



## RESEARCH ARTICLE

### ETIOPATHOLOGICAL FACTORS INDUCING EDENTULISM

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#### ABSTRACT

Edentulism is a devastating condition characterized by partial or complete loss of teeth, which can have a severe pathological impact on oral, systemic and psychological health of the individual. This article enumerates the various etiological factors contributing edentulism to enhance better understanding about this condition and hence enact suitable remedial measures.

#### Key words:

Edentulism, Caries, Periodontitis,  
Oral health.

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## INTRODUCTION

Teeth and their supporting structures are an integral part of the facial skeleton (Duncan and Foerster, 2001). Prior to the 17th century, tooth loss was considered an inevitable part of human life and was generally accepted. Long before dentistry emerged as a true profession, "tooth pullers" were a necessary part of most cultures (Naz, 2011). Tooth pullers or barber surgeons as they were called, traveled from one town to another in a carnival atmosphere, not only extracting teeth but also cutting hair and lancing boils. As the profession of dentistry evolved during the 19th century, much of the work of dentists was still devoted to tooth extraction since restorative work was crude and painful and prevention was unknown. In the absence of ways to treat infection in the pre-antibiotic era, people expected to lose teeth and dentists expected to extract them. More emphasis was given to conservation of teeth with time. Development of newer materials and techniques has significantly reduced the necessity for extraction. From 1990's and onwards, tooth retention has further improved. Changes are coming with improvement in restorative work, rising attitude towards tooth retention and advances. Studies on reasons for exodontia are important because exodontia is an indicator of dental caries and status of oral health of a population (Naz, 2011). Caries has been found to be the main reason for tooth extraction upto 40- 60 years of age and periodontal disease thereafter (Naz, 2011; Rahman). Lindquist (1967) found

caries and periodontal disease to be equally important reasons for exodontia from 50 years of age (Naz, 2011). Tooth loss has always been a part of the aging process that is inevitable (Nayar *et al.*, 2013). The twentieth century has witnessed a wide array of changes in the rate of edentulism between the developed and the developing countries (Nayar *et al.*, 2013). Wientraub *et al* used the term edentulism to describe the complete absence of natural teeth, regardless of whether they had been replaced or not. Tooth loss is dental equivalent to mortality (Reddy *et al.*, 2012). The preservation of dentition can be justified on the following grounds that, teeth are useful in maintaining arch length, esthetics, mastication, phonetics. One of the major handicaps in the elderly of our population is loss of teeth, affecting their mastication, dietary intake and their nutritional status (Reddy *et al.*, 2012).

Edentulism is a debilitating and irreversible condition and is described as the "final marker of disease burden for oral health" (Emami *et al.*, 2013). Edentulism can lead directly to impairment, functional limitation, physical, psychological and social disability and handicap (Emami *et al.*, 2013). Thus, the impact of edentulism on general health should be examined by analysing the major dimensions of health: physical symptoms and functional capacity, social functioning and perception of well-being (Emami *et al.*, 2013). Edentulism is defined as the loss of all permanent teeth and is the terminal outcome of a multifactorial process involving biologic processes like caries, periodontal disease, pulpal pathology, trauma, oral cancer, as well as non-biologic factors related to dental procedures like

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access to care, patient's preferences and limitations in treatment options (Polzer *et al.*, 2010; Walls *et al.*, 2000).

### Important causes of teeth loss

**Children:** Toddlers and children run the risk of two types of traumatic tooth loss: premature loss of baby teeth and loss of permanent teeth due to injury or neglect. Dental caries are a major cause of tooth loss in children and teens (Bertoldi *et al.*, 2013).

**Adults:** Gum disease (gingivitis or periodontitis) and dental caries are the leading causes of tooth loss among adults. Periodontal disease is a chronic bacterial infection affecting the gums and bone supporting the teeth. As the disease destroys gum tissue and bone, teeth loosen and may require extraction. Smoking, heart disease and diabetes also are associated with tooth loss (Bertoldi *et al.*, 2013).

