

Republic of Iraq

Ministry of Higher Education

And

Scientific Research

University of Baghdad

College of Dentistry



Oral Hygiene Practices In Removable Prosthodontics

A Project Submitted to

The College of Dentistry, University of Baghdad, Department of
Prosthodontic in Partial Fulfillment for the Bachelor of Dental
Surgery

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2022 A.D

1443 A.H

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

اقْرَأْ بِاسْمِ رَبِّكَ الَّذِي خَلَقَ * خَلَقَ الْإِنْسَانَ
مِنْ عَلَقٍ * اقْرَأْ وَرَبُّكَ الْأَكْرَمُ * الَّذِي عَلَّمَ
بِالْقَلَمِ * عَلَّمَ الْإِنْسَانَ مَا لَمْ يَعْلَمْ *

صدق الله العظيم

سورة العلق الايه (1-5)

Declaration

I certify that this project entitled” **Oral Hygiene practices in removable prosthodontics**” was prepared by the fifth-year student Osama Asaad Azeez under my supervision at the College of Dentistry/University of Baghdad in partial fulfilment of the graduation requirements for the Bachelor degree in dentistry.

Supervisor’s name

Assist.Lec. Ban Saad Jasim

B.D.S, M.Sc.

Dedication

To all people who helped me in complete this work, family,
friends and one amazing person

All these people provide me with support and patience to bring
all the good in me

Acknowledgment

Firstly, all gratefulness, faithfulness to **ALLAH** for providing me with patience, perseverance and the ability to undertake and complete this study.

I would like to thank **Professor Dr. Raghad Al-Hashimi**, the dean of the College of the Dentistry, University of Baghdad for providing me the opportunity to complete my work.

Also, I express my thanks to **Prof. Dr. Ali Al-Bustani**, Assistant dean for Scientific Affairs and students of the college of Dentistry, University of Baghdad for his continuing support to complete this work.

I would like to thank **Prof. Dr. Abdulbaset Ahmed Fathallah** , the chairman of the prosthodontic department for his support.

My deepest gratitude and my heartfelt thanks to my supervisor **Assist.Lec.BanSaad Jasim**. At the time that my graduation project come to the end, my appreciation to all those and to everyone who helped me and work with me during the time of the study.

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List of Abbreviations

Abb.	Meaning
Spp.	species
PDT	Photodynamic treatment
P.aeruginosa	Pseudomonas aeruginosa
S.Aureus	Staphylococcus aureus
E.coli	Escherichia coli
K.pneumoniae	Klebsiella pneumoniae
RPDs	Removable partial dentures
C.ablicans	Candida ablicans
PICO	patient/population, intervention, comparison and outcomes.
RCTs	randomized controlled trials
SLS	sodium lauryl sulphate
CCTs	cisco certified technicians
CFUs	colony- forming units
PS	photosensitizer

Introduction

And

Aim of the study

Introduction: -

The issue of removable prostheses hygiene is considered of utmost importance as the available scientific evidence suggests the development of both oral and systemic infections, as a result of improper hygiene habits among removable denture wearers (**Sumi et al., 2007**).

Denture base acrylic resin is easily colonized by *Candida* spp. and bacteria of both intra- and extra-oral origin as well, leading to denture stomatitis, while potential respiratory pathogens have also been detected on denture surfaces (**Cenci et al., 2008**).

Based on the findings of a recent systematic review, both disinfection and antiseptic methods were equivalently effective with antifungal therapy in the treatment for denture stomatitis. The study highlighted the issue of oral hygiene education, which is considered crucial factor in promoting removable denture wearers' compliance with evidence-based oral hygiene guidelines.

Brushing represents the most commonly applied mechanical method combining the advantage of simplicity, effectiveness and low cost. Chemical cleansing methods can include a wide range of treatments: hypochlorite, peroxides, enzymes, acids, crude drugs and mouthwashes. Ultrasonic devices pair the mechanical removal of biofilm with the concurrent use of a chemical agent. Irradiation of dentures through photodynamic therapy (PDT) or microwave application has also been described as an alternative disinfection method of complete dentures. (**Ribeiro et al., 2012**) (**Pavarina et al., 2009**)

An ideal denture hygiene method should, in addition to bactericidal and fungicidal action, possess the ability to remain unaltered the physical and mechanical properties of both denture base and prosthetic teeth. In particular, color and

dimensional stability of a denture material are considered prerequisites for its clinical longevity (**Basso et al., 2010**).

