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Aging, Oral Health and Quality of Life

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1. Introduction

The aging of populations is a global phenomenon that presents great challenges as humanity seeks to meet and promote the physical and mental wellbeing of the elderly (United Nations, 2002). As a population ages, a demographic and epidemiological transition occurs caused by the comparative increase of elderly individuals within the population. This is accompanied by a changing profile of disease as the incidence of chronic degenerative diseases, such as diabetes, arthritis, osteoarthritis, cardiovascular disease, rheumatism, depression and oral health problems increases, and the prevalence of infectious disease decreases.

The oral health of the elderly is, in part, precarious, as the majority use or require some form of dental prostheses. The average number of teeth in the oral cavity is typically minimal and the incidence of root caries and periodontal disease is high. This trend often directly influences the quality of life of the elderly, causing psychological, physical and social detriment to the patient (Correa da Silva and Fernandes, 2001). This demographic of the population also commonly experience xerostomia, temporomandibular joint problems and a reduction in taste sensation. Often, these physiological changes inhibit the maintenance of a proper diet as patients seek to mitigate the challenges associated with an inability to chew (Cassolato and Turnbull 2003, DeBoever et al. 1999, DeMarchi et al. 2008, Moynihan et al. 2009, Thonsom et al. 2006).

Decayed, Missing, Filled Teeth (DMFT) and Community Periodontal Index for Treatment Needs (CPITN) are instruments used to perform oral assessments of patients in populations. Using the data collected from these indexes, the oral health of populations can be evaluated in an objective manner. However, the simple assessment of the mouth does not answer a clinical question that has been a more recent concern of health research: What is the effect of poor oral conditions on quality of life?

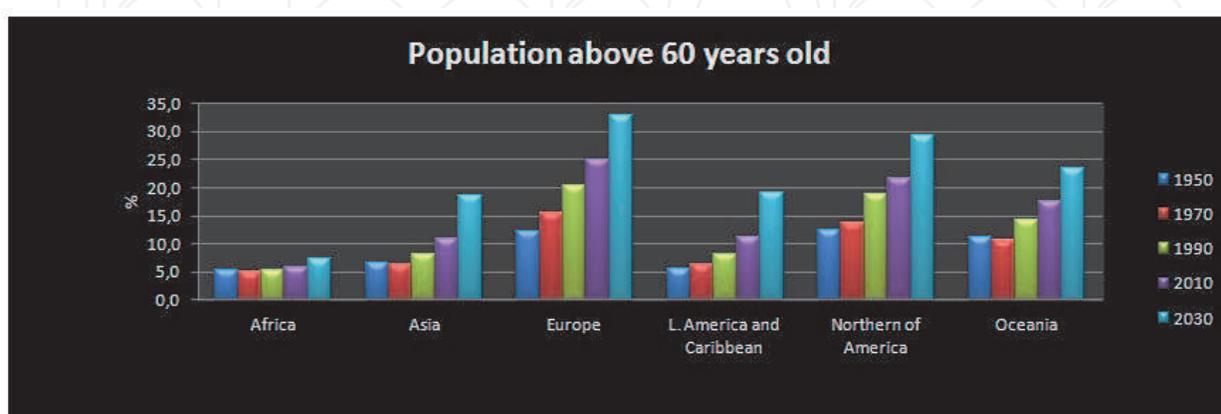
Several rating systems have been proposed and subsequently used to answer this question, most prominently when considering those patients that are greater than 60 years of age. Certainly, the impact of health on quality of daily life is deeply conditioned by cultural, socioeconomic standards and the level of social interrelations.

2. Demographic and epidemiological transition

Aging is a biological, pathological, socioeconomic and psychosocial process. It varies from one individual to another according to patient health, culture and life expectancies (Kalk et al. 1992). Epidemiological aging is a result of the mortality rates in a population. As the

mortality rate decreases, there is an increase in the average life span of the population, bringing it to the biological limit of the species. This increase in life span is a natural aspiration of any society, but it is also important that the desire improve the quality of life for those who are elderly occurs in conjunction with this phenomenon (Ramos 1993).

