

Frequency and Causes of Fracture of Acrylic Resin Complete Dentures in Edentulous patients

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ABSTRACT

Background: The rehabilitation of edentulous patients requires acrylic resin complete dentures to fulfil their functional and esthetic needs. Fractures of dentures are one of the commonest complaints around the world.

Aim: To evaluate the frequency of acrylic complete denture fractures among edentulous patients and find out their association with certain variables.

Methodology: A cross sectional observational study was carried out in Prosthodontic department of Lahore Medical and Dental College, Lahore from 26th March 2020 to 26th September 2021. A total of 58 completely edentulous patients reported with fractured acrylic dentures were selected. Patients were evaluated both intra and extra orally to find out the cause and site of fracture. Various parameters namely, denture age, fracture sites, gender were statistically evaluated to find out their relationship with denture fracture.

Results: Results showed that male patients; 56.9% were presenting more with fractured dentures than female; 43.10%. In males the midline denture fractures were most commonly seen 45.5%, whereas in females' fracture at premolar area was commonly observed 28.0% however no statistical dependence between fractured dentures sites and gender was found. Denture fractures were most prevalent in mandibular arch 50% as compared to maxillary 39.7%. Mid line fracture was the commonest site observed in both maxillary 30.4% and mandibular arches 31.0%. Insignificant association between fracture sites and dental arches was seen. Maximum denture fractures were recorded in first 2 years of denture fabrication 55.2%. The most frequent cause of denture fracture was accidental falling 34.5%.

Conclusion: The frequency of complete denture fracture is more in mandible as compared to maxilla and the main reason is patients' negligence. The study also showed midline fracture of dentures to be the most frequent site of denture fracture.

Keywords: Acrylic dentures, Complete dentures, Edentulism, Edentulous, Prosthesis, Tooth loss,

INTRODUCTION

Edentulism is the condition that results in complete loss of teeth.¹ The rehabilitation of edentulous patients requires a prosthesis that fulfils their aesthetics, phonetics and functional demands.^{2,3} Complete denture is the most commonly offered prosthesis to edentulous people around the world. Dentures are made up of acrylic resins that is chemically called polymethyl methacrylate^{4,5}. The material possesses good aesthetics qualities, ease of manipulation and repair and is very cost effective. Despite its popularity, one of the major complications encountered using this material is the denture fracture^{5,6}.

Denture fracture remains a significant problem even after advances in the dental material technology.⁷ The denture fractures result due to many factors, like the factors that increase the stress concentration in denture bases like deep frenal notches, thin or underextend denture flanges, tori, non-balanced occlusion, ill-fitting denture and poor denture designing.^{7,8} Fracture of a denture can also occur due to accidental or mechanical reasons in the form of different forces like impact and flexural fatigue.⁸ Extraoral causes resulting in fracture are accidental falling or dropping, however intraorally are the improper occlusal contact, poor teeth arrangement, opposing natural teeth in the arch, high frenal attachment and hard and soft tissue undercuts.⁷⁻⁹ Some other factors that can fracture a denture include bruxism and parafunctional habits. There could be many possible sites where a denture can get fracture⁷. The most common site of denture fracture reported in dental literature includes the midline fracture of both maxillary and mandibular denture bases followed by teeth debonding resulting from poor laboratory techniques^{7,9}.

It is important to consider all the facts resulting in acrylic denture fracture because edentulous patients are elderly and most

of them are dissatisfied with their dentures^{6,8,9}. They feel helpless and believe that they have to accept denture problems as a part of wearing a complete denture.^{9,10} Denture fractures or their repeated repair not only disturbs the life quality of an edentulous patient, add additional cost of repairing but also results in 40 to 60% reduction of dentures transverse strength^{10,11}. Moreover, a repaired denture will often refractured at the junction of new and old material and the process continues^{9,12}.

Despite high frequency of denture fractures surprisingly very less dental literature is available. Present study was an attempt to determine the frequency and causes of denture fracture so that measures can be taken and attention to be directed to reduce the frequency of such occurrence. Preventive measures can be taken to avoid frequency and improvement in prosthesis can be made.

Therefore, the purpose was to find out number, type of denture fracture at Lahore Medical and Dental College and to ascertain its association between certain variables.

METHODOLOGY

A cross sectional observational study was conducted on 58 completely edentulous patients of both genders. The patients reported for denture repair. Age of the patients ranged from 40 to 80 years. All the patients were selected from the outdoor of Prosthodontic department of Lahore Medical and Dental College, from 26th March 2020 to 26th September 2021. The study was conducted in 18 months period. Non probability purposive sampling was used for patient selection. The sample size was estimated from the previous study carried out on denture fractures in edentulous patients.⁷ Patients wearing acrylic complete dentures in both arches or single arch were selected. Patient with good neuromuscular control and normal oral anatomy were included in the study. Patients who had bruxism, uncontrolled neuromuscular movements, Parkinsonism, maxillo mandibular orofacial defect, poor denture control and those with abnormal eccentric mandibular

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movements were excluded from the study. Unwilling patients to participate in the study were also not included. Informed consent was taken and ethical approval letter obtained from Ethical Approval Committee of Lahore Medical and Dental College.