**Elderly:** Plaque accumulation and hardening, gum recession, older fillings and dry mouth put the elderly at greater risk for losing their natural teeth (Bertoldi *et al.*, 2013). The incidence of edentulism among certain populations reflects differences in healthy behaviors and attitudes toward oral health and dental care, as well as access to and use of dental services and treatments (Bertoldi *et al.*, 2013).

Research indicates that tooth loss caused by gum disease is commonly associated with risk indicators that include age, gender (more common with males), smoking, inadequate personal oral hygiene and professional dental care, diabetes mellitus, hypertension, and rheumatoid arthritis (Bertoldi *et al.*, 2013).

Race/ethnicity and socioeconomics also play a role in tooth loss. For example, studies suggest that non-Hispanic black adults keep fewer teeth than non-Hispanic white and Mexican-American adults. Also, a higher percentage of people at every age living below the poverty level is edentulous compared to those living above the poverty level (Bertoldi *et al.*, 2013).

### Other causes of teeth loss

Other causes of edentulism include the following:

**Poor oral hygiene habits:** Not brushing and flossing daily can cause the development and progression of tooth decay and gum disease, increasing the risk of tooth loss (Bertoldi *et al.*, 2013).

**Poor diet:** Foods and beverages high in sugar, carbohydrates and acid may cause irreversible tooth and gum damage, resulting in tooth loss.

**Bad habits:** Smoking, chewing tobacco and/or drug use can damage teeth to the point of tooth loss (Bertoldi *et al.*, 2013).

**Lack of education about tooth loss:** A lack of education about the causes and consequences of tooth loss prevents people from taking the proper preventative lifestyle and oral health care measures, or from getting periodic dental maintenance or necessary restorative treatment (Bertoldi *et al.*, 2013). **Fear and embarrassment:** Many people suffer from dental phobia, or anxiety/fear of going to the dentist, and do not seek dental treatment, even if they know they have a problem or are in

pain. Others are embarrassed or ashamed to seek dental treatment because they feel they will be blamed or judged negatively for the condition of their teeth. Ignoring tooth decay or other serious dental problems can prolong and aggravate the condition and eventually lead to tooth loss (Bertoldi *et al.*, 2013).

**Finances:** Some people have to postpone or forgo dental visits and treatments, including regular check-ups and cleanings, due to high dental care costs and/or lack of insurance coverage. Unfortunately, prolonging or eliminating dental care increases the chances of developing serious problems and, subsequently, greater expense for repairs (Bertoldi *et al.*, 2013).

**Trauma:** Babies and young children are most susceptible to losing teeth prematurely due to trauma, because their tooth roots and gums are still developing. If parents do not take the proper — and often immediate — steps to deal with dental trauma, their children's oral health can be permanently affected. Adults, particularly those who participate in sports or suffer accidents affecting the face, also are at risk for tooth loss (Bertoldi *et al.*, 2013).

**Systemic conditions:** Systemic conditions such as heart disease, respiratory disease, diabetes, HIV infection, malnutrition and immunosuppression are all associated with forms of periodontitis that often result in tooth loss (Bertoldi *et al.*, 2013).

**Medical treatments:** Certain treatments, such as chemotherapy, head radiation therapy and immunosuppressive medications, weaken the immune system. These treatments may increase the risk of tooth infections and, consequently, the need for tooth extraction (Bertoldi *et al.*, 2013).

### Effects of teeth loss on general health

Extensive tooth loss reduces masticatory performance and affects the choice of food of an individual (Nayar *et al.*, 2013). Hence edentulous people tend to avoid dietary fibre and often prefer soft foods rich in saturated fats and cholesterol. Tooth loss results from severe dental caries, periodontitis, or trauma (Walls *et al.*, 2000). Use of tobacco poses a high risk factor for tooth loss in people consuming them for a long period of time. Thus it becomes an important task as the health care provider to detect the rate of edentulism and generating awareness among the general public and offering the appropriate treatment wherever necessary (Nayar *et al.*, 2013).