A systematic review of the current hygiene interventions in Removable Prosthodontics is required to inform oral healthcare, denture biofilm reduction and/or elimination of microorganisms' counts, as well as to investigate the effect of hygiene practices on removable prosthesis color and dimensional stability under clinical conditions. Finally, this article aimed to document current patients' attitudes and habits towards removable dentures hygiene. The importance of proper plaque control and its relation with the long-term health of dentures and existing teeth is very well documented in the literature (**Ribei et al., 2009**).

Inadequate denture hygiene may contribute to biofilm accumulation and colonization of the intaglio surface of prostheses by microorganisms, which engender opportunistic oral infections (**Çakan et al., 2015; Emami et al., 2007**).

Aim of the project: -

The aim of this project was to assess the knowledge and hygiene habits of patients wearing removable partial dentures including selected sociodemographic characteristics and to know the materials and methods used in denture hygiene practices.

Chapter one

Review of literature

Review of literature: -

1.1 denture plaque and stain:

Every surface in the oral cavity, natural or synthetic, becomes covered within about 30 minutes with a 0.5-1.5 μ -thick precipitate of salivary glycoprotein and immunoglobulin that is termed “pellicle.” The pellicle in turn provides a substrate to which oral debris (such as mucin, food particles and desquamated epithelial cells) and microorganisms (bacteria and fungi) readily adhere. Certain adherent bacteria and fungi convert materials such as sucrose and glucose in the oral environment into a protective plaque covering under which they can thrive and proliferate further. **(Shay, 2000)**

Dental plaque formation is favored when salivary flow is impaired by disease or, more commonly, as a side effect of medications. In the absence of an adequate amount of saliva, less antimicrobial action will be available to counter the activity and proliferation of microorganisms. **(Garg et al., 2010)**

The fungal organisms that are most commonly associated with denture plaque are of the genus *Candida*. **(Shay, 2000)** The biofilm formed with *Candida* species has been shown to be a causative factor in denture stomatitis. Several oral bacteria have also been found to be important in this disease process. **(Paranhos et al., 2009)**

The oral deposits and microorganisms that adhere to a dental appliance bring about several undesirable effects. First, the adherent material itself is unesthetic in appearance and unpleasant in terms of tactile sensation, taste, and odor. Because of the process of accommodation that sensory receptors undergo, the person with an unclean denture is likely unaware of the unpleasant smell and taste of the

prosthesis, but gustatory experiments have confirmed impairment in taste and smell perception of external stimuli under circumstances of poor denture hygiene. (Shay, 2000)

1.2 Effects of the denture material and porosities on denture hygiene:

There is evidence that removable dental prosthetic constructions serve as a reservoir for oral bacteria and yeast (Wu et al., 2015).

Materials that are used for manufacturing removable prosthesis bases, such as acrylic resins and thermoplastic materials, interact with the microbiota of the oral cavity and tissues of the prosthetic bed (Volchkova et al., 2020).

Adherence of microorganisms and debris is also favored by rough or otherwise irregular surface topography. Surface irregularities provide an increase in surface area and an expansion in the number of niches not readily cleansed by actions of the tongue or other orofacial musculature. This is a particular concern in the case of oral appliances fabricated out of methacrylate resin. Despite an outwardly smooth appearance, these appliances have a pockmarked surface when viewed under microscopic magnification. (Kulak et al., 1997)

This is due to bubble formation from unpolymerized monomer in the course of denture processing. Increased tendency for undesirable deposits is similarly observed when a chemically polymerized and rather porous chair side reline material has been applied to a denture surface. This occurs to a greater degree with over-the-counter, insoluble home reliner materials that are even more porous and generally far less smooth than processed and polished acrylic resin. (