Complete denture fractures: A clinical study

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ABSTRACT

The main purpose of the study was to determine the causes for the fracture of complete dentures of patients reporting to the Department of Prosthodontics, Teerthanker Mahaveer Dental College, Moradabad, Uttar Pradesh, India. Data collected from 200 patients reported for repair of their complete dentures. Data was collected from patients, aged between 30 to 80 years (mean 55 plus/minus 25 years), from both the genders. Investigations were done on factors causing the fracture. After the analysis it was observed that the ratio of fracture of upper to lower denture was 1:3. Most fractures were common among males (55%). The most common reason being accidental dropping of the denture in case of the lower and improper fit and stability of the denture, improper arrangement and occlusion of the teeth for the upper one. Midline fracture was the most common site of fracture (60%). After analysis, the causes for the fracture were divided into material factors and clinical/technical factors. It was concluded that the after denture delivery, instructions of denture care were required to reduce mishaps, proper principles of denture construction were required for mechanical advantage of the denture - balanced occlusion, removal of interferences, reduction of stress concentration areas, etc has to be followed. The use of high impact acrylics and strengthened acrylic along with methods increasing fracture toughness of the conventional acrylic dentures are to be used.

KEY WORDS: Acrylic, complete denture fracture, prosthodontics

INTRODUCTION

The life of a complete denture wearer is abruptly paralyzed by the sudden fracture of his/her denture which is of utmost 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. As literature suggests, there are many causes and reasons associated with fractures of complete dentures. This study was undertaken to investigate the causes of denture fracture and device ways of reducing these problems in the future.

MATERIALS AND METHODS

This study was conducted in the Dept of Prosthodontics, Teerthanker Mahaveer Dental College and Research Center, Moradabad, India. Data was collected for one year from 200 complete denture patients who reported for the repair of their dentures due to fracture of the denture. The data was categorized with the following parameters separately for upper and lower dentures:

1. Age and gender of the patient
2. Age of the denture
3. Reason for the fracture, according to history, given by the patient and clinical analysis of the clinician.
4. Site of the fracture

A detailed history of the fracture was taken from the patient and the denture was assessed for retention, stability, occlusal errors, etc by the clinician. The data collected was analyzed using chi square test and the result was considered statistically significant when probability was less than 0.05.

RESULTS

In this study, 200 complete dentures were examined,
excluding removable partial dentures and debonded teeth. [Table 1 and 2]

It was observed that the ratio of fracture of upper denture to lower denture was 1:3 [Table 3].

Maximum fracture was seen in the denture age group of two to four years post-delivery followed by zero to two years.

Accidental dropping of the denture while cleaning, insertion and removal (53%) was the most common cause for lower denture fracture followed by poor retention and fit (22%) whereas poor fit was the most significant factor for upper denture fracture (43%) followed by accidental dropping of the denture (25%)

Midline fracture was most common in both the upper and lower dentures (more than 60%). Midline fracture results from cyclic deformation of the base during function. Since lower dentures fractured it was postulated that the less surface area and thinness in the middle part of the denture are responsible for the fracture. Also, patient negligence during insertion, removal and cleaning of the denture are the major causative factors. Accidental dropping of the denture was the prime cause in these cases, the lower being the delicate of the two was fractured in the ratio of 3:1 to the upper. Presence of deep incisal notches, diastema and thin labial flanges for esthetics and comfort factors of the patient act as stress raisers and contribute to midline fracture of the maxillary denture. Poor fit was the prime cause in upper denture fracture, such dentures flex in the mouth during function around the midline and due to repeated small loadings during mastication lead to the fatigue fracture. This study also holds good with the study of Beyli and von Fraunhofer[1] who suggest the poor fit is the main culprit. Mathews and Wain[2] show that tensile stresses are on the palatal aspect of the denture.

The other causes of fracture are poor occlusion (16% in upper, 12% lower). Many of the dentures in the study opposed natural dentition and most of the sets were not balanced occlusally leading to unwanted stresses in the weaker parts of the denture. Heavy occlusal contacts from the natural teeth and overerupted natural teeth lead to strong forces and caused constant interferences in the masticatory movements. Faulty teeth setting outside the ridge may concentrate stresses on non-stress bearing areas of the denture.

From studies of Beyli and Smith,[3] it is clear that internal defects in the acrylic denture base like voids, porosities, notches, scratches, residual stresses are predominant factors in the fracture of the denture. These areas of stress concentration lead to crack formation and propagation.

Inherent properties of the denture base material also play a very important role in impact strength of the denture. Fractures from accidental droppings can be prevented to a large extent by using high impact resins, metal reinforcement (in the form of plates, wires and fillers) and, glass fibers in the form of woven mat. Reinforcement with glass fibers enhances the mechanical strength characteristics of denture bases such as the transverse strength, ultimate tensile strength, and impact strength. The technical work of fabricating acrylic dentures using modern techniques which reduce voids and porosities releasing residual stress is a must.

