluation. The beak of Physics forceps was placed on lingual/palatal aspect of tooth at or below Cementoenamel Junction (CEJ) and bumper was placed on buccal alveolar ridge at mucogingival junction and constant controlled traction force was given until tooth was displaced out of the socket. Same clinical examination and post extraction instructions were given to all the patients.

**RESULTS:**

**TRAUMA TO GINGIVA:** There was statistically significant difference in the gingival trauma between two groups (p<0.005) (Table 1) Which implies

mesial 1/3<sup>rd</sup> ,middle 1/3<sup>rd</sup> has statistically significant values p= 0.005 and 0.000 except distal 1/3<sup>rd</sup> which is not statistically significant with p value=0.063. However overall trauma to gingiva is statistically significant by conventional forceps. And trauma to to gingiva is more in conventional forceps than in the physics forceps.

**TRAUMA TO MARGINAL BONE:** Trauma to marginal bone is described as mesial 1/3<sup>rd</sup>, middle 1/3<sup>rd</sup>, distal 1/3<sup>rd</sup> are measured prior to extraction and post extraction with both forceps. It is found that, difference between the physics forceps and conventional forceps has statistically significant. There with, the mesial 1/3<sup>rd</sup>, middle 1/3<sup>rd</sup>, distal 1/3<sup>rd</sup> of marginal bone has statistically significant p value 0.013,0.003,0.035 respectively. Therefore trauma to marginal bone is less in the physics forceps used in extraction than the conventional forceps used in extraction

**PAIN SCORE:** Mean VAS score post op pain within group (physics forceps) was 5.31(Table 1). Mean VAS score within group (conventional forceps) was 6.44(Table 1) Mean VAS score after 24 hours within group (physics forceps) was 2.53(Table 1). Mean VAS score within group (conventional forceps) was 3.81(Table 1) Both the vas score immediate post op and after 24 hours have statistically significant p value >0.020 Hence physics forceps has less intensity of pain than the conventional forceps employed in extraction. **Incidence of root and crown fracture (CHOI CRITERIA):** Above all, statistically significant with the concordance of CHOI et all criteria in respect to physics forceps group with p value 0.005. Beyond any doubt physics forceps has less incidence of root fracture than the conventional forceps used in extraction. Data were analyzed using SPSS software version 17. Data were expressed in number, percentage and mean and standard deviation. For quantitative data comparison we used Levene's Test, t-test for equality of means, Independent samples test and descriptive statistic. (Table 2)

**TABLE 1: GROUP STATISTICS**

	Forceps Used	N	Mean	Std. Deviation	P VALUE
After Extraction Gingival level at mesial	1	32	6.53	1.849	.005
	2	32	5.22	1.736	.005
After extraction gingival level at middle 1/3 <sup>rd</sup>	1	32	8.28	.924	.000
	2	32	7.41	.946	.000
After extraction gingival level at distal 1/3 <sup>rd</sup>	1	32	5.91	1.614	.063
	2	32	5.06	1.933	.063
After extraction marginal bone at mesial 1/3 <sup>rd</sup>	1	32	7.31	1.061	.012
	2	32	6.50	1.437	.013
After extraction marginal bone at middle	1	32	9.34	1.335	.003

1/3 <sup>rd</sup>	2	32	8.31	1.355	.003
After extraction marginal bone at distal 1/3 <sup>rd</sup>	1	32	6.97	1.596	.035
	2	32	6.13	1.540	.035
Choi _criteria	1	32	4.69	.592	.004
	2	32	5.00	.000	.005
Post op pain	1	32	6.44	1.917	.020
	2	32	5.31	1.839	.020
24h_pain	1	32	3.81	1.281	.000

**TABLE NO 2: INDEPENDENT SAMPLES TEST**

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
AE_G LEVEL_MESIAL	Equal variances assumed	.071	.790	2.927	62	.005	1.313	.448	.416	2.209
	Equal variances not assumed			2.927	61.757	.005	1.313	.448	.416	2.209
AE_G LEVEL_MIDDLE	Equal variances assumed	.345	.559	3.744	62	.000	.875	.234	.408	1.342
	Equal variances not assumed			3.744	61.967	.000	.875	.234	.408	1.342
AE_G LEVEL_DISTAL	Equal variances assumed	.223	.638	1.895	62	.063	.844	.445	-.046	1.734
	Equal variances not assumed			1.895	60.079	.063	.844	.445	-.047	1.734
AE_MB LEVEL_MESIAL	Equal variances assumed	3.742	.058	2.574	62	.012	.813	.316	.181	1.444
	Equal variances not assumed			2.574	57.050	.013	.813	.316	.180	1.445
AE_MB LEVEL_MIDDLE	Equal variances assumed	.009	.925	3.068	62	.003	1.031	.336	.359	1.703
	Equal variances not assumed			3.068	61.986	.003	1.031	.336	.359	1.703
AE_MB LEVEL_DISTAL	Equal variances assumed	.204	.653	2.152	62	.035	.844	.392	.060	1.627
	Equal variances not assumed			2.152	61.920	.035	.844	.392	.060	1.627
CHOI_CRITERIA	Equal variances	56.707	.000	-2.985	62	.004	-.313	.105	-.522	-.103

	assumed									
	Equal variances not assumed			-2.985	31.000	.005	-.313	.105	-.526	-.099
POST OP PAIN	Equal variances assumed	.134	.715	2.396	62	.020	1.125	.470	.186	2.064
	Equal variances not assumed			2.396	61.895	.020	1.125	.470	.186	2.064
24H_PAIN	Equal variances assumed	.587	.447	3.941	62	.000	1.281	.325	.631	1.931
	Equal variances not assumed			3.941	61.946	.000	1.281	.325	.631	1.931