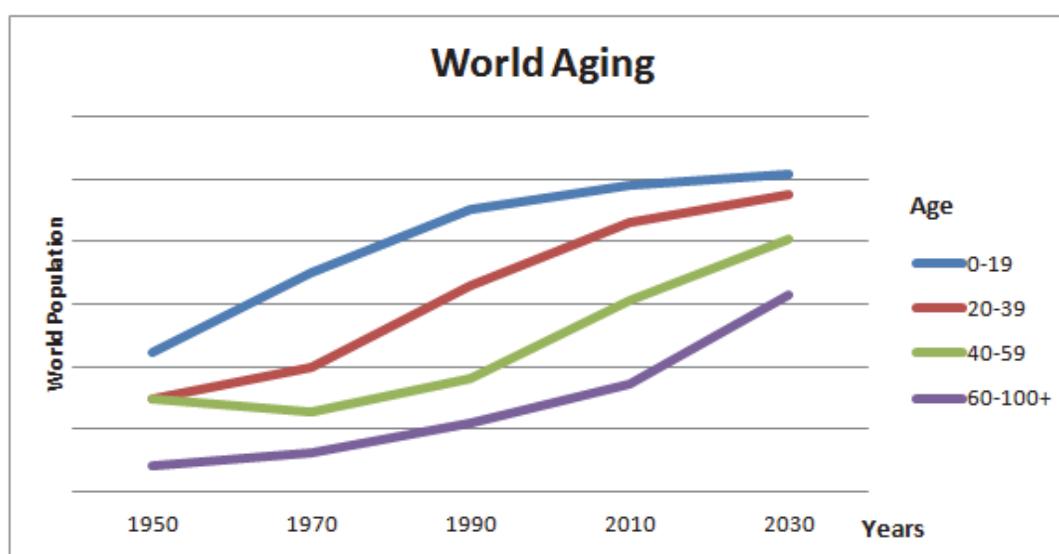
The growth of the aging population is a global fact. The graphic below (Graphic 1, Graphic 2, Graphic 3) shows a representation of this growth along with projections of population increase for this demographic in the future (United Nations, 2010).



Source: United Nations 2010

Graphic 1.

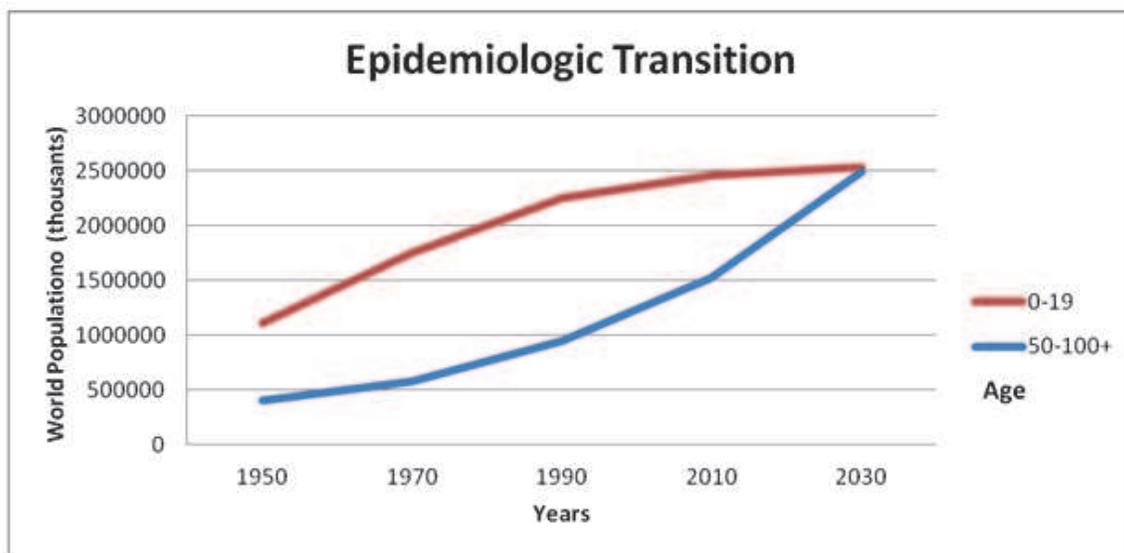
A primary concern when considering demographic and epidemiological transition is how to prepare health care services to better suit the needs of this new segment of the population. This concern is most prominently raised in developing countries where public attention is urgently needed to address the lack of sufficient oral health care. As mentioned previously, a main feature in an aging population is the increase of chronic disease prevalence and the subsequent decrease of infectious disease.



Source: United Nations 2010

Graphic 2.

This change results in an increased demand for continual treatment in an demographic of elderly individuals. Historically, treatment of the oral cavity was not prioritized to the elderly population. Consequently, the evaluation of oral health treatment requires attention as elderly individuals, who suffer more prominently from a high prevalence of caries and periodontal disease, become more numerous in modern populations (Moreira et al. 2005).