Two experienced Prosthodontists carefully examined the patient as well as the denture. Detailed history was obtained and evaluation of denture done both intra and extra orally. Type of damage, age of denture, gender, cause of fracture was noted and denture fractures were related with these factors. Physical examination of denture fracture done for fracture line, incisal notch, teeth setup, occlusal wearing, denture base thickness, porosity. Intraoral examination of patient was done in respect of the hard palate form and shape of dental arch, palatal vault depth, ridge resorption, prominence of mid palatal suture, frenum, undercut and presence of opposing naturals. The denture repair was done using conventional method with cold cure acrylic resin. Repaired dentures were delivered after checking adaptation, retention, stability and function.

Data Analysis: Data was entered and analyzed using SPSS version 20. Descriptive analysis was done and frequency and percentages obtained. Chi Square test was used to find out the association between the selected variables and denture fractures. The results were considered statistically significant when probability was less than 0.05.

RESULTS

In the study 58 completely edentulous patients were examined. Out of all the patients it was observed that male patients were presenting more with the complaint of fractured dentures than female i.e., 3(56.9%) male and 25(43.10%) female patients. The age range of the patients was 40 to 80 years with the mean age 63.5±SD 9.72. In males the midline denture fractures were most commonly seen 15(45.5%), whereas in females' fracture at premolar area was commonly observed 7(28%). Statistical dependance between fractured dentures sites and gender was assessed using Chi square test and was found insignificant i.e. $p > 0.05$ (Table I).

Denture fractures were most prevalent in mandibular arch 29;50.0% as compared to maxillary arch 23(39.7%) whereas only

6(10.3%) patients reported with fractured dentures in both the arches. Mid line fracture was the commonest site observed in both maxillary and mandibular arches 7(30.4%), 9(31%) whereas least common fracture site observed in both arches was retromolar pad/tuberosity area 3(13%) and 0%. The association between fracture sites and dental arches was found to be insignificant, i.e., $p > 0.05$ (Table II).

The most frequent cause of denture fracture was found to be the accidental falling 20;34.5% followed by poor fitting of the denture 16(27.6%) and occlusal prematurity 14(24.1%). The least reported cause of denture fractures was denture porosities 8(13.8%).

The most common denture fracture site observed was mid line and labial flange fracture 19;32.8%, 14;24.1% and least observed fracture site was the retromolar pad /tuberosity area 3(5.2%). However, fracture site at premolar and canine area was found to be 9(5.5%) and 12(20.7%) respectively. The denture fracture sites and causes were associated and insignificant results were obtained, $P > 0.05$ (Table III).

Regarding the age of the denture, the maximum denture fractures were recorded in first 2 years of denture fabrication 32;55.2% however least reported fractures were found in denture aged 6 to 8 years. The association between age of dentures and number of fractures was found using Chi Square test and insignificant results obtained, $p 0.822$ Table IV. The major cause of denture fractures in early years was accidental falling followed by occlusal prematurity and denture porosities. The major cause of fractures however in the later ages of dentures was the poor fit of the denture (Table IV).

Table: I Association of denture fracture sites with respect to gender (n= 58)

Cause	Male n%-	Female n%
Mid line fracture	15(45.5)	4(16.0)
Labial flange	8(24.2)	6(24.0)
Canine area	3(9.1)	6(24.0)
Premolar area	5(15.2)	7(28.0)
Retromolar pad/tuberosity area	1(3.0)	2(8.0)
Other areas	1(3.0)	0(0.0)
P value	0.137	

Table II: Frequency distribution of denture fracture sites in dental arches (n=58)

Fracture site	Maxillary denture n%	Mandibular denture n%	Both dentures n%
Mid line	7(30.4)	9(31.0)	3(50.0)
Labial flange	4(17.4)	9(31.0)	1(16.7)
Canin area	3(13.0)	5(17.2)	1(16.7)
Premolar area	5(21.7)	6(20.0)	1(16.7)
Reteromolar pad/tuberosity area	3(13.0)	0(0.0)	0(0.0)
Other areas	1(4.4)	0(0.0)	0(0.0)
Total	23(39.7)	29(50.0)	6(10.3)

Table III: Frequency distribution of denture fracture causes in relation to fracture sites (n=58)

Denture fracture sites	Accidental falling n%	Occlusal prematurity n(%)	Poor fit n%	Denture porosity n%
Mid line	6(30.0)	6(42.9)	5(31.2)	2(25.0)
Labial flange	5(25.0)	2(14.3)	6(37.5)	1(12.5)
Canine area	2(10.0)	4(28.6)	0(0.0)	3(37.5)
Premolar area	3(15.0)	2(14.3)	5(4.2)	2(26.0)
Reteromolar pad/tuberosity area	3(15.0)	0(0.0)	0(0.0)	0(0.0)
Other causes	1(5.0)	0(0.0)	0(0.0)	0(0.0)
P value	0.220			