**Nutritional state-** One of the studies reveals that After comparing the frequency of ingestion of hard and soft foods, along with their ratings of chewing difficulty, the researchers concluded that “shifts in food selection patterns result from impairments in masticatory ability and appear to depend on the degree of impairment.” (Hutton *et al.*, 2002).

According to a systematic review evaluating the relationship between oral function and dentition, tooth numbers below a minimum of 20 teeth, with 9 to 10 pairs of contacting units, are associated with impaired masticatory efficiency, performance, and masticatory ability. (Van Kampen *et al.*, 2004; Bhojar *et al.*, 2012)

**Food habits -** Furthermore, complete denture wearers require 7 times more chewing strokes than those with natural dentitions

to be able to cut food into half of its original size (Emami *et al.*, 2013). Moreover, the thickness of the masseter muscle was found to be decreased in edentulous patients, thus decreasing bite force (Emami *et al.*, 2013). This may partly explain why individuals wearing complete dentures have difficulty chewing hardfoods (Emami *et al.*, 2013). This disability could substantially influence the desire to bite, to chew, and to swallow and could lead to a modification of food choices (Emami *et al.*, 2013). As a result, research has consistently demonstrated that tooth loss and dental status have a negative impact on diet and food selection. (Feine and Lund, 2006) Edentulism also leads to oral mucosal disorders, including denture stomatitis, an inflammatory condition of the palatal mucosa seen in complete denture wearers, angular cheilitis, oral candidiasis and traumatic ulcers are more common (Emami *et al.*, 2013). Edentulism may induce an oral dyskinesia, defined as abnormal, involuntary, patterned or stereotyped, and purposeless orofacial movements (Feine and Lund, 2006). Nutritional factors, especially antioxidants, may decrease following tooth loss and modulate systemic disease by interfering with the inflammatory cascade and preventing carcinogenesis (Emami *et al.*, 2013). Poor oral health has been shown to have a negative effect on peoples overall health and quality of life (Walls *et al.*, 2000).

**Systemic effects** - Chewing movements are generated by a Central Pattern Generator in the brain stem. The rhythmic muscular activity patterns are constantly modified by sensory input of the oral-facial structures. Peripheral receptors monitor tooth loading and customise centrally generated stereotype muscle pattern for biting and chewing. They also generate proprioceptive signals to the motor-cortex (Walls *et al.*, 2000). It was shown in animal experiments that after the extraction of all teeth there is loss of afferent nerve fibres in the mandibular canal. Therefore, sensory input is considerably reduced in complete denture wearers. Complete denture wearers have a threshold to active tactile stimuli which is 7 to 9-fold higher than in dentate individuals (Naz, 2011; Polzer *et al.*, 2010). Bucca *et al.* describe edentulous patients with obstructive sleep apnoea whose disorder worsened with the removal of the dentures, possibly due to a decrease in the anteroposterior oropharyngeal wall distance. Other studies confirmed these associations between sleep-disordered breathing and denture use, but they also only speculated about the mechanism by which edentulism leads to upper airway obstruction (Walls *et al.*, 2000). However, this relationship might have mechanical causes due to a loss of occlusal support when the dentures are missing (Polzer *et al.*, 2010). Several studies proposed a correlation of edentulism and Alzheimer's disease, while another a longitudinal study could not confirm this association (Polzer *et al.*, 2010; Abarca *et al.*, 2006). Edentulous people may eat a less nutritious diet which could present a risk for developing Alzheimer's disease. Nordenram *et al.* reported that the stage of dementia in people with Alzheimer's disease is strongly related to the ability to eat independently (Utz and Wegmann, 1986). The role of sex in edentulism has been suggested to be both social and biological cause of edentulism. The differences may be related to better dental attendance patterns and dental health behaviour and not just disease occurrence alone. Haikola *et al.* believe that women might appreciate dental, oral and facial appearance more than men and therefore be a motivating factor for attending the clinic (Peltzer *et al.*, 2014; Muneeb *et al.*, 2013). According to the study done by Inez polzer, Reasons for extraction were: 42.2% extractions were due to caries, 30.6%