Source: United Nations 2010

Graphic 3.

3. Self perception of oral health and quality of life index

Epidemiological indicators such as the DMFT Index are used to analyze the amount of caries, restorations and missing teeth in a patient's oral cavity, while the CPITN Index can assess periodontal disease as well as the need for removable prostheses (WHO 1987). Since the 1990's there has been a growing recognition of the social and psychological impact that changes in oral health can have on the daily life of a patient. This impact on quality of life can be assessed through a variety of procedures that have been proposed in recent years and are primarily aimed at reaching the older generations of populations. These developments improve the understanding of oral health by adding a subjective component and revealing that oral abnormalities have significant social, psychological and economic consequences to overall quality of life.

3.1 Oral health impact profile (Slade and Spencer 1994)

The Oral Health Impact Profile (OHIP) is a self-perception measuring instrument that contains 49 questions divided into seven areas: functional limitation, physical pain, psychological discomfort, physical disability, psychological difficulty, social obstacle and social handicap. Questions are answered on a Likert scale from 0 to 4, with 0 = never, 1 = almost never, 2 = sometimes, 3 = often and 4 = very often. The most significant advantage of this index is that it can represent both an individual as well as a group of individuals, while measuring the extent with which poor oral health can affect daily life. In more recent years, the Oral Health Impact Profile Short Form or OHIP-14 was developed. This index is a

reduced form of the original, containing only 14 questions divided into the same seven domains (Slade 1997).

3.2 Dental impacts on daily living (Leao and Sheihan 1996)

The Dental Impacts on Daily Living (DIDL) index consists of 36 items divided into five scales or domains including comfort, appearance and pain. The responses to this questionnaire are scored within a range of +1 to -1, where +1 signifies a positive impact, 0 shows no impact, and -1 corresponds to a negative patient impact. The weight of each domain is represented by the sum of the patient responses to the questions within the domain being assessed.

3.3 Oral impacts on daily living (Adulyanon and Sheihan 1997)

The Oral Impacts of Daily Living (OIDP) Index was created to quantify the relative frequency of oral health problems impacting quality of life. This questionnaire pertains to the effects of oral health on such things as feeding and the utilization of food, the clear pronunciation of words, sleep and relaxation, the ability to show teeth without shame, the maintenance of a stable emotional state, and the willingness to go to work or social events. Responses to the test questions range from zero (no effect in the last six months) to five (often happening in the last six months).

3.4 General oral health assessment index (Atchison and Dolan 1990)

The General Oral Health Assessment Index (GOHAI) assesses the impact of oral health and oral disorders on the quality of life of individuals. It consists of 12 questions that can be answered with scores of zero to five.

4. Oral health and quality of life studies

It was found that data collected using the GOHAI Index differed from data found by clinical examination, with interviewees noting dental and gingival problems. When asked to evaluate their individual oral health, 42.7% of dentate patients considered their condition to be fair, while edentulous patients had the overall best self-assessment, with 55.8% of patients evaluating their overall oral health as good. In general, interviewees with a better self-evaluation (those with good or excellent) had, on average, more carious teeth than those who assessed their own oral health as fair, poor or very poor. Those patients with an oral environment that had been evaluated as poor or very poor had at least one tooth that was intended for extraction (Correa Silva and Fernandes 1999).

