The Effect of Microwave-Curing of Acrylic Resin on Microbial Growth in Complete Denture cases

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DEDICATION

TO THE CANDLES WHO LIGHTENED MY LIFE .....

TO MY MOTHER WHO GAVE ME LOVE, CARE AND SUPPORT...

TO MY LOVING AND CARING FATHER...

TO MY SISTERS AND BROTHER WHO WERE BY MY SIDE IN EACH STEP....

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Introduction

Complete denture prosthesis involves the replacement of the lost natural teeth and the associated structures of the maxilla and the mandible. The basic objectives of complete denture prosthesis are the restoration of function, speech, facial appearance and the maintenance of the patient health. (1)

Wearing removable dental prosthesis causes an alteration in the oral microbial flora. For certain individuals, this new environment is responsible for the development of a particular condition: denture associated stomatitis. (2)

Although individual denture bases may be formed from metals or metal alloys, the majority of denture bases are fabricated from common polymers. Such polymers are chosen on the bases of availability, dimensional stability, handling characteristics, color and compatibility with oral tissues. (3)

Acrylic resin has been used in the construction of denture bases since 1930s. (4) However, the use of heat-cured acrylic resin have shown several problems including dimensional instability (either due to polymerization shrinkage or porosity), water sorption and tissue hypersensitivity due to leaching out of the residual monomer resulting in tissue irritation. (5)

Polymerization is a chemical reaction where small molecules, called monomers, are added together to make larger molecules, called polymers. This is interesting in many applications because while in monomer form, the material is fluid and can be molded into different shapes which then harden during polymerization. (6)

Modifications applied to denture base construction include; Self-cured resins, pour-type resins, high impact strength resins, light-cured resins, and microwave-cured resins. New methods of activation of the polymerization of denture base resins were introduced including light and microwave energy. Curing with microwave radiation presents several advantages. The most important property is that the external and internal porosity of the denture base can be eliminated by microwave curing. (7-11)

Wearing removable dental prosthesis causes an alteration in the oral microbial flora due to formation of plaque on the surface of denture which is a common problem among denture wearers as it can lead to stomatitis. This condition is very common and can be best considered multi-factorial in etiology but the most important factor is the bacterial infection due to adhesion of microorganisms to denture surface and their colonization. (3, 12-18)

Awareness of the susceptibility of the denture base to bacterial colonization should be an important factor in their use to preserve and maintain the health of the oral mucosa.

Review of Literature

1-Oral microbial flora:

The oral flora is defined as "organisms that are present in a healthy mouth as commensals and normal inhabitants without causing any disease". A wide diversity of microorganisms including bacteria, yeasts, mycopalsms, viruses and even protozoa grow in the mouth. (19)

In 1999, ***Marsh and Martin*** classified the bacterial genera found in the oral cavity as: (32)

(1)Gram positive *cocci* which include; *Abiotrophia Enterococcus, Peptostreptococcus, Streptococcus, Staphylococcus and Stomatococcus.*

(2)Gram positive rods which include; *Actinomyces,Bifidobacterium, Corynbacterium, Eubacterium, Lactobacillus, Propionibacterium, Pseudoramibacter and Rothia*.

(3)Gram negative cocci which include; *Moraxella, Neisseria and Veillonella*.

(4)Gram negative rods which include; *Bacteriods, Campylobacter, Cantolnella, Capnocytophaga, Centipeda, Eikenella, Fusobacterium, Haemophilus , Johnsonii, Leptotrichia, Porphyromonas, Prevotella and Treponema*.

At birth, the oral cavity is usually sterile but it may be contaminated with several types of microorganisms such as *Streptococci, Staphylococci, Coliform bacilli* and gram positive rods. The early oral microbial flora after birth is mainly aerobic and facultative anaerobic. (20)

With eruption of teeth, anaerobes as *Spirochetes, Bacteroids* especially *Bacteriods melaninogenicus, Fusobacterium, Lactobacilli, Actinomyces* and some anaerobic *Vibrios* are established while *Streptococcus mutans* and *Streptococcus sanguis* do not appear to become established until the full eruption of teeth. (21)

With complete loss of the dentition, reversion of the microbial flora to a predominately aerobic facultative type and reduction in the number of *Streptococci* and yeasts had been reported. (21)

Meanwhile, denture wearing was reported to encourage the growth of *Candida species, Staphylococci, Streptococci, Neisseria and Diphtheroids*. (19)