were extracted for periodontal reasons, 6.1%for orthodontic reasons, 10.2% for mixed reasons, 6.1% for failed endodontics, 4.1% on account of tooth fracture and 0.7% for pre-prosthetic reasons Maxillary second molars were the most frequently extracted teeth (Polzer *et al.*, 2010). More posterior teeth were extracted due to caries while periodontitis was the main reason for extraction in the anterior teeth. Maxillary second molar was found to be the most frequently extracted tooth. Reason could be that it is a far reached tooth, which is difficult to clean (Polzer *et al.*, 2010). Also, it is difficult to restore complicated carious lesion in a maxillary posterior tooth as compared to similar lesion in a mandibular molar. Mandibular anterior teeth were more frequently

### Edentulism and atherosclerosis

Subjects with a history of atherosclerotic disease, heart failure and ischemic heart disease were more likely to be edentulous (Polzer *et al.*, 2010). Edentulism was reported to have a significant effect on total and coronary heart disease (CHD), but when smoking was added into the analysis the effect was lost and smoking was the greatest independent risk factor. However, a recent longitudinal cohort study suggested an age-dependent association between chronic periodontitis, edentulism and CHD, independent of a variety of established cardiovascular risk factors, including smoking (Polzer *et al.*, 2010). While younger men showed a dose-dependent association between periodontitis and CHD, periodontally healthy dentate older men had a lower risk for CHD compared to the edentulous aged 60+. Another study revealed that edentulism was associated with stroke (Polzer *et al.*, 2010). Elevated levels of systemic C-reactive protein (CRP) were found in the edentulous, possibly due to chronic infections of the oral mucosa, comparable to an increased systemic inflammatory response in patients with periodontal disease (Polzer *et al.*, 2010). Another explanation was suggested by Holm-Pedersen *et al.* who argued that the systemic damage due to periodontal inflammation may partly persist even when all teeth are lost (Polzer *et al.*, 2010). Dietrich *et al.* argue similarly to Slade *et al.*, that increased CRP concentrations in edentulous patients may indicate an "underlying proinflammatory trait" that predisposes to (previous) periodontitis and CHD, independent of known cardiovascular risk factors (Polzer *et al.*, 2010).

### Treatment of teeth loss

Patients and their dentists should develop a treatment plan that emphasizes prevention and early detection of oral diseases in order to keep the remaining teeth especially in cases of partial edentulism. Prevention and detection strategies include patient education about edentulism causes, consequences and treatments, and following preventive oral health practices (e.g., daily oral health care), as well as preventative and therapeutic treatment (Muneeb *et al.*, 2013; Naz, 2011). However, if tooth loss is unavoidable, there are several options for restoring teeth and smile (Hosseini *et al.*, 2013). Dental implants are artificial tooth roots surgically attached to the jaw to secure a replacement tooth, bridge or denture. Permanent and stable, implant-supported restorations look, feel and function like natural teeth. Dental implants also can be used with a denture for better stabilization. Implants take two to six months for the bone and implant to bond together by osseointegration. During this time, a removable temporary tooth replacement can be worn over the implant site. Research also has advanced to

where an implant can be placed immediately following tooth extraction in certain cases (Bertoldi *et al.*, 2013). Dentures are removable replacements for missing teeth and adjoining tissues. Partial dentures fill in the spaces created by missing teeth, keep remaining teeth from shifting and provides esthetics and function. "Immediate" dentures are inserted immediately after removal of the natural teeth; "conventional" dentures are placed in the mouth about three to six months after removal of teeth (Bertoldi *et al.*, 2013).

## Conclusion

Edentulism is a dreadful condition affecting the oral cavity and subsequently the general health of a person. The prevalence of partial and complete edentulism exists in high rate even now in India. Most of the causes for edentulism are caries, periodontal diseases, habits, systemic conditions, poor oral hygiene, less frequent of dental follow up and financial problems to afford dental treatment. Dental education and motivation are important tools to identify the availability of prosthetic services and to correct the misconception that tooth loss is unavoidable.

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