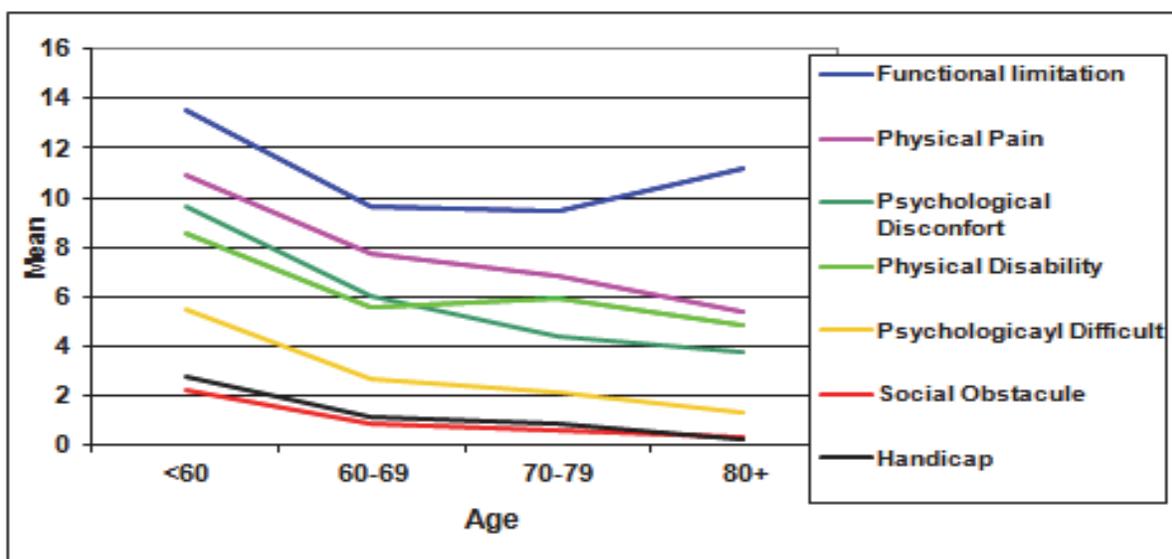
A study was conducted on the impact of oral health on quality of life by applying the OHIP-14 and comparing two techniques of denture fabrication. Sixty-five patients were selected, thirty-two of which had their dentures made in the conventional technique while the remaining thirty-three had the "copies of the edge" technique used. The OHIP-14 was applied before and after treatment. The results showed that there were no significant differences in impact on quality of life when comparing the denture fabrication techniques. However, in most cases, the patients reported an improvement with the use of their new prostheses (Scott Forgie and Davis 2006).

Two hundred and twenty-four patients were evaluated with the OHIP-49 before, during and after oral rehabilitation treatments with dental prostheses. After the completion of the

treatment, another questionnaire was completed to measure patient satisfaction and evaluate subsequent improvements in oral health. It was observed that the results of the OHIP questionnaire performed before and during treatment were almost constant. However, the results changed after the completion of treatment, indicating a decrease in the effect of oral health on the quality of life. The vast majority of patients (59%) described an improvement in their oral health status after treatment, while 15.5% maintained that their oral hygiene remained stable, and 0.5% felt it was worse after treatment (John et al. 2009).

The OHIP-49 was used in a population of 224 patients aged 50 or older. By including patients between 50 and 60 years of age as well as those in the more elderly demographic, the “floor” effect, which occurs when a large number of zero scores affect an indexes ability to discriminate, is avoided (Locker and Allen 2002). In addition to the OHIP-49, clinical examinations were also conducted that included an assessment of patient dental status (DMFT Index), community periodontal index (CPITN), and periodontal attachment loss. As well, the use or need for use of full or partial dental prostheses was assessed according to the instructions of the WHO-Oral Health Surveys (Basic Methods 4th Edition 1987).

The index showed that the OHIP impacts of oral health on social domains are less severe than they are on the physical and psychological domains. Individual age was a significant factor in all areas. With the exception of the ‘functional limitations’ domain, age is inversely correlated with the amount of impact oral health has on quality of life (Graphic 4).



Graphic 4. OHIP outcomes from Bianco et al., 2010.

In the functional limitation domain, 90.63% of patients reported some sort of impact, while 83.48% described physical pain, and 73.22% experienced physical disability. In the psychological discomfort domain, the impact percentage was 70.54% and 53.57% in psychological incapacity. The impact experienced by patients in the social disability and social disadvantage domains was significantly less at 24.55% and 26.79% respectively. These results were similar to those in the original OHIP Slade and Spencer (1994) (Table 1). The Community Periodontal Index (CPI) emerged as significant in the functional limitation, physical pain, physical disability and disadvantage domains. The number of missing teeth had significant impact on functional limitation and disability.

Domains	Alfa	
	(Bianco et al.2010)	(Slade and Spencer1994)
Functional limitation	0,67	0,70
Physical Pain	0,61	0,76
Psychological discomfort	0,80	0,77
Physical disability	0,71	0,82
Psychological difficulty	0,74	0,83
Social Obstacle	0,71	0,73
Handicap	0,65	0,37

Table 1. OHP Alfa Cronbach Coefficient comparison among Bianco et al. (2010) and Slade & Spencer (1994).

The interpretation of these indexes allows for the formation of a clinical profile of a population that can be correlated with the social and psychological aspects of oral health. This information can then be used to influence public policies for this age demographic and help to improve prevention programs and ensure adequate treatment opportunities (Bianco et al. 2010).