In a healthy state, humans are colonized by diverse populations of bacteria and fungi. Among these microbial populations, *Candida albicans* is the most commonly detected fungus in association with humans that it has been recognized as a part of the normal oral flora without any harmful effects but may cause opportunistic infections in immunocompromised hosts such as patients suffering from AIDS, Leukemia and head or neck cancer.(23-29)

In a study made by ***Koopmans et al.*** in 1988, the predominant microbial flora of collected denture and mucosal plaque samples was shown to be consisted mainly of Gram-positive bacteria, mainly *streptococcus* species. This study had demonstrated that denture plaque and palatal plaque of the denture-bearing area are composed mainly of bacteria and contains only a low number of yeasts in both of the healthy control group and the denture induced stomatitis group. (30)

Then in 1990, ***Stenderup*** reported that largest proportion of the fungal microbial flora present in the oral cavity of healthy individuals is made up of *candida* species including; *C.albicans* (the most common species), *C.glabrata, C.tropicalis, C.Krusei, C.Parapsilosis and C.guilliermandi*, and *Saccharomyces* species. (31)

Several studies demonstrate an association between *Candida albicans* and oral bacteria such as *Streptococcus, Actinomyces, and Fusobacterium* species and these microbial interactions likely contribute to denture colonization and oral candidiasis. The known relationships between *Candida albicans* and oral *Streptococci* illustrate the various ways by which bacteria and fungi can attach to one another or co-aggregate using specific cell surface factors, leading to mixed-species biofilm. Oral microbial biofilm is three-dimensional structured bacterial communities attached to a solid surface like the enamel of the teeth, the surface of the root or dental implants and are embedded in an extracellular polysaccharide matrix (23, 24, 33-36)

The adhesion of *Candida* cells to oral surfaces is regarded as the first step for oral biofilm formation which is mediated mainly by means of extracellular polymer production by *Streptococci* and other bacterial species. Also; adhesive interactions between *Candida* and other oral microbes can be mediated by protein-protein, lectin-carbohydrate interactions and hydrophobic and electrostatic interactions. So, the complex structure of oral microbial flora with mixed species communities can intermediate the predisposition for many oral conditions including candidiasis. (23, 37-43)

Streptococcus mutans is a frequent member of acrylic dentures surfaces and if incubated simultaneously with *Candida albicans* may compete for binding sites but it can also promote yeast adhesion. This bacteria-yeast interaction has been a matter of investigation of many in-vitro and in-vivo studies. The analysis of the in-vitro adherence of *Streptococcus mutans* and *Candida albicans* can contribute to the understanding of the behavior of these organisms in the dental plaque. The interaction of these microorganisms in a combined culture can be understood as mutualistic, since both seem to be favored. (37, 44-48)

In 1996, Oral candidiasis have been classified as: (50)

*Primary oral candidiasis (in which localized Candidal infections are present only in the oral and peri-oral tissues) and

*Secondary oral candidiasis (in which Candidal infections are manifested in a general manner both in oral cavity and in other mucous and cutaneous surfaces).In both types, the oral lesions may appear as pseudomembranous, erythematous (atrophic) or hyperplasic.

And lately in 1999, Oral candidiasis have been classified into: (51)

*acute pseudo membranous candidiasis (Oral thrush),

*acute erythematous candidiasis (Atrophic candidiasis),

*chronic erythematous candidiasis (Denture stomatitis),

*chronic Plaque-like and nodular (Candidal leukoplakia) and

*acute/chronic angular cheilitis.

Pseudomembranous candidiasis (Oral thrush) is an acute infection which may persist intermittently for many months or even years in immune-compromised patients, patients under corticosteroid therapy, neonates and patients with terminal illness. It is characterized by discrete white lesions that may be formed on the buccal mucosa, tongue, hard palate and throat. (19)

While **erythematous candidiasis (atrophic candidiasis)** may arise as a consequence of persistent acute pseudo membranous candidiasis when the pseudo membranes are shed .It is frequently seen in the palate of the elderly and in full denture wearers in the form of erythematous lesions of varying severity confined to tissues underlying the denture surfaces. It appears as raised discrete areas that vary from small palpable translucent white area to large dense opaque plaque-like lesions. (52)

In the mean time, **Angular cheilitis** is an inflammatory reaction at the corners of the mouth which is characterized by dry scaling and fissuring affecting the lip surface. (53)