INDONESIAN JOURNAL OF PROSTHODONTICS

REVIEW

Complete denture fractures: Insights into clinical failures and management strategies

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Keywords: Acrylic, Complete denture, Elderly, Fracture

ABSTRACT

Background: Complete denture fractures are a common complication in edentulous patients, mainly due to a combination of anatomical, biomechanical, material, and technical factors. This condition affects masticatory function, comfort, and quality of life in elderly patients, who are the largest users of dentures. Purpose: This article aims is to review the epidemiology, etiology and contributing factors, and management of complete denture fractures. Review Summary: Various studies show that fractures most often occur within first two to four years of the denture age, especially in the mandible and midline area due to flexural fatigue. The main causes include poor fit, unbalanced occlusion, fall trauma, and material defects such as porosity or an overly thin base. Repairs can be made using autopolymerizing resin, heat-cured resin, microwave polymerization, or visible light-cured resin, with reinforcement techniques such as E-glass fiber reinforcement, which has been shown to increase denture strength. Prevention focuses on proper design, good stress distribution, occlusal balance, and regular monitoring. Conclusion: A clear understanding of the etiology and fracture patterns is essential to improving clinical outcomes in denture fracture management. Strengthening clinical protocols through better diagnostic awareness and preventive strategies can help reduce the overall risk of denture fractures. (IJP 2025;6(2):146-151)

Introduction

Edentulism is defined as the condition of having no natural teeth.[1] Edentulism can be partial or complete. Complete edentulism represents a chronic oral health issue characterized by the total absence of all natural teeth.[2,3] Some studies suggest that the main causes of edentulism are untreated dental caries and chronic and progressive periodontal disease, both of which gradually damage the supporting tissues of the teeth and lead to permanent tooth loss if not properly treated.[4,5] Complete edentulism is not only caused by local factors such as caries and periodontitis but is also closely related to systemic diseases. Conditions such as diabetes mellitus, cardiovascular disease, and chronic inflammation can worsen periodontal health and accelerate tooth loss.[4,6,7] Complete edentulism is strongly influenced by socioeconomic factors. Individuals with low levels of education and income tend to have limited access to dental health services, increasing the risk of total tooth loss.[8,9] The World Health Organization estimates that by 2023, the global prevalence of adults over the age of 60 will be 23%.[10] Based on a national study conducted by Pengpid & Peltzer (2018) using Indonesia Family Life Survey (IFLS-5) data for 2014-2015, the prevalence of complete edentulism in Indonesia in the population aged 50 years and older was 7.2%.[11]

Complete edentulism can limit a person's ability to articulate speech, decrease masticatory efficiency, alter facial appearance, alter quality of life, and can be associated with social embarrassment. Rehabilitation of edentulism patients requires a prosthesis that meets the needs of aesthetics, phonetics, and improves masticatory function.[2,3,12] The most common restorative treatment used for edentulism is the removable complete denture.[13] Various materials have been used for the fabrication of complete dentures. Wood, ivory, bone, and alloys were used in ancient times. Acrylic or polymethyl methacrylate (PMMA) is the most common denture material used for the fabrication of partial or complete dentures due to its good esthetic characteristics, adequate strength, easy repair, low water absorption, and simple processing technique. Disadvantages of acrylic material include porosity, presence of residual monomer, increased finishing time, brittleness, and unevenness.[14]

One of the complications associated with removable complete dentures is denture fracture, which may result from functional stresses and material fatigue. Complete denture fracture influenced by multiple factors, exhibit various characteristics, and can be classified into different categories. The causes of complete denture fractures can be divided into intraoral and extraoral, or material and clinician or technician factors. Intraoral and clinician or technician factors include poor fit, improper occlusion, and inadequate design, which can lead to uneven stress distribution.[15-17] Extraoral causes mainly involve accidental trauma, such as dropping the denture during cleaning. Material defects, like porosity and thin bases, can also contribute to fracture risk. The location of the fracture may vary among individuals. The purpose of this study is to review the epidemiology, etiology and contributing factors, and management of complete denture fractures. By examining current literature and clinical practic-