5. Oral health of the elderly

Oral health is inseparable from overall health. General characteristics of the individual and the environment affect the stomatognathic system, which makes an understanding of these interactions extremely important to the diagnosis of the needs and priorities of elderly patients (Shinkai 2000). An absence, or inability to adequately conduct the mechanical acts of oral hygiene, such as brushing and flossing, allows for the accumulation of plaque to such a degree that it can disrupt the balance of oral microbiota. The maintenance of the oral environment is the single most important preventative measure for the elderly, especially in reference to caries, periodontal problems, and opportunistic infections such as *Candida albicans*. The diagnosed conditions and risks of elderly patients must be assessed individually by the dental team in order for an effective treatment plan to be established. Using this evaluation, the proper course of oral hygiene, professional cleaning, fluoridation and antimicrobial use can be determined. Note that in older patients there is a higher occurrence rate of lesions on the oral mucosa, most predominantly in denture wearers. Chart 1 shows the main mucosal changes found in elderly patients.

These injuries are so common in the elderly due to the decreased elasticity of the mucosa, causing it to behave in a brittle fashion and be more susceptible to damage from irritants. Elderly patients are also more susceptible to injuries of the oral mucosa as a secondary result of a systemic problem, such as an inability to complete proper oral hygiene maintenance, reduction in oral flora due to prescription drugs, xerostomia, diabetes and leukemia (Rosa et al. 1999, Shay and Ship 1995, Smith and Sheiham 1979).

Amalgam tattoo	Denture stomatitis	Nicotinic stomatitis
Angular cheilitis	Erythroplakia	Nonspecific tumor
Burning mouth syndrome	Fissured tongue	Nonspecific ulcer
Cheek or lip biting	Geographic tongue	Pseudomembranous candidiasis
Cleft lip/palate	Homogeneous leukoplakia	Recurrent aphthous ulcers
Coated-hairy tongue	Macroglossia	

Source: Ship and Baum (1993), Avcu et al. (2005).

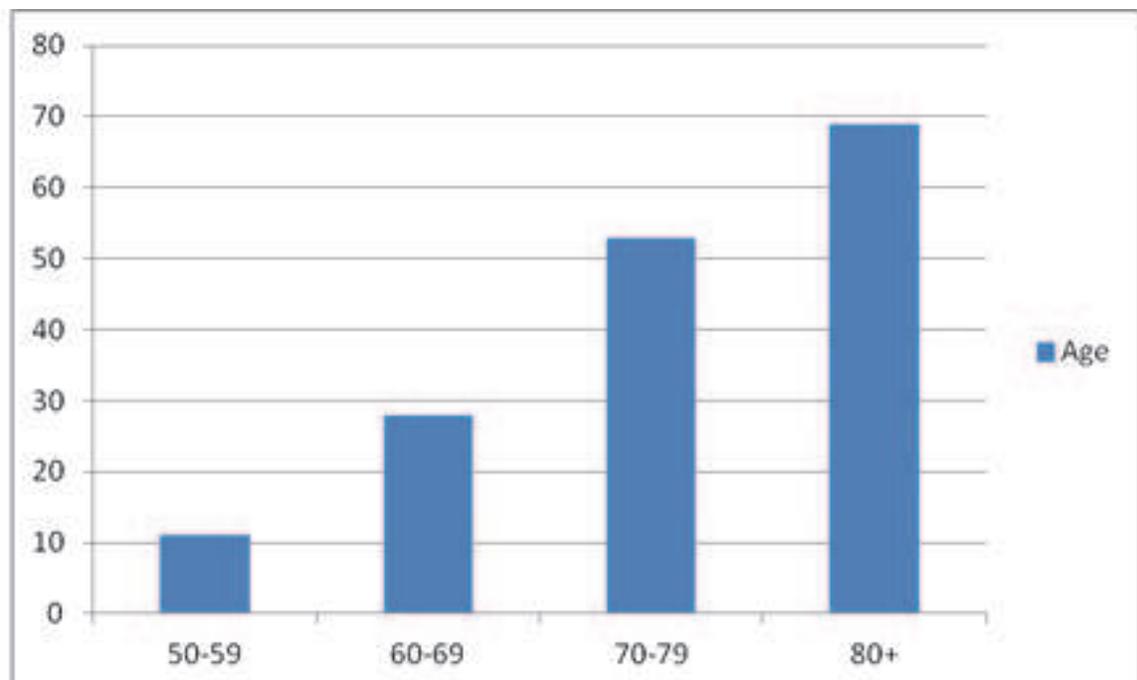
Chart 1. Most frequent mucosal lesions in elderly persons.