Material breakdown with age and water sorption will

| Table 1: Number of fractures in relation to age of denture |
|-----------------------------------------------------------|
| Age of the denture (years) | No. of dentures |
|---------------------------|-----------------|
| 0-2                       | 42              |
| 2-4                       | 56              |
| 4-6                       | 32              |
| 6-8                       | 24              |
| 8-10                      | 31              |
| >10                       | 15              |
| Total                     | 200             |

| Table 2: Causes for fracture in relation to upper and lower denture |
|-------------------------------------------------------------------|
| Proposed cause of fracture | Upper | Lower |
|----------------------------|-------|-------|
| Accidental dropping        | 13 (25) | 79 (53) |
| Poor fit, retention stability | 22 (43) | 33 (22) |
| Poor occlusion and interferences | 08 (16) | 18 (12) |
| Acrylic base defects | 02 (04) | 03 (02) |
| Material breakdown | 01 (02) | 12 (08) |
| Faulty teeth arrangement | 05 (10) | 04 (03) |
| Total                     | 51 (100) | 149 (100) |

\[ \chi^2 = 20.89, P = 0.034, \text{Figures in parentheses are in percentage} \]

| Table 3: Upper and lower denture fractures in relation to site of fracture |
|--------------------------------------------------------------------------|
| Site of fracture | Upper denture | Lower denture |
|------------------|---------------|---------------|
| Midline fracture | 32 (62) | 89 (60) |
| Incisor area | 13 (26) | 15 (10) |
| Canine area | 02 (04) | 21 (14) |
| Premolar area | 00 (00) | 06 (04) |
| Molar, maxillary tuberosity and retromolar pad area | 02 (04) | 12 (08) |
| Any other area | 02 (04) | 06 (04) |
| Total | 51 (100) | 149 (100) |

\[ \chi^2 = 14.90, P = 0.186, \text{Figures in parentheses are in percentage} \]
reduce the fatigue resistance of the material. Hence selection of the material for denture requires more emphasis.

The study showed that maximum denture fractures are in the group of two to four years post-delivery followed by zero to two years. According to Hargreaves,\(^4\) physical properties of acrylic do not deteriorate with age, but the clinical function may induce stress which after a period of usage may bring deterioration of the material and hasten fracture.

CONCLUSION

From this study, the following conclusions can be drawn:

- Proper patient education and motivation of patients using dentures to reduce accidental mishaps.
- Following definite prosthodontic principles in denture construction – analyzing proper fit and retention of the denture. Eliminating occlusal interferences and establishing balanced occlusion.
- Using high impact polymers, metal reinforcements, glass fibers.
- Using processing techniques which reduce chances of voids and porosities.
- Maintaining proper thickness in flanges and incisal notch areas to prevent stress concentration.

Inducing methods of research for manufacture of high strength material which can reduce the denture fractures.

REFERENCES

1. Beyli MS, Von Fraunhofer JA. An analysis of causes of fracture of acrylic resin dentures. J Prosthet Dent 1981;46:238-41.
2. Matthews E, Wain EA. Stresses in denture bases. Br Dent J 1965;100:167-71.
3. Smith DC. The acrylic denture: Mechanical evaluation mid-line fracture. Br Dent J 1961;110:257-67.
4. Hargreaves AS. The prevalence of fractured dentures. Br Dent J 1969;126:451-5.
5. Jagger DC, Harrison A, Jandt KD. The reinforcement of dentures. J Oral Rehabil 1999;26:185-94.
6. Darbar UR, Huggett R, Harrison A. Denture fracture: A survey. Br Dent J 1994;176:342-5.
7. Wiskott HW, Nicholls JI, Belser UC. Stress fatigue: Basic principles and prosthodontic implications. Int J Prosthodont 1995;8:105-16.
8. Jagger DC, Harrison A. The fractured denture-solving the problem. J Primary Dent Care 1998;5:159-62.
9. Kydd WL. Complete base deformation with varied occlusal tooth form. J Prosthet Dent 1956;6:714-8.
10. Lambrecht JR, Kydd WL. A functional stress analysis of the maxillary complete denture base. J Prosthet Dent 1962;12:865-72.
11. Rees JS, Huggett R, Harrison A. Finite element analysis of the stress concentrating effect of fraenal notches in complete dentures. Int J Prosthodont 1990;3:238-40.
12. Yunus N, Harrison A, Huggett R. Effect of microwave irradiation on the flexural strength and residual monomer levels on an acrylic repair material. J Oral Rehabil 1994;21:641-8.
13. Uzun G, Hersek N, Tincer T. Effect of five woven fiber reinforcements on the impact and transverse strength of a denture base resin. J Prostheth Dent 1999;81:616-20.
14. Vallittu PK. Comparison of the in vitro fatigue resistance of an acrylic resin removable partial denture reinforced with continuous glass fibers or metal wires. J Prosthodont 1996;5:115-21.
15. Vallittu PK, Lasila VP, Lappalainen R. Transverse strength and fatigue of denture acrylic–glass fiber composite. Dent Mater 1994;10:116-21.
16. Kim SH, Watts DC. The effect of reinforcement with woven E-glass fibers on the impact strength of complete dentures fabricated with high-impact acrylic resin. J Prostheth Dent 2004;91:274-80.
17. Polyzois GA, Andreopoulos AG. Acrylic resin denture repair with adhesive resin and metal wires: Effects on strength parameters J Prostheth Dent 1996;75:381-7.
18. Barpal D, Curts DA, Finzen F, Perry J, Gansky SA. Failure load of acrylic resin denture teeth bonded to high impact acrylic resins J Prostheth Dent 1990;80:666-671.
19. Jameson WS. Fabrication and use of a metal reinforcing frame in a fracture prone mandibular complete denture. J Prostheth Dent 2000;83:476-9.