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DOI 10.46934/ijp.v6i2.309

Table 1. Prevalence of complete denture fractures by denture age

Denture Age	Prevalence	References
0-3 years	19%	Khasawneh & Arab, 2003
4-6 years	29%	
7-9 years	19%	
10-12 years	15%	
13-15 years	9%	
More than 15 years	9%	
Less than 1 year	20%	El-Sheikh & Al-Zahrani, 2006
1-3 years	48.8%	
More than 3 years	31.1%	
0-2 years	15%	Abdel-Rahman, 2011
3-5 years	32%	
6-8 years	24%	
8-11 years	12%	
12-14 years	11%	
More than 15 years	6%	
Less than 1 year	22.05%	Lukram et al., 2015
1-3 years	45.5%	
More than 3 years	29.41%	
0-2 years	21%	Bosânceanu et al., 2017
2-4 years	28%	
4-6 years	16%	
6-8 years	12%	
8-10 years	15.5%	
More than 10 years	7.5%	
0-2 years	21%	Naik, 2017
2-4 years	28%	
More than 10 years	7.5%	
1 year	5.14%	Kamble et al., 2021
1-3 years	34.2%	
More than 3 years	60.5%	
0-2 years	55.2%	Iftikhar et al., 2022
3-5 years	29.3%	
6-8 years	5.2%	
More than 8 years	10.3%	

Table 2. Prevalence of complete denture fracture by causative factors

Causes	Prevalence	References
Poor fit	34.5%	Khasawneh & Arab, 2003
Poor occlusion	16%	
Dropping	22.5%	
Defect in acrylic base	15.5%	
Material breakdown	8%	
Setting in the teeth out of the ridge	3.5%	
Accident	2.22%	Sheikh & Al-Zahrani, 2006
Impact	80%	
Mastication	17.7%	
Chewing load	51.6%	Takamiya et al., 2011
Fall	40.3%	
Accident or trauma	5.3%	
Other	2.4%	
Accident	2.94%	Lukram et al., 2015
Impact	77.9%	
Mastication	19.1%	
Accident	39%	Bosânceanu et al., 2017
Instability	32.5%	
Occlusal interferences	14%	
Polymerization defect	3%	
During mastication	5%	
Others	6.5%	
Poor denture fit	44%	Sharma, Singh & Bharti, 2019
Poor occlusion	20%	
Base defect	12%	
Materal breakdown	16%	
Accidental fall	8%	
Accidental fall	28%	Kumari & Bala, 2021
Poor fit	18.6%	
Poor occlusion	26.6%	
Material breakage	16.6%	
Acrylic base defect	10%	
Accidental falling	34.5%	Iftikhar et al., 2022
Poor fitting of the denture	27.6%	
Occlusal prematurity	24.1%	
Denture porosities	13.8%	
Accidental fall	35.7%	Sharma, Paharia & Tiwari, 2023
Poor occlusion	28.5%	
Material breakage	21.4%	
Acrylic base defect	14.2%	

es, the study seeks to support improved durability and longevity of complete dentures in prosthodontic treatment.

Review

Prevalence of Complete Denture Fracture

Most individuals who use complete dentures are elderly patients, a population that is particularly vulnerable edentulism.14 In older adults, prolonged tooth loss is frequently associated with progressive alveolar bone resorption, decreased neuromuscular control, and age-related changes in oral and perioral musculature. These physiological alterations of the elder can compromise the retention, stability, and overall functional performance of complete dentures, thereby highlighting the unique clinical challenges encountered in the prosthodontic management of the elderly.[18]

The incidence of denture fractures also varies depending on the gender and age of the denture wearer. Men have been reported to experience denture fractures more frequently than women.[3,19-23] This trend is often attributed to the generally higher occlusal forces observed in male patients, which place greater mechanical stress on the prosthesis.[31-32] The age of the wearer significantly influences the prevalence of complete denture fractures, with elderly being particularly susceptible. A study reported that the highest incidence of denture fractures occurs in patients aged 60 years and older. This finding aligns with evidence indicating that elderly are the most common population using the complete decture.[3]

