

Evaluation of fracture of removable complete and partial denture prosthesis in West Uttar Pradesh Population - A survey.

Lukram A^{1*}, Jadhav S², Singh K³, Yadav A⁴

^{1*}Consultant Prosthodontist And Maxillofacial Implantologist, Imphal, INDIA,

²PG Resident, TMDC and RC, Moradabad, Uttar Pradesh, INDIA.

³PG Resident, Department of Prosthodontics, KD Dental College, Mathura, Uttar Pradesh, INDIA.,

⁴Consultant Orthodontist, Delhi, INDIA.

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*Correspondence to:

Anooj Lukram,
Sega road top leriak machin,
Imphal, INDIA.
anoojlukram19@yahoo.com.

ABSTRACT

Objectives: Present study was conducted to determine the causes and types of partial and complete denture fractures. **Materials and method:** Totally 160 patients were examined, out of which 68(42%) were complete denture (CD) wearers and 92 (58%) removable partial denture (RPD) wearers. All the patients were reported to have the fracture in their dentures in the specific region. The questionnaire was administered which collected the information related to denture fracture and its relation with demographic variables and various other factors. **Results:** Lower partial denture was seen to be the most common type of denture base on which fracture occurred. Maximum number of fractured denture patients had Kennedy Class 1 lower partial denture (75.4%). More number of fractures occurs in 1-3 years age of denture (52.5%). 68.4% of males got fractured denture while 31.6% of females got fractured denture. Damage of denture according to age of wearer was seen mostly in age group of <=59 years. Impact wear (77.8%) was the main reason for denture fracture. Breakage in the acrylic base (69.8%) was the most important type of fracture. 57.4% of patients had not undergone any previous denture fracture. Complete denture (42.3%) is the most common type of antagonist to fractured denture base. In 92.8% of patients no strengthener was used. **Conclusion:** The life of a denture wearer gets paralyzed abruptly by the sudden fracture of his/her denture which becomes a necessity for his/her day to day routine life. As part of the dental education faculty, it is always our goal to make the life of denture-wearers easier and happier by investigating and solving the problems related to complete denture patients. Damage to removable dentures is quite frequent causing much distress and cost to the patient. Present study finding's provides reliable base-line data regarding the prevalence, distribution and severity of damage in dentures.

KEYWORDS: Acrylic resin, Complete denture, Denture fracture, Midline fracture.

INTRODUCTION

In spite of advances in dental technology, it can be seen that fractures of acrylic resin dentures remain a significant problem and the number of denture fractures has not lessened. Denture fracture is usually mechanical or accidental.^{1,2} Mechanical causes are related to faulty design, faulty fabrication and, or poor materials choice.³⁻⁵ Any factor that exacerbates deformation of the base or alters its stress distribution will predispose the denture to fracture.^{1,6} While denture bases deform under loading, this deformation may be exacerbated by other factors such as changes in the denture base, tooth wear, and sharp changes in contour, pin holes, inclusions, deep

scratches, and residual processing stresses may all cause stress intensification.⁴ A survey of denture fractures, however, has indicated that most failures occurred when there was deep notching at the midline labial frenulum. This supports the contention that the incisional notch is the most important causative factor in midline fracture and that cracks initiate at the tip of the notch where there is high local stress concentration.

MATERIALS AND METHODS

Training of the recording clerk: The examiner was assisted by a recording clerk who was trained and instructed in recording the data on the assessment sheets.

The **Inclusion Criteria** were patients with broken dentures attending the Department of Prosthodontics and Crown & Bridge, Teerthanker Mahaveer Dental College and Research Centre, Moradabad. All the patients gave informed consent for examination.

Exclusion Criteria were medically compromised individuals, patients who refused to sign the consent form, un-cooperative patients and physically/mentally disabled individuals.

Survey Instrument: The proforma used in this survey comprises the following parameters:

- 1) General Information in respect of the patient's name, age, sex, address and occupation.
- 2) Questionnaire to evaluate the fractured dentures.

Questionnaire for the evaluation fractured denture Depending upon type of denture:

Of 160 patients, 68 patients were complete denture wearers (maxillary dentures (38); and mandibular dentures (30), while 92 of them were partial denture wearers (maxillary dentures (22) and mandibular dentures (70). The partial denture wearers were classified according to the Kennedy's classification. (Class I, Class II, Class III, Class IV)

Depending upon age of Denture: The total age of the denture were entered as: < 1 year, 1-3 years and > 3 years.

Depending upon demographic variables: Out of 160 patients, 109 were males while 51 were females. According to their age, patients were divided into two groups: < 59 yrs. and > 59 yrs.