Another important consideration when dealing with the oral health of the elderly population is the nutrition status of patients who are partially edentulous or who use ill-fitting dentures. Many of these prostheses are no longer able to exercise proper function due to the wearing away of the artificial teeth. It is also fairly common for edentulous patients to use only an upper denture since adaptation to the lower prosthesis is more difficult due to its lack of stability (Bianco 2010). Typically, these patients tend to consume foods with a lower nutritional value in order to allow for ease of chewing. The maintenance of the teeth, gingiva and proper use of well fitted prostheses have a crucial role in the nutritional status of these patients (DeMarchi et al. 2008, Moynihan et al. 2009).

Temporomandibular joint problems are also commonly observed in this demographic of the population. Pops, crackles, pain and reduced mouth opening may be related to the systemic health of the patient. In general however, the clinical profile of temporomandibular dysfunction in the elderly does not differ from that of younger patients. Consequently, the same conservative treatments for these dysfunctions in younger patients can also be used for the elderly (DeBoever, DeBoever, Keersmaekers, 1999).

5.1 Edentulism

The most common causes of tooth loss are caries and periodontal disease. Often, edentulism occurs as a secondary result of systemic diseases that enhance periodontal disease, or as a result of iatrogenic effects, trauma, or damaging patient habits such as drug, alcohol or tobacco use. As well, patients who suffer from various congenital syndromes may exhibit an absence of some or all teeth (anodontia) (Dolan et al. 2001, Muller et al. 2007). Elderly patients also tend to exhibit a low demand for professional dental care, and are often non-compliant for both preventative and restorative dental treatments. It has been found that there is an adaptation of sorts to edentulism by elderly patients as they age. Typically, as age increases, the impact of oral health on the overall quality of life decreases. Graphic 5 shows the distribution of the use of denture according to their age (Bianco; 2010).



Graphic 5. Percentage of Dentures wearing according with age, Bianco et al. (2010).

Epidemiologically, edentulism is present in most studies involving the elderly population. One study examined 247 patients between the ages of 50 and 88 years old and discovered that among those examined, 25.9% were edentulous, 74.1% had at least one tooth present in the oral cavity, and the average number of teeth present in each individual was 17.9 (Locker et al. 1989). In a survey of 303 individuals, those between the ages of 60 to 69 years old had a 58.3% prevalence of edentulism, while 65.9% of patients in the 70 to 79 year age group were edentulous. In patients older than 80 years, the number of edentulous patients reached 68% of the population (Bergman et al. 1991).

A longitudinal study was conducted between 1992 and 1994 that shows the prevalence of tooth loss in patients over 65 years of age. The first part of the survey was conducted with 1,667 subjects, and it revealed that 54.8% of this sample size was edentulous. In the second part of the survey, 1108 patients were assessed, and 56% were determined to be edentulous (Pucca Jr 1998). In a study evaluating 201 elderly patients, the DMFT results lead to an average of 26.66, while each patient had an average of 11.42 teeth in the oral cavity. Root caries were detected in 37.8% of the dentate patients. As well, the need for and use of prosthetic appliances were also evaluated and it was determined that, clinically, most patients that did not use dental prostheses needed them. Of the edentulous patients, the majority used some form of dental prostheses. However, over 62.5% of these patients required the fabrication of a new prosthetic due to the clinical ineffectiveness of their current one (Correa da Silva and Fernandes 1999).

In a study of 224 patients, aged 50 or older, 117 participants (52%) were total upper denture wearers. Seventy-four of these patients also wore lower dentures (33% of the total sample size). Of the denture wearers, 54.7% needed the upper prosthetic replaced, while 59.7% of those who wore lower dentures required replacement as well. Three patients in the study wore only a lower full denture, and eight edentulous subjects wore no prostheses at all (Bianco et al. 2010).

A study of elderly individuals observed that the patients involved had an average of 17 teeth in the oral cavity, and as age increased, this average decreased. Patients aged 60 to 65

had an average of 20 teeth while older patients (80 years of age or older) had an average tooth count of only 12 (Varela 2011).