The likelihood of complete denture fractures has been shown to increase with the age of the denture. As dentures are used over long periods, cumulative mechanical stress, material fatigue, and gradual loss of structural integrity contribute to a higher risk of fracture. This is supported by studies demonstrating that older dentures exhibit a significantly greater proportion of fractures compared with newer ones.[12] Several studies have also reported that most complete denture fractures occur within the first two to four years of the denture age, indicating an early period of vulnerability.[3,20-22,24] Other investigations, have identified a different pattern, in which fractures more commonly occur after three to eight years of the denture age.[19,26]

Causes of Complete Denture Fracture

The causes of complete denture fractures are multifactorial and the data presented across studies show a consistent pattern. Accidental dropping or external trauma is one of the most frequently reported etiological factors. These findings suggested that sudden impact forces, especially those occurring during handling, played a major role in complete denture fracture.[3,16,17,28] This risk was increased in older adults, whose age-related decline in motor coordination made accidental denture drops more common.[33,34] Poor denture fit also contributes significantly to fracture occurrence, as insufficient adaptation of the denture base can increase localized stress and ultimately compromise structural stability.[3,15,17] Similarly, premature

DOI 10.46934/ijp.v6i2.309

Table 3. Classification and prevalence of complete denture fracture according to fracture site

Classification	Prevalence	References
Midline	59%	Abdel-Rahman, 2011
Labial flange	12%	
Canine area	18%	
Premolar area	4%	
Tuberosity and retromolar pad area	5%	
Other areas	2%	
Median	34.8%	Takamiya et al., 2011
Border	17.2%	
Median and border	1.7%	
Debonding teeth	55.2%	
Breakage teeth	8.6%	
Midline	70.37%	Ray et al., 2014
Other areas	18.52%	
Teeth were de-bonded from the base	11.11%	
Midline	23.9%	Sharma, Singh & Bharti, 2019
Labial flange	10.8%	
Canine area	15.2%	
Premolar area	17.3%	
Tuberosity area	17.3%	
Other areas	15.2%	
Incisor area	16.6%	Kumari & Bala, 2021
Canine area	20%	
Midline	33.3%	
Molar area	6.66%	
Maxillary tuberosity/retromolar pad area	23.3%	
Midline	32.8%	Iftikhar et al., 2022
Labial flange	24.1%	
Retromolar pad/tuberosity area	5.2%	
Premolar	5.5%	
Canine	20.7%	
Other area	1.72%	
Midline	22%	Sharma, Paharia & Tiwari, 2023
Incisor area	14%	
Canine area	12%	
Labial flange	18%	
Molar area	10%	
Maxillary tuberosity/retromolar pad area	24%	

Figure 1. Fracture site. A. Class I maxillary denture fracture, B. Class I mandibular denture fracture, C. Class II mandibular denture fracture, D. Class III maxillary denture fracture, E. Class IV maxillary denture fracture, F. Class V maxillary denture fracture, G. Class V mandibular denture fracture

contacts and occlusal interferences have been documented as major contributors, these factor indicating that inadequate occlusal balance leads to uneven force distribution and consequently increases susceptibility to midline or base fractures.[3,16,17,26] Material-related problems are also consistently noted such as porosity, polymerization defects, base degradation, and acrylic resin imperfections. These defects weaken the material and reduce its ability to withstand repeated loading.[3,25] In several populations, functional stresses emphasizing the cumulative effect of repetitive or excessive loading on denture leading to the complete denture fracture.[22,24,28]

Classification of Complete Denture Fracture

Fractures in complete dentures have adopted several classification systems to identify and compare the location of structural fractures. Most classifications are based on anatomical regions of both maxillary and mandibular dentures. Fracture sites commonly categorized into the incisor area, labial flange, midline, canine area, premolar area, molar area, and the maxillary tuberosity or retromolar pad regions. This anatomical approach helps explain observed patterns in clinical data, particularly as the prevalence of fractures in mandibular complete dentures has consistently been reported to be higher than in maxillary dentures.[23] Within these anatomical classifications, cumulative evidence shows that midline fractures are the most frequently reported.[3,16,17,19,27] The midline region is structurally vulnerable due to significant tensile stresses generated during mastication and anatomical constraints such as the presence of the labial frenulum, making it a common site of flexural fatigue.