Table: IV Frequency distribution of denture fractures with respect to denture age and cause, N=58

Denture age	Number of dentures%	Accidental falling%	Occlusal prematurity%	Poor fit%	Denture porosity%
0-2	32(55.2)	13(40.0)	8(25.0)	8(25.0)	3(9.4)
3-5	17(29.3)	3(17.6)	5(29.9)	6(35.3)	3(17.6)
6-8	3(5.2)	1(33.3)	0(0.0)	2(66.7)	0(0.0)
>8	6(10.3)	3(50.3)	1(16.7)	0(0.0)	2(25.0)

DISCUSSION

In this study more male patients (56.9%) reported with complete denture fracture as compared to females (43%). Similarly, Al-Sheikh¹³ reported 65.2% males and 34.8% females with denture fractures and association between gender and fractures showed no statistical significance. Rajesh¹⁴, Keziah¹⁵, Khalid¹⁶ and Bosanceanu¹⁷ found dominance of male patients in their respective studies. However, in contrast female denture fractures were most frequently seen in a study by Al-Sheikh¹³ and co-workers where 46.4% mandibular dentures with fractures were reported in females and the finding was consistent with other studies^{13,17}.

Most common cause of denture fracture found in current study was patient negligence that resulted in accidental denture falling (34.5%) followed by poor fitting (27.6%) and occlusal prematurity's (24.1%). Likewise, Impact fracture (80.4%) was the main reason of fracture reported by Al-Sheikh¹³ and co-workers and stated that lack of attention being paid by the patients towards denture care. Bosanceanu¹⁷ and Naik¹⁸ in their respective studies found the common cause for fracture in maxilla was poor fitting denture and in mandibular accidental falling. Khalid¹⁶ reported poor fitting (40%) followed by poor occlusal relation (21%) as the prominent cause of fracture in maxilla and accidental dropping (33%) in mandibular denture fracture. However, in contrast significant results between denture causes and fractures were seen in his study $P < 0.001$.

The most common fracture site observed was midline fracture and labial flange fracture 32.8%, 24.1%. Midline fracture in maxillary denture results from cyclic deformation of denture base during load applied. Fracture usually resulting from the labial notch due to stress concentration. In mandible the denture is thinnest from the midline and attributes to fracture. Moreover, patient's negligence in inserting and removing the dentures are the reasons of fracture^{18,19}. Bosanceanu¹⁷ stated mandibular denture fracture was in ratio of 3:1 as compared to maxillary as mandible is smaller in width. Similarly, Khalid¹⁶ reported midline fracture as the commonest cause of fracture (59%) and more in mandible i.e.; 2:1 ratio with maxilla. Naik¹⁸ reported 60% midline fracture and stated that less surface area and thinnest middle part of denture are responsible for the breakage.

Frequently high number of denture fractures were seen in mandibular arches as compared to maxillary. In concordance Choudhary¹⁹ reported 61% fractures in mandible and 46.87% in maxilla and found this as statistically significant results. Similarly greater number of fractures seen in mandible than maxilla by Keziah¹⁵ and coworkers. Naik¹⁸ reported this difference between arches in 3:1 ratio where mandibular is more than maxillary denture fracture. Ray⁸ and coworkers 40.8% maxillary and 59.2% mandibular denture fractures. Increased prevalence in maxillary denture fracture reported by Takamiya⁵ and found significant difference from mandible. The reason for this finding is that mandibular dentures being thinnest in the middle area plus less surface area as compared to maxilla results in more breakage^{5,20,21}.

Most fractures occurred in first two years of denture age (55.2%) and main cause in early age was accidental falling followed by occlusal prematurity whereas, in later ages i.e.; up to eight years main reason was poor fitting dentures. Similar findings were reported by Bosanceanu¹⁷ and co-workers and found maxillary fractures in early years. Early year fractures were also found in Al-Sheikh¹³ study. Naik¹⁸ reported fracture in first two to four years.

Patient negligence results in dropping and impact results in breakage in latter ages loose fitting dentures resulted in occlusal disturbances and denture flexion during function leads to fatigue fracture. Denture fractures are frequent and result in much distress and cost for patients so proper patient education, and patient

motivation should be done to reduce accidental mishaps. Furthermore, prosthodontic principles in denture constructions should be followed maintaining proper thickness of dentures to prevent stress concentration.

CONCLUSION

The frequency of complete denture fracture is more in mandible as compared to maxilla and the main reason is patients' negligence. The study also showed midline fracture of dentures to be the most frequent site of denture fracture.

Authors Contribution: JI & ZS: Data collection, **MNS:** Statistical analysis, **FA:** Manuscript proof reading, **AN:** Literature review, **AT:** Manuscript Writing, **KQ:** Conceived idea, Designed research

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