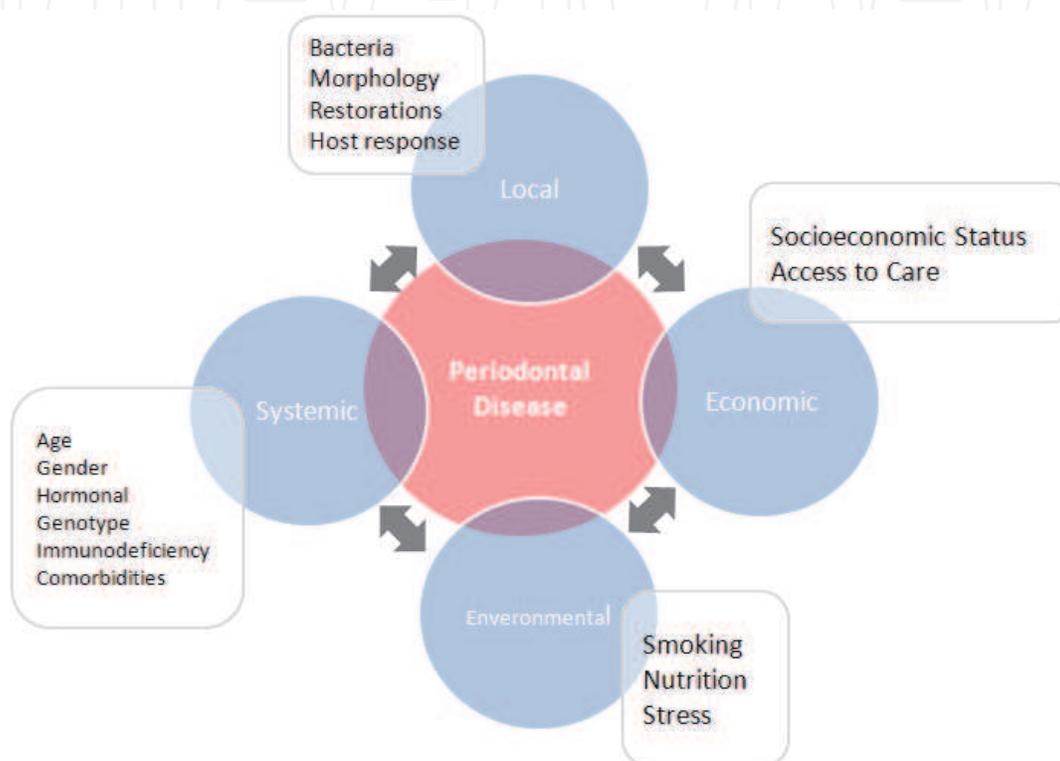
5.2 Periodontal disease

Periodontal disease is caused by the accumulation of plaque as it adheres to tooth surfaces, leading to the destruction of the surrounding periodontal tissues. Metabolic products synthesized by the bacteria in the accumulating plaque cause an inflammatory response in the gingival tissues surrounding the affected teeth. Consequently, the periodontal support is compromised and a loss of crestal bone results. Both horizontal and vertical alveolar bone resorption occurs, resulting in subsequent gingival recession, mobility and the potential for tooth loss. As a patient ages, unevenness on the surface of cementum and alveolar bone occurs, and there is an increased deposition of cementum at the apical region of the roots. Bone tissue begins to change as the amount of mineralized material in both cortical and trabecular bone decreases. This alteration leads to a reduced resilience in the bone structure, and an increased fragility. Typically, the amount of bone resorption increases while bone formation decreases, resulting in overall bone porosity (Gomes et al. 2010, Locker et al. 1998). In the gingival tissues, aging may result in a decrease in keratinized tissue that can indicate tissue permeability, and a decreased resistance to infection and trauma (Needleman 2004). As well, fibroblast formation and activity is also reduced in older patients, and as a result, there is a decrease in the production of organic matrix and vascularization, with a subsequent increase in elastic fibers (Johson et al. 1989, Needleman 2004, Severson et al. 1978, Zenobio et al. 2004).

The apical migration of the junctional epithelium (JE) is associated with aging, as well as with periodontal disease. However, the insertion loss that results as a consequence of age alone has been suggested to have no clinical significance (Locker et al. 1998). The progression of gingival recession can occur as a result of several factors, such as passive eruption caused by wearing away of tooth structure, anatomical factors and traumatic tooth brushing. It has been found that gingival recession is caused not only by aging, but by the progressive and cumulative effects of periodontal disease or trauma throughout life (Needleman 2004).