Several authors have proposed specific classifications of complete denture fracture locations, whereas other author have grouped these fracture sites more broadly into five classes: Class I representing midline fractures, Class II for diagonal fractures, Class III for sickle-shaped fractures involving the labial or buccal flange, Class IV describing base fractures with teeth remaining intact, and Class V encompassing fractures due to generalized denture loosening or breakage. Choundary reported that complete denture fractures occurred predominantly at the mandibular midline.[29]

Treatment of Acrylic Denture Fracture

Acrylic denture fracture problems can be treated with several treatment options. Broken acrylic resin dentures are repaired with autopolymerizing acrylic resin, heat-cured acrylic resin, microwave-polymerized acrylic resin, and visible light-cured acrylic resin.[14,26] Autopolymerizing acrylic resin repair is easy to perform due to its easy handling and quick repair at a low cost. Autopolymerizing acrylic resin repair is weaker than other methods and can reduce the transverse strength of the denture by 40-60%. Heat-cured acrylic resin repair provides stronger results than autopolymer-

izing acrylic resin. Microwave-polymerized acrylic resin has higher resistance than conventional methods. The use of cyanoacrylate adhesive in combination with microwave polymerization was found to be a good technique for repairing tooth debonding in complete dentures and can increase the strength of denture repairs. Visible light-cured acrylic resin repair is a new method that shows potential improved adhesion strength and fracture durability.[14,15,19,21,29,30]

There is also a need for a new and more suitable method of reinforcing the denture base during preparation. One promising approach involves the use of continuous electrical-glass (E-glass) partial fiber reinforcement. This method has been demonstrated to enhance key mechanical properties of denture bases, including transverse strength, ultimate tensile strength, and impact strength. In comparison to metal-wire reinforcement, E-glass fibers offer superior aesthetic outcomes and improved bonding with the resin matrix. In vitro studies have confirmed that unidirectional E-glass partial fiber reinforcement markedly improves the mechanical performance of both complete and partial removable dentures.[22,24,30]

Different prevention measures can be taken to reduce the incidence of denture fracture through maximum denture retention and stability, uniform occlusal loading, and balanced articulation. Additional strategies involve the use of high-strength polymer materials (such as high-impact resins), good processing techniques to eliminate surface defects and inclusions within the denture base, reducing the need for deep frenal grooves through frenectomy, adequate thickness in the anterior region (maximum to suit the tongue space) and placing thin beads around the labial frenum to improve the seal.[22,26]

A majority of the midline fractures can be avoided by the application of established prosthodontic principles during denture construction. The principles include an even and adequate bulk of denture base material cured to achieve optimum polymerization and free of porosity, relief of incompressible tissue in the center of the hard palate, addition of labial flange to increase rigidity of denture base as well as even and balanced occlusion to reduce wedging effect and locking of occlusion. Additionally, advancements in denture base resin materials, along with the careful reduction of stress concentrators such as notches and diastema, can further contribute to the prevention of such fractures.[22]

All repaired dentures were comprehensively evaluated in the mouth for optimal retention, stability, and occlusion. Phonetics, esthetics, and chewing were also assessed and asked of patients. Post-repair evaluation includes retention, stability, and occlusion to ensure patient comfort.[20,23]

Discussion

Complete denture fractures remain a common complication among edentulous patients and continue to present a clinical challenge due to their multifactorial nature. The high rate of fractures in older adults aligns with previous reports showing that elderly denture wearers frequently experience marked ridge resorption, decreased neuromuscular control, and soft-tissue changes. These conditions reduce denture retention and stability, making the prosthesis more difficult to maintain during function. As a result, functional stresses on the denture base increase, which in turn heightens its vulnerability to fracture.[18,25]

