

Correlation Between Extent of Supraeruption of Posterior Teeth and Period of Edentulism: A Cross Sectional Study

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ABSTRACT

Aim: The aim of this study was to correlate the extent of supraeruption of unopposed posterior teeth to the period of edentulism of opposing missing teeth.

Materials and Methods: A total of 58 unopposed posterior teeth were considered in the study. Diagnostic impressions of the arch with unopposed posterior teeth were made and casts were poured. Following which photographs were made of the casts using standardized photographic setup. The extent of supraeruption was measured using Adobe Photoshop CS5 software. The extent of supraeruption was then categorized into five groups based on the period of edentulism. The data was then subjected to statistical analysis.

Result: The mean value of supraeruption found in this study was 2.13 millimetre. For group I (8-20 months), group II (21-60 months), group III (61-100 months), group IV (101-140 months) and group V (141-180 months) mean value of extents of supraeruption was 1.25 mm, 1.99 mm, 3.28 mm, 3.74 mm and 3.77 mm respectively.

Conclusion: Within the limitations of the study it was concluded that unopposed posterior teeth were supraerupted and mean value of supraeruption was 2.13 millimetre. The positive correlation between the extents of supraeruption and period of edentulism was found. Furthermore, more extent of supraeruption was found in unopposed teeth whose antagonists were extracted because of caries rather than poor periodontal condition.

Keywords: Supraeruption, Period of edentulism.

INTRODUCTION

Over the past few decades with the increase in awareness, a decrease in state of edentulism is observed with more people retaining their natural teeth until old age.

Restorative dentist faces many challenges due to loss of posterior teeth as it causes alteration of arch form, interocclusal space and occlusal planes leading to development of occlusal interference.¹ The main positional change that observed is

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supraeruption of unopposed teeth, retained root stump and carious teeth.² Battistuzzi et al³ and Marcus et al⁴ found that the most commonly missing posterior tooth was the first permanent molar, followed by the second molar, second premolar, and finally the first premolar.

Craddock et al reported that teeth may move in several directions unless restrained by other tooth contacts and the magnitude of these movements can be variable.⁵ Christou P et al also reported a change in the position of teeth in all three dimensions.⁶ According to Craddock and Youngson 83% of teeth are likely to supraerupt which in terms of restoration could be clinically significant.⁷

Also, a majority of supraeruption occurs in the early years following loss of opposing tooth. The actual mechanism of the eruptive movement in adults is not clearly understood. Compagnon and Woda concluded that the phenomenon of supraeruption is dependent on several components including periodontal growth, passive and active eruption.⁸ Ainamo and Talari considered the change in width of the attached gingiva following loss of an opposing tooth. They noted that unopposed teeth continue to erupt following the loss of an antagonist. The supporting structures also developed vertically to follow tooth eruption.

The supporting structures also developed vertically to follow tooth eruption.⁹ Even in the present day scenario in a country like India restoration of missing teeth is often a challenge because of economic constraints, leading to long periods of edentulousness. There is no reported literature correlating the extent of supraeruption to the period of edentulousness. Hence, it arises a need to study the extent of supraeruption of the unopposed teeth and correlate it to the period of edentulism of the opposing side.

MATERIALS AND METHOD

This study was conducted in the Department of Prosthodontics, Crown and Bridge, K. M. Shah Dental College and Hospital, Sumandeep Vidyapeeth, Vadodara. Both the ethical clearance to conduct the study and completion certificate were obtained from Institutional Ethics Committee.

Patients who reported to the outpatient department were screened based on selection criteria by principle investigator. Patients having two or more unopposed posterior teeth with atleast canine and second molar present and who gave written informed consent were included in the study. Patients with periodontally compromised dentition, having a history of previous orthodontic therapy, orthognathic reconstructive surgery or patients having congenital or acquired defects, fixed restoration or splinting on unopposed teeth were excluded from this study.

Information about the study was provided through patient information sheet in the language they understood. Basic information of the patient was filled in the proforma sheet. Sample size of 58 participants was calculated using an online sample size estimation calculator.

Diagnostic impressions of the arch with unopposed posterior teeth were made and casts were poured in Type IV dental stone. A photograph of the cast was obtained using a standardized photographic setup (fig.I), in which the cast was oriented such that buccal aspect of the posterior teeth was kept parallel to the lens of the camera and the image was captured with the lens at a distance of 15 cm with magnification of 1:1.¹⁰ The photos were then transferred to the computer, and the extent of supraeruption was measured using Adobe Photoshop CS5 software.

With the aid of the software a curve was determined using incisal edge of incisors, cusp tip of the canine and buccal cusp of the premolar and molar as reference points (fig.II). The unopposed tooth/teeth were not considered in the process of determining the curve. A perpendicular line was drawn from highest point of the supraerupted teeth to the curve to measure the extent of supraeruption.

The patient was asked to fill up the reason for extraction of the teeth in the patient information sheet to classify them into

- 1) Extraction of teeth due to Caries and 2)
Extraction due to Periodontal problems

The above classifications were then categorized into five different groups based on the period of edentulism as given below:

1) 8-20 months 2) 21-60 months 3) 61-100 months
4) 101-140 months and 5) 141-180 months.¹¹

For different groups the determined values of supraeruption were obtained and appropriate statistical tests were performed. All the statistical

analysis was done by using SPSS software version 18.

RESULTS

All the 58 (100%) unopposed teeth showed varied extent of supraeruption.

Table 1: Distribution of extent of supraeruption at different period of edentulism.

	Extent of Supraeruption (in mm)				
	8-20 Months	21-60 Months	61-100 Months	101-140 Months	141-180 Months
1.03		1.98	3.23	3.58	4.35
0.79		2.04	3.59	3.64	3.20
0.98		1.56	3.09	4.06	-
0.45		1.61	2.98	3.96	-
1.77		1.20	3.98	3.50	-
1.56		2.15	2.85	-	-
1.45		1.82	3.15	-	-
1.43		1.96	3.42	-	-
1.88		2.11	-	-	-
1.46		1.76	-	-	-
2.07		2.07	-	-	-
0.80		1.86	-	-	-
2.60		1.8	-	-	-
1.52		1.56	-	-	-
1.07		1.67	-	-	-
0.66		2.23	-	-	-
1.54		1.89	-	-	-
1.13		2.1	-	-	-
0.20		2.75	-	-	-
0.78		2.49	-	-	-
-		2.54	-	-	-
-		2.45	-	-	-
-		2.23	-	-	-
Total no. of samples	20	23	08	05	02
Mean value	1.26	1.99	3.29	3.75	3.78

Table I summarizes the values of extent of supraeruption of unopposed teeth with different

period of edentulism. The smallest recorded reading was 0.20 mm and the highest was 4.35 mm.

Table 2: Descriptive statistics.

Months	N	Mean	Std. Deviation	Confidence Interval (95%)	
				Lower Bound	Upper Bound
8-20	20	1.26	0.58	0.99	1.53
21-60	23	1.99	0.36	1.84	2.15
61-100	8	3.29	0.37	2.98	3.59
101-140	5	3.75	0.25	3.44	4.05

141-180	2	3.78	0.81	-3.53	11.08
Total	58	2.13	0.99	1.87	2.39

Table II shows the mean extent of supraeruption recorded was 2.13 mm with the standard deviation of 0.99 with 95% confidence interval. The extent of supraeruption was further classified on the basis of

the reason for extraction of that tooth and the mean values of supraeruption for the same were tabulated as shown in table III and Table IV.

Table 3: Distribution of Extent of supraeruption along different periods of edentulism: (Reason of extraction: Caries).

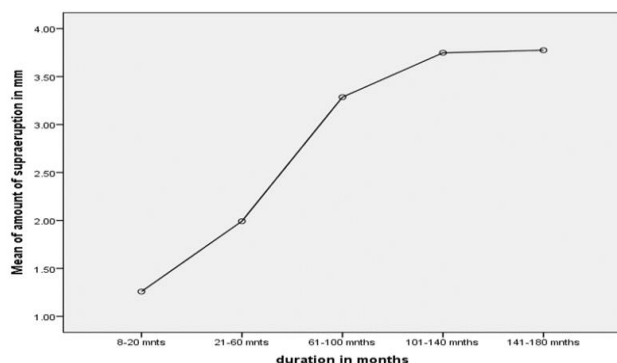
Reason of extraction	Extent of Supraeruption (in mm)				
	8-20 Months	21-60 Months	61-100 Months	101-140 Months	141-180 Months
Caries	1.03	1.82	3.23	3.58	4.35
	0.79	2.04	3.59	3.96	-
	0.98	2.11	3.42	4.06	-
	0.78	1.61	2.98	-	-
	1.77	1.20	3.98	-	-
	1.56	2.75	-	-	-
	1.45	2.49	-	-	-
	1.43	2.54	-	-	-
	1.88	2.45	-	-	-
	1.46	1.76	-	-	-
	1.52	1.89	-	-	-
	1.07	1.86	-	-	-
	-	1.67	-	-	-
Total no. of samples	12	13	05	03	01
Mean value	1.31	2.01	3.44	3.87	4.35

Table 4: Distribution of extent of supraeruption along different periods of edentulism: (Reason of extraction: Poor periodontal condition).

Reason of extraction	Extent of Supraeruption (in mm)				
	8-20 Months	21-60 Months	61-100 Months	101-140 Months	141-180 Months
Poor periodontal condition	2.07	1.8	2.85	3.64	3.20
	0.80	1.56	3.15	3.50	-
	2.60	1.98	3.09	-	-
	0.45	1.56	-	-	-
	1.54	2.15	-	-	-
	1.13	1.96	-	-	-
	0.66	2.07	-	-	-
	0.20	2.23	-	-	-
	-	2.1	-	-	-
	-	2.23	-	-	-

Total no. of samples	08	10	03	02	01
Mean value	1.18	1.96	3.03	3.57	3.20

A stronger Pearson's correlation was observed in the loss due to caries group ($r=0.9698$) than the loss due to periodontal reasons ($r=0.8849$).



Graph 1: Mean values of extent of supraeruption for different groups.

This graph shows plotting of mean values of extent of supraeruption for different groups. This suggests that extent of supraeruption increases as the time period after extraction increases.

DISCUSSION

It is of utmost importance to understand the associated tooth movement following extraction, as the goal of any treatment is to maintain a state of occlusal stability. Beyron commented that occlusion is not a static concept but changes throughout life, due to disease, wear, tooth loss, and restoration, and therefore should be considered as an entity undergoing constant change.¹²



Fig 1: Standardized Photographic Setup.

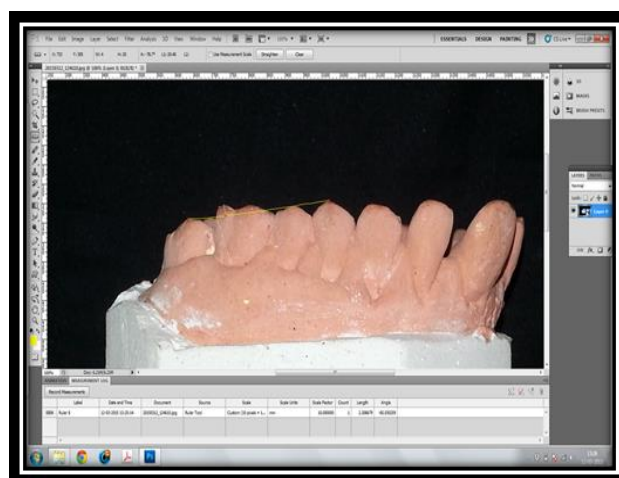


Fig 2: Measurement of supraeruption of an unopposed tooth.

This study found that all the 58 cases studied, showed some extent of supraeruption which is in accordance with a study done by Craddock et al⁷ who demonstrated 83% over eruption in unopposed teeth which had less than 20% contact with the antagonist and by Hakeem S. et al¹¹ in 2012 who measured frequency of over eruption in unopposed posterior teeth.

This study included patients with unopposed posterior teeth having at least canine and second molar in both the arches, as this would guide in determining the vertical position at desired occlusal plane level of teeth to be studied for the extent of supraeruption.

This study employed the use of digital photographs obtained from the diagnostic casts. The extent of supraeruption was measured by generating "Spline Curve"¹³ on the computer using Adobe Photoshop CS5 software. Manual measurement of the supraeruption on the casts with the ruler was avoided to eliminate intra-observers' error in measurement and to achieve more precise observations.

Compagnon and Woda concluded in their study that "Supraeruption of a tooth following the loss of antagonist contact is shown by the movement of the crown beyond the occlusal plane. This phenomenon can be divided into periodontal growth on the one

hand and active eruption on the other. With a normal dentition, periodontal growth seems to be liberated by the loss of occlusal contacts by only takes place during the early years following the extraction. Later when the hypo functioning continues supraeruption is chiefly the result of active eruption. In the case of an inflamed periodontium, supraeruption is more pronounced and is mainly due to active eruption.”⁸

This study observed a positive correlation between the extent of supraeruption and the period of edentulism, however the limitation of the study is it fails to measure the amounts of active or passive extent of supraeruption.

The most common reasons for the loss of teeth is either caries or poor periodontal health. This study observed a greater extent of supraeruption in tooth lost due to caries than as compared to that lost due to periodontal reason in each of the five subgroups. The possible explanation for the above observation may be that many a times the patient neglects care for the carious tooth unless it becomes symptomatic. However, there is a continuous loss of the tooth structure which may allow supraeruption of the opposing tooth.

Limitations of the study:

1. This study did not measure whether the extent of supraeruption was due to active or passive mechanism.
2. It only measured the vertical component of supraeruption but not supraeruption due to rotation, tipping, or drifting of tooth and tooth wear.

Therefore, further studies can be undertaken with the above variables and larger sample size.

CONCLUSION

This study concludes that:

1. There is supraeruption of an unopposed tooth.
2. A positive correlation exists between the extent of supraeruption and period of edentulism.
3. Extent of supraeruption is more in tooth which is lost due to caries than periodontal reasons.

CONFLICTS OF INTEREST

The authors declare they have no potential conflict of interests regarding this article.

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