The presence of dental calculus, gingivitis and periodontal disease is a common finding in elderly patient populations. In a study of 120 elderly patients, gingivitis was found in 100% of those that were examined. Nineteen percent had pocket depths of 3-5mm and 5% had depths of 6mm or more (Mojon 1995). Another study conducted using the CPITN Index found that on average, 3.53 of the six sextants in the human dentition were excluded for elderly patients as a result of missing teeth. Of the 1.29 sextants with periodontal pockets, 43.7% of these were deep, 28.1% were shallow, and dental calculus was present in 26% of the valid sextants. Bleeding on probing was found for 8.2% of the applicable sextants, and areas of health were represented by only 3% (Correa da Silva and Fernandes 1999). In a study of elderly patients using the CPINT and Periodontal Attachment Loss (PAL) Indexes, edentulous patients were excluded, leaving only 57.6% of the sample to be assessed. For the CPINT and the PAL Index, a score of zero represents a healthy periodontal environment. A score of 1 signifies the presence of bleeding on probing for the CPINT Index, and an attachment loss of 4 to 5mm for the PAL Index. A score of 2 is characterized by the presence of calculus (CPINT) and attachment loss of 6 to 8mm (PAL Index). Lastly, an individual who receives a score of 3 will have pocket depths of 4 to 5mm (CPINT) and attachment loss of 9 to 11mm (PAL). In general, most of the subjects had zero scores for both indexes. However, when those subjects with scores of 1 or higher were summed, those individuals outnumbered the patients with scores of zero. Specifically, for the CPITN Index, 60.9% of

patients tested had a score of 1 or above, and the same was true for 55.8% of patients using the Periodontal Attachment Loss Index (Bianco 2010). Another study found that only 6% of patients had periodontal problems, while 26% experienced gingival bleeding, 57% had dental calculus, and 31% had some extent of periodontal attachment loss (Varela et al. 2011). It is evident that aging is not solely responsible for the occurrence of periodontal disease. Other influences such as the accumulation of plaque, along with environmental, systemic and economic factors, can also increase the risk of developing periodontal disease. This can be visualized in the schematic below (Schema 1).



Schema 1. Risk model for periodontal disease. (Based in Novak 2008).

6. Concluding remarks

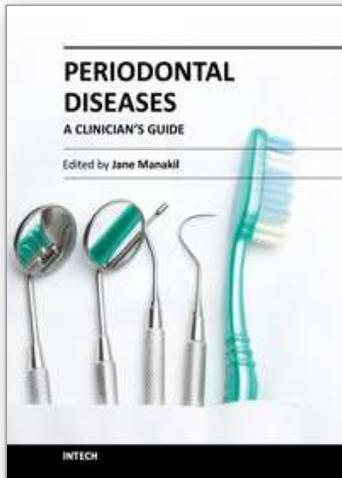
It has been proven that the elderly population is increasing in prominence worldwide, and the importance of preparing both private and public health services for this phenomenon is becoming increasingly apparent. Planning for health services accessibility and specialized prevention for this new demographic should be seriously assessed, most commonly in developing countries. It is imperative that health professionals work as a unit, both within the dental field and otherwise.

The assessment of the general health of the patient should be part of the dental treatment protocol, and should be completed well before beginning any procedure. As well, how treatment will affect the daily life of the patient must also be taken into consideration. A plan for appropriate treatment of elderly individuals must be cautious and allow for the development of treatment options that suit the needs of the patient. It is necessary for health professionals to develop preventative dental programs for future generations of adults who will, one day, be part of this elderly demographic. By doing so, dental professionals will be able to better provide oral care and quality of life to these patients.

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Periodontal Diseases - A Clinician's Guide

Edited by Dr. Jane Manakil

ISBN 978-953-307-818-2

Hard cover, 368 pages

Publisher InTech

Published online 03, February, 2012

Published in print edition February, 2012

"Periodontal diseases" is a web-based resource intended to reach the contemporary practitioners as well as educators and students in the field of periodontology. It is fully searchable and designed to enhance the learning experience. Within the book a description is presented of the current concepts presenting the complex interactions of microbial fingerprint, multiple genotypes, and host modulations. In addition, an overview is given of the clinical outcome of the disease's progression, as influenced by the epigenetic factors. Emerging concepts on periodontitis as a risk factor for various systemic diseases and as a bilateral modulating factor have been elucidated in detail as well.

How to reference

In order to correctly reference this scholarly work, feel free to copy and paste the following:

Vinicius Cappel Bianco and José Henrique Rubo (2012). Aging, Oral Health and Quality of Life, Periodontal Diseases - A Clinician's Guide, Dr. Jane Manakil (Ed.), ISBN: 978-953-307-818-2, InTech, Available from: <http://www.intechopen.com/books/periodontal-diseases-a-clinician-s-guide/aging-oral-health-and-quality-of-life->

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