Several studies indicate that elderly experience an intraoral retention instability due to poor fit and higher incidence of denture fractures, commonly resulting from accidental dropping especially among elderly patients with reduced manual dexterity.[15,19,24] Evidence from several studies indicates that midline fractures represent the most frequent fracture site, with mandibular dentures demonstrating a higher prevalence of fracture compared to maxillary dentures. Mandibular dentures experience higher mechanical stress because they have a narrower base, less supporting surface area, and greater flexure during function. These anatomical constraints contribute to increased stress concentration along the midline, thereby accounting for its consistent identification as the most frequently reported fracture site across nearly all classifications and studies.[3,29]

The causes of denture fracture are divided into intraoral and extraoral factors and material factors. The impact strength of the denture is strongly affected by the intrinsic mechanical characteristics of the denture base material. Dentures with a strong base can significantly enhance mechanical performance and reduce the risk of fractures, particularly those caused by accidental dropping.[15,21]

Denture fractures are generally attributed to intraoral factors, extraoral factors, and material-related causes, with the mechanical properties of the denture base material playing a critical role in determining overall durability.[22,35,36] The impact strength and intrinsic mechanical behavior of the denture base significantly influence its resistance to fracture, particularly during accidental dropping or sudden impact.[35-38] Recent studies have demonstrated that heat-cured PMMA continues to exhibit superior flexural strength and fracture toughness compared with several newer light-cured or 3D-printed resins, which remain more susceptible to crack propagation and impact-related fracture. Moreover, contemporary material modifications, including fiber reinforcement and nanoparticle fillers, have been shown to enhance the mechanical performance of denture bases and effectively reduce

DOI 10.46934/ijp.v6i2.309

fracture incidence, especially in extraoral scenarios.[39-43]

In terms of management, autopolymerizing acrylic resins remain widely used for denture repair due to their accessibility and ease of manipulation. However, their lower transverse strength compared to heat-cured or microwave-polymerized acrylics limits the long-term success of repairs. Emerging materials such as visible light–cured resins and reinforcement techniques using continuous E-glass fibers have shown promising improvements in mechanical strength, impact resistance, and fracture toughness. These advancements suggest that future prosthodontic strategies may benefit from integrating reinforcement systems, particularly for high-risk areas such as the mandibular midline.[19,24,26]

Preventive measures also play an essential role. Ensuring uniform denture base thickness, reducing stress concentrators, optimizing occlusal schemes, and maintaining retention and stability can significantly reduce fracture incidence. Regular follow-up during the critical early years of denture use allows clinicians to detect early signs of wear, maladjustment, or occlusal imbalance before catastrophic fracture occurs.[22]

Overall, the findings of this review emphasize the importance of understanding fracture patterns and contributing factors to improve prosthetic longevity. Enhancing denture design, material selection, and fabrication techniques while integrating appropriate reinforcement can substantially reduce denture fracture rates and improve patient comfort, satisfaction, and oral function. Future research should focus on evaluating the long-term clinical performance of reinforced denture bases, as well as quantifying their cost-effectiveness and patient-reported outcomes.

Conclusion

Complete denture fracture constitutes a prevalent and multifactorial complication in prosthodontic practice, particularly among elderly patients. The condition is predominantly attributed to mechanical stresses arising from occlusal disharmony, inadequate denture adaptation, and accidental trauma, with mandibular midline fractures occurring most frequently as a result of flexural fatigue and anatomical constraints. The highest incidence is reported within the first two to four years of clinical service, reflecting the influence of material properties, fabrication protocols, and patient-specific anatomical factors on prosthesis longevity. Although autopolymerizing acrylic resin is widely employed for repair, its durability is generally inferior to that of heat- or microwave-polymerized resins. A comprehensive understanding of the etiology, prevalence, and classification of complete denture fractures is therefore essential to optimize prosthetic design, minimize fracture risk, and enhance patient-centered clinical outcomes.

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