**DISCUSSION:**

The design, a powerful mechanical advantage, proficient first class lever principle, a complex amalgamation makes physics forceps unique unlike the conventional forceps.<sup>6</sup> As Dym and Weiss<sup>7</sup> postulated the contemporary needless scenario of elevation, as usual conventional muco periosteal elevation usually needed for conventional forceps. Yong Hoon et al choi<sup>8</sup> have discussed about the atraumatic extraction and corner stone in terms of preserving the gingival and marginal bone as it requires. Also he added the incidence of decreased root fracture in multi rooted tooth. Khaled<sup>9</sup> stated the fact that force applied over the tooth helps in alleviating pain in the gingiva during extraction and also added consistent and persistent force applied over the gingiva makes less available for buccal bone fracture. Above all the bumper provides stable compressive force aids in tooth exit and also supports and preserves buccal bone in place. Kosinski<sup>10</sup> stated that physics forceps is helpful in orthodontic tooth movement as it maintain dexterity and facial contour of soft tissue. All 32 extraction that performed in our study found to be more comfortable in terms of using physics forceps than with conventional forceps on specific area post operative discomfort as it goes well with Soumen Mandal<sup>11</sup>. Trauma to gingiva is very much less in compare with conventional forceps with statistically significant p value except distal 1/3<sup>rd</sup> of gingival .As it provides greater contour and dexterity that needed for the orthodontic tooth movement for reestablishing alignment of teeth. Never the less or loss of marginal bone level signifies significant preservation in terms of marginal bone level as it is found in our study that requires for orthodontic tooth movement thereby that is the need of an hour in orthodontic treatment. Above all the significant p value in terms of marginal bone level loss in respect to physics forceps versus conventional forceps statistically significant is well substantiated with the results found. In our study only 4 patient under had gingival tear( table 1) using physics forceps. However

other patient it was absolutely atraumatic in terms of gingiva. On contrast patient underwent extraction with conventional forceps invariably traumatized the gingiva and statistically significant with p value 0.065. Having said that, beyond any doubt conventional forceps found to be traumatic and old school to contemporary physics forceps. Unique and special design of physics forceps aids in force like crushing torque and creep sparing buccal cortical plate. Microfracture of cortical plate have been higher in our study for those patient underwent conventional forceps than with the physics forceps. Desired sparing of periodontium around the tooth been achieved significantly which is higher in physics forceps group of in accordance with Saumen mandal as in his study revealed similar findings in terms of trauma to periodontium.<sup>12</sup> However interestingly Soennu avinash et al argued as exacerbated laceration of gingiva found to be more with concordance with the type of soft tissue covering tooth and boldly over stated as it is immaterial owing to the forceps usage. Mandal S et al widely studied about the gingival status measuring gingival level both post extraction and pre extraction in extent of measuring the laceration of gingiva. Thereby, he also added in measuring the laceration of gingiva and stated boldly with the percentage that physics forceps has gingival trauma above 52.38% and conventional forceps 16.6% respectively with overhauling appeal to physics forceps less traumatic. Immediate post operative pain measured by the vas scale in the study and 24 hour later also elicited. Beyond any doubt, the difference in forceps used has statistically significant p value 0.0035. Which is concordance with the study of Satish madanepalli et al<sup>13</sup>. Soft tissue getting damaged most obvious in conventional forceps as it has natural sequel requires of elevation muco periosteal flap known to be traumatic. In our study, statistically significant in terms trauma to gingiva with the p value 0.002. Thereby it states that trauma to gingiva is more in conventional forceps than with the physics forceps. In our study none of the patient using physics

forceps has negligible root tip fracture as it well depicted with Choi et al criteria. However, the root tip fracture is evident in conventional forceps tooth extraction and with statistically significant changes in the extraction of forceps used with significant p value.(0.005) Above all, statistically significant with the concordance of CHOI et al criteria in respect to physics forceps group with p value 0.005. Beyond any doubt physics forceps has less incidence of root fracture and crown fracture than the conventional forceps used in extraction.

## CONCLUSION

With this study it can be concluded that marginal bone level and gingival level has been substantially preserved with the physics forceps than conventional forceps during extraction which is needed for orthodontic tooth movement. The incidence of the root fracture is relatively higher in conventional forceps whereas it is negligent in using physics forceps as observed in our study. We conclude that patient experience less pain, better efficacy and can perform atraumatic extraction using physics forceps when compared with the conventional forceps.

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