Causes of Fracture: In our study, fractures of dentures were found to be due to accident, trauma, impact, and mastication. The denture fractures were divided into the following types - hairline fracture, breakage in acrylic base, loosening of artificial tooth and damaged clasp. Data was collected depending upon the number of repairs attempted in the past.

Type of Antagonist: This was considered to play a major role in determining the denture fractures. The status of fracture depending on the type of antagonists such as natural teeth or fixed prostheses, complete denture, partial denture was recorded.

Strengtheners: The denture fractures were assessed whether or not the strengtheners, such as, metal wire, metal mesh played any role.

Infection control: The diagnostic instruments were sterilized using an autoclave (enclave) in the department before the procedure. The investigator used disposable mouth masks and gloves during examination. Surface disinfectants (povidone iodine 10 %) were used to clean the surface near the examination area.

Collection and Storage of Survey forms and Questionnaire: The questionnaire sheets were arranged in serial numbers and stacked together in a bundle. The bundle was labelled with ID numbers and date of

recording so as to make them ready for data entry. The data entry was made on the same day or within 2-3 days, so that any discrepancy if present could be rectified.

DATA ANALYSIS: Statistical procedure were divided into two parts-

1. Data Compilation and Presentation: The data obtained was compiled systematically, transformed from a pre-recorded proforma to a computer and a master table was prepared. The total data was distributed meaningfully and presented as individual tables along with graphs.

2. Statistical Analysis: Descriptive statistical analysis has been carried out in the present study. Results on categorical data were compared by applying chi-square (Pearson's) test. Significance is assessed at 5% level of significance.

RESULTS

A total of 160 patients reported to the Department of prosthodontics with the complaints of broken dentures. Out of which, 58% were having complaints of fractured partial dentures (group A) while remaining 42% were having complaints of fractured complete dentures (group B).

In group A, the majority i.e. 76.1 % patients had fractured mandibular partial denture while 23.9 % had fractured maxillary partial denture. In group B, 55.9% had fractured maxillary complete dentures and 44.1% had fractured mandibular complete denture (Table 1).

The partial dentures (n=92) were divided into four classes as per the frequency of fractures in each. It was seen that among the total partial denture cases, 75.4% were of Class I category, 12.1% of class II category, 3.7% of class III while remaining 8.8% belonged to class IV type (Kennedy's Classification) Table 2.

Age-wise, the fractured dentures were classified as: Group A (<1year), Group B (1-3years) and Group C (>3 years). The reports showed that a total of 17.4% dentures were found to be used for less than 1 year while 52.5% were used for 1-3years, remaining 30.1% were used for more than 3 years. The Chi-square test showed a statistical dependence between damaged dentures and age of the denture (P=0.004) (Table) 3.

As per the gender of the patient the denture fractures were found to be higher in male patients (68.4%) than female wearers (31.6%). There was no statistically significant differences between fractured dentures and the sex of denture wearers (P = 1.013) (Table 4).

As per the age of the patient the fractured dentures, were classified into two groups: Group A- ≤59 years, and Group B - ≥60 years. Result showed that the denture damage was seen to be higher in Group A (61%) than in Group B (39%). There was no statistically significant difference between damage of denture according to age of wearer (P=1.104) (Table 5).

Table 1. Fracture in different types of dentures in the study population.

TYPE OF DENTURE	n	%
Upper complete denture (UCD)	38	23.6
Lower complete denture (LCD)	30	18.4
Upper partial denture (UPD)	22	14.1
Lower partial denture (LPD)	70	43.9

Table 2: Frequency of damage (fracture) in partial denture prosthesis as per Kennedy's classification.

VARIABLES		UCD	LCD	UPD	LPD	TOTAL	P-value
KENNEDY CLASSIFICATION	CLASS 1	-	-	11(16.2)	58(83.8)	69 (75.4)	.00094 (<0.001)
	CLASS 2	-	-	3(29.4)	8(70.6)	11 (12.1)	
	CLASS 3	-	-	0	3 (100)	3 (3.7)	
	CLASS 4	-	-	9(100)	0	9(8.8)	

P-values are obtained using Chi-Square test, p-value<0.00094 is considered to be statistically significant

Table 3: Frequency of damage (fracture) in partial denture prosthesis as per age of denture.

