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ORIGINAL ARTICLE

Association of tooth wear with freeway space among different age groups in patients with generalized tooth wear.

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ABSTRACT… Objective: To determine the association of tooth wear with freeway space among different age groups in patients with generalized tooth wear reporting to Khyber College of Dentistry, Peshawar. **Study Design:** Descriptive, Cross-sectional study. **Setting:** Department of Prosthodontics, Khyber College of Dentistry, Peshawar. **Period:** 3rd May 2020 to 29th January 2021. **Methods:** For this study, a total of 180 subjects were observed to identify the occurrence of tooth wear within the age group of 25-34 years, considering a prevalence rate of 3%. The sample size was determined with a 95% confidence level and a margin of error of 3%. Moreover, a non-probability consecutive sampling technique was used for data collection. **Results:** Data from 180 subjects were collected within a study duration of 7 months. The mean age of the subjects was 40.36±9.048 (SD) yrs. The chi-square test determined the association between tooth wear and freeway space, revealing a statistically insignificant (p-value of 0.16) relationship between the two variables. **Conclusion:** Freeway space was found to be statistically insignificant to the rate and degree of tooth wear.

Key words: Freeway Space, Generalized Tooth Wear, Tooth Surface Loss.

INTRODUCTION

Wear has existed millions of years ago since the evolution of dental structures.[1] When seen through the evolutionary perspective, it is logical to declare that wear was one of the most important selective factors that redefined the composition of dental tissue and altered the shape of teeth. Masticatory efficiency is dependent on the anatomical interplay and various wear characteristics of dentine and enamel, as well as the wear process.[2]

Tooth wear is a continuous physiological condition affecting the teeth throughout one's life.[3] This condition may advance to a pathological state caused by three distinct processes: erosion, abrasion, and attrition.[4] Accurate diagnoses and treatment approaches are required to provide visually acceptable and functional restorations to ensure the neuromuscular system and temporomandibular joint (TMJ) stability and adaptability.[5]

The height of the face is measured with the teeth in occlusion. It can be separated into upper and lower components that correlate to the maxillary basal bone.[6] Tooth wear is expected to impact lower face height because it has a connection with the dental alveolar structures within the facial region. In contrast, the upper face height is primarily determined by genetic and airway features, making it less vulnerable to the impact of tooth wear.[7]

In a study conducted by Murphy[8], Australian aboriginal skulls were examined, revealing a decrease in facial height due to severe dental wear. Murphy proposed that continuous tooth eruption and generalized alveolar bone growth might have served as compensatory mechanisms, but the overall compensation was deemed inadequate. Consequently, a decrease in facial height and an accompanying increase in freeway space were observed (freeway space =rest vertical

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dimension minus occlusal vertical dimension).

Tallgren[9] also documented these alterations in facial height. She studied the correlation between tooth wear and changes in adult face height. The results revealed a significant decrease in lower face height among patients with advanced wear.

A study by Levartovsky et al. revealed a higher incidence of tooth wear with increasing age ($p < 0.01$). Among the examined skulls, significant wear was observed in 11 of 16 individuals above 50 years (68%), while only 3% of individuals in the age group of 20-34 years exhibited notable wear.[10]

Russell[11] validated this concept, demonstrating an abnormal condition exists when the freeway space exceeds 5-6 mm. He further reported that the occlusal wear that caused extra space had progressed at a rate surpassing the compensatory mechanisms intended to mitigate it. All these findings lead to the idea that compensatory mechanisms don't provide full compensation and lead to an increase in freeway space in patients with generalized tooth wear.

This study is designed to remove the ambiguities from existing literature as to whether compensatory mechanisms are enough to maintain the freeway space or not. To my knowledge no local data is available. The results of this study will also provide a magnitude of the increase of freeway space in patients with tooth wear, which will act as a useful aid in management of patients with tooth wear.

METHODS

This Descriptive Cross-Sectional was conducted at Prosthodontics Department, Khyber College of Dentistry from 3rd May 2020 and concluding on 29th January 2021.

The Sampling Technique used was Consecutive non-probability by taking the 3% prevalence of tooth wear in the age group of 25-34 years[10], with a 95% confidence level and 3 % margin of error, the total sample size was 180 by using the WHO sample size calculator.

Selection Criteria

Inclusion Criteria

- The study's participants included both men and women with age group 20 to 60 years.
- Patients visiting dental OPD to restore missing teeth either via fixed or removable partial dentures.
- Patients with no mental or physical disability.

Exclusion Criteria

- Patients with physical/mental problems, e.g., epilepsy, cerebrovascular accident, facial palsy.
- Teeth restored with fixed partial denture prostheses.

Data Collection Procedure

The hospital's ethical committee approved the study (81/AD/PG/R/KCD) (15.2.20). Individuals who satisfied the inclusion criteria were asked to participate in the research. They were given detailed information about the study's aims, methodology, possible risks, and benefits. To ensure that they understood the study and were willing to participate, written informed consent was obtained. They were assured of maintaining the confidentiality of the personal data being collected. For the facial height measurement, a millimeter scale was used. Both occlusal and rest vertical dimensions were recorded, in the single visit, with the patient sitting upright and head unsupported, using two dot technique with one dot placed on the most prominent point of nose and other on the most prominent part of chin. Rest vertical dimension was measured with the jaw at rest and occlusal vertical dimension with the teeth in occlusion and the difference between the two was noted. Freeway space was calculated by measuring the difference between the rest vertical dimension (RVD) and occlusal vertical dimension (OVD). Every measurement was taken thrice to limit error, and the final value was calculated by taking the average.

Data Analysis

The data was collected, entered, and subjected to analysis using the software Statistical Package for Social Sciences (SPSS) version 20. Frequency

and percentages were calculated for categorical variables like grades of tooth wear. Mean ± SD was calculated for numerical variables like freeway space. The post-stratification analysis was done through chi-square, keeping p values<0.05 at a significant level. All the data is presented in the form of tables and graphs.

RESULTS

Age and Gender Distribution of Subjects

Data from 180 subjects having features of tooth wear were collected over a period of 07 months. The mean age of the subjects was 40.36±9.048 (SD) yrs. The distribution of subjects in various age group is shown in Table-I

Among the 180 subjects, male to female distribution is shown in Table-II. This yields a male-to-female ratio of 1.27:1. Most patients, i.e., 70 (38.9%), were between the ages of 31 and 40. The distribution of males to females in this age group was 38 (54.3%) males to 32 (45.7%) females. (Table-III)

Age groups	N (%)
20-30 yrs.	20 (11.1%)
31-40 yrs.	70 (38.9%)
41-50 yrs.	69 (38.3%)
51-60 yrs.	21 (11.7%)
Total	180 (100%)

Table-I. Distribution of the subjects in the various age groups

Gender	N (%)
Male	101 (56.1%)
Female	79 (43.9%)
Total	180 (100%)

Table-II. Gender distribution

Age Groups	Males (N)	Females (N)	Total (N) (%)
20-30 yrs.	11	9	20 (11.1%)
31-40 yrs.	38	32	70 (38.9%)
41-50 yrs.	36	33	69 (38.3%)
51-60 yrs.	05	16	21 (11.7%)
Total	101	79	180 (100%)

Table-III. Age & gender distribution

Relation of Tooth Wear to Freeway Space

This study was graded in order of increasing severity, and its effect on the increase of freeway space was noted accordingly. The data (in Table IV) gives statistical analysis using the Chi-square test of the relation of tooth wear to freeway space. The significance level was chosen as 0.05, meaning a statistically notable difference when $P \leq 0.05$. The relationship between tooth wear and freeway space is presented in (Table IV). Tooth wear has a statistically insignificant relationship with freeway space having a p-value of 0.16

DISCUSSION

The present study studied the relation of tooth wear to freeway space. Also, the effect of age and gender on tooth wear was studied. It was found that tooth wear has no significant effect on freeway space. The findings of my study align with those of S.J. Davies, who reported that dentoalveolar growth plays a role in retaining the overall facial height by rectifying vertical height loss induced by substantial dental wear.[12] This study is also consistent with the findings of D. Barlett, who stated that the concept of alveolar compensation is reasonably well understood; as teeth are worn and reduced in height, the opposing teeth maintain occlusal contact by appearing to over-erupt, and the result is a change in the occlusal plane.

Grade of Tooth Wear	Mean Freeway Space (mm)								Total	P-Value
	2.00	2.50	3.00	3.50	4.00	4.50	5.00	5.50		
1	14	7	12	5	4	0	0	0	42	0.16
2	3	3	9	4	7	0	0	0	26	
3	3	2	6	0	0	17	15	6	49	
4	4	5	15	3	0	7	8	2	44	
5	4	3	9	1	1	1	0	0	19	
Total	28	20	51	13	12	25	23	8	180	

Table-IV. Relation of dental wear to freeway space

According to him, this adaptive process was the basis of the 'Dahl' appliance, conceived to reverse the adaptive change in the position of teeth.[13]

Murphy observed a correlation between the extent of occlusal wear and a reduction in the occlusal vertical dimension when comparing the upper and lower face heights of Aboriginal skulls in 1959. He concluded that, despite a compensatory mechanism for this severe tooth wear that comprised continued tooth eruption and generalized alveolar bone development, the compensation was ineffective, and the end consequence was a loss in face height.[14] His results contrast ours, which might be differences in wear rates between civilizations related to food or other variables. Also, his study was conducted on dried skulls, not living creatures. The participants in the present study were selected from the local population of Peshawar. It seems that the existence of abrasive particles in meals is the primary cause of significant wear. Their diet consists primarily of meat and meat products, a specific variety of soft bread known as ''pitta'', rice, tomatoes, onions, eggs, and various dairy products like cheese and butter.[15] Pitta is traditionally prepared by manually grinding wheat using a stone pestle and mortar or simple milling processes. Consequently, the flour used to make pitta contains many stone fragments.[16] These variables, dietary practices, and environmental circumstances might interact to cause wear over time. As a result, the compensatory mechanism within the dent alveolar system may be able to maintain overall face height. D.W. Barlett's research also found a substantial link between nutritional patterns and tooth wear.[13]

The researchers found no statistically significant variation in tooth wears grade or gender. The results are consistent with the study by F.Kiran et al , who conducted a study at Bahria Medical and dental college Karachi.[17] Research on skulls of human beings from the Roman-Byzantine era and mediaeval skulls from northern Sweden have likewise shown that dental wear is distributed equally across the genders with no gender disparities.[18] These results are in contrast to the study by S. Donachie and Walls, who discovered that men had greater wear than women.[19] Peter Wetselaar, who conducted study on Dutch population, stated that males had an average score of 2.00, while females had a score of 1.81. [20] This slight difference in results could potentially be attributed to significant ethnic differences, variations in life style and diet.[21]

This study also discovered a positive correlation between age and dental wear. Tooth wear is recognized as a natural outcome of aging, and the extent of wear in relation to the patient's age serves as a useful sign for determining if the tooth tissue loss is normal or aberrant.[22] A study conducted by Katie e Faillace also supported a positive relation between tooth wear and age. In this study, Pearson's correlation coefficient analysis of all categories of tooth wear scores showed a significant ($p < 0.01$) and positive association between dental wear and age.[23] A study by M.A Awad also found positive association between age and tooth wear. As per his study tooth wear can act as a tool for age estimation.[24]

It is crucial to bear in mind that study on a given population provide us with the opportunity to evaluate the effects of tooth wear on freeway space in certain ethnic group, the results of which cannot be generalized to whole population. Nonetheless, it is critical to interpret these results cautiously, as the examination provides limited insights into the complex biological relationships under certain circumstances.

CONCLUSION

1. Dental wear doesn't have an impact on the mean freeway space significantly.
2. A positive significant relationship exists between age and dental wear.
3. There were no statistically significant variations in dental wear depending on gender.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

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AUTHORSHIP AND CONTRIBUTION DECLARATION

No.	Author(s) Full Name	Contribution to the paper	Author(s) Signature
1	Anhum Haroon Jadoon	Conception or design of the work, data collection.	
2	Abid Hussain	The acquisition, analysis of data.	
3	Afnan Rahman	Interpretation of data and drawing inferences.	
4	Fatima Khalid Qazir	Final draft of article.	
5	Sadia Bano	Critical analysis.	
6	Ehtisham Khan	Final review.