VARIABLES		UCD	LCD	UPD	LPD	TOTAL	P-value
Age of denture	<1year	8(29.4)	7(24.2)	5(17.2)	8(29.2)	28(17.4)	.004
	1-3 years	13(15.4)	18(21.3)	5(6.4)	48(46.9)	84 (52.5)	
	>3 years	14(28.2)	6(12.2)	13(27.1)	15(32.5)	48 (30.1)	

P-values are obtained using Chi-Square test, p-value= 0.004 is considered to be statistically significant.

Table 4: Frequency of denture damage as per the gender.

VARIABLES		UCD	LCD	UPD	LPD	TOTAL	P-value
Wearer of denture	Male	8(25.4)	19(17.2)	16(14.4)	46(43.0)	109(68.4)	1.013
	Female	9(18.4)	10(19.8)	7(13.4)	25(48.4)	51(31.6)	

P-values are obtained using Chi-Square test, p-value=0.00094 is considered to be statistically not significant.

Table 5: Frequency of damage of denture as per the age of the wearer.

VARIABLES		UCD	LCD	UPD	LPD	TOTAL	P-value
Age of wearer	<=59 YEARS	21(21.5)	14(14.6)	12(12.2)	51(51.7)	98(61.0)	1.104
	>=60 YEARS	15(24.8)	17(26.9)	8(12.4)	22(35.9)	62(39.0)	

P-values are obtained using Chi-Square test, p-value= 1.104 is considered to be statistically not significant

Table 6: Causes of fracture.

VARIABLES		UCD	LCD	UPD	LPD	TOTAL	P-value
Causes of fracture	Accident	2(26.5)	(0)	6(73.5)	(0)	8(5.2)	.003
	Impact	28(22.4)	25(19.8)	15(12.5)	56(45.3)	124(77.8)	
	Mastication	8(29.2)	5(17.5)	3(12.2)	12(41.1)	28(17.0)	

P-values are obtained using Chi-Square test, p-value<0.00094 is considered to be statistically significant.

Table 7: Types of fracture

VARIABLES		UCD	LCD	UPD	LPD	TOTAL	P-value
Type of fracture	Hairline	8(32.2)	9(33.4)	5(17.6)	4(16.8)	26(16.4)	.001
	Breakage	25(22.4)	17(14.8)	10(9.6)	60(53.2)	112(69.8)	
	Loosening of tooth	4(36.8)	5(37.4)	2(13.6)	1(12.2)	12(7.5)	
	Damaged clasp	(0)	(0)	5(52.6)	5(47.4)	10(6.3)	

P-values are obtained using Chi-Square test, p-value= 0.001 is considered to be statistically significant.

Table 8: Number of previous fractures

VARIABLES	UCD	LCD	UPD	LPD	TOTAL	P-value
Number of previous fracture	0	27(29.4)	17(18.5)	12(13.4)	36(38.7)	.873
	1	3(14.5)	5(21.6)	3(14.2)	12(49.7)	
	2	6(17.1)	5(13.4)	5(13.2)	21(56.3)	
	3	1(12.4)	2(23.5)	2(23.6)	3(40.5)	

P-values are obtained using Chi-Square test, p-value=0.873 is considered to be statistically not significant.

Table 9: Type of antagonist of the damaged denture

VARIABLES	UCD	LCD	UPD	LPD	TOTAL	P-value	
Type of antagonist	Natural teeth or fixed prosthesis	9(16.1)	11(8.2)	14(24.5)	30(51.2)	58(36.5)	<0.001 .00016
	Complete denture	27(39.2)	23(33.5)	0(0)	18(27.3)	68(42.3)	
	Partial denture	0(0)	0(0)	8(23.4)	26(76.6)	34(21.2)	

P-values are obtained using Chi-Square test, p-value=0.00016 is considered to be statistically significant.

Table 10: Use of strengthener in the damaged denture

VARIABLES	UCD	LCD	UPD	LPD	TOTAL	P-value	
Strengthener	No	32(21.4)	27(18.4)	24(16.5)	65(43.7)	148(92.8)	.0317
	Metal wire	7(62.2)	5(37.8)	0(0)	0(0)	12(7.2)	

P-values are obtained using Chi-Square test, p-value= 0.0317 is considered to be statistically not significant.

Various causes were found to be responsible for the denture fracture - 77.8 % of fractures appeared to be due to heavy impact on the denture in different situations (carelessness towards denture handling). Totally 17.0% denture fractures were found to be due to heavy masticatory loads (non-vegetation food , beetle nut chewing etc.). Remaining 5.2% of denture fractures were found to be due to some kind of accident. There was a statistically significant difference between causes of fracture (P=0.003) (Table 6).

Breakdown of the acrylic base 112 (69.8%) was the most frequent type of damage followed by hairline fracture 26 (16.4%), loosening of teeth 12 (7.5%) and damaged clasp 10 (6.3%). There was a highly statistical significant relationship between damaged dentures and type of fracture (P=0.001) (Table 7).

Out of 160, only 68(42.5%) patients underwent (1 to 3) repair attempts before reporting to us. Thirty-seven (54.4%) of them underwent repair twice before coming to our department while by 23 (13.8%) patients underwent repair of dentures only once before and 8 (5.4%) underwent repair 3 times. There was no statistically significant relationship (P = 0.873) between damaged dentures and number of previous fractures (Table 8).

The type of antagonist plays an important role in the fracture of denture. It was seen that the majority of them were wearing a complete denture (42.3%) as an antagonist, followed by 36.5% with natural teeth or fixed prosthesis, while 21.2 % were wearing partial denture as an antagonist (Table 9).

The present study has evaluated only 12 cases (7.2%) who presented the fractured prosthesis in spite of use of strengthener in the denture. There was no statistically significant difference found in respect of the type of strengthener used and the frequency of damaged denture (Table 10).

DISCUSSION

Impact failure (77.8%) was the most common cause of damage of the dentures in the present study. This agrees with that of Kydd⁷, Hargreaves², El-Sheikh and Al-Zahrani.⁸ The most frequent type of damage seen in this study was the breakage in the acrylic base (69.8%) which is in compliance with the study conducted by El-Sheikh and Al-Zahrani.⁸ El-Sheikh AM et al.⁸ have encountered past repair attempts in their patients but more than half (56.3%) the dentures they repaired in their study had broken for the first time. Similar results are reported in our study where 57.4% of patients had not undergone any previous fractures in their denture, while 23.4% had undergone fractures in their denture twice, followed by 13.8% who had undergone fracture only once before they reported to us.

The present study showed that the complete denture (42.3%) is the most prevalent type of antagonist to damage dentures followed by natural teeth or fixed prosthesis (36.5%) and partial denture (21.2%). These results are in agreement with the study conducted by El-Sheikh AM et al.⁸ who reported that the most common antagonist to damaged denture was complete denture (43.8%) among their patients. The study states that most

dentures (53.6%) were damaged within 1-3 years of use. The result of the present study is in accordance with the study conducted by Hargreaves², El-Sheikh and Al-Zahrani⁸ who found that midline fractures in dentures were most likely to occur within 2 to 3 years of use.

The most frequent type of damage seen in this study was the breakage in the acrylic base (69.8%). The problem of acrylic resin fracture can be reduced by the use of the improved high impact resins. All the dentures examined in the present study were reported to be acrylic dentures without any kind of reinforcement. Studies have shown that some kind of reinforcement can strengthen the denture. Uzun and Hersek (2002)⁹ have mentioned in their study that there is also a need for a new and more suitable method of reinforcing the denture base during fabrication process. This could be achieved by using continuous electrical-glass (E-glass) partial fibre reinforcement.¹⁰ Reinforcement with glass fibres enhances the mechanical strength characteristics of denture bases such as the transverse strength, ultimate tensile strength, and impact strength.

CONCLUSION

The life of a denture wearer gets paralyzed abruptly by the sudden fracture of his/her denture which becomes a necessity for his/her day to day routine life. As part of the dental education faculty, it is always our goal to make the life of denture-wearers easier and happier by investigating and solving the problems related to complete denture patients. Damage to removable dentures is quite frequent causing much distress and cost to the patient. Repeated fractures can be reduced by careful attention to the design and construction of dentures particularly during the laboratory stages. Using improved high impact resins and strengtheners can reduce the problem of acrylic resin fracture.¹¹

The present study was conducted to ascertain the prevalence of fracture in the denture patients coming for denture repair. The findings of the study are that lower partial denture is the most common type of denture base on which fracture occurred, maximum number of fractured denture patients had Kennedy Class 1 lower partial denture (75.4%), maximum fractures occur in 1-3 years age of denture (52.5%), 68.4% of males got fractured denture while 31.6% of females got fractured denture; damage of denture according to age of wearer was seen mostly in age group of <=59 years, impact wear (77.8%) was the main reason for denture fracture; breakage in the acrylic base (69.8%) was the most important type of fracture, 57.4% of patients had not undergone any previous denture fracture.

Complete denture (42.3%) is the most common type of antagonist to fractured denture base.¹² In 92.8% of patients, no strengthener was used. The present study highlighted the increased prevalence of fractured denture

patients coming to Department of Prosthodontics. These findings established reliable base-line data regarding the prevalence, distribution and severity of damage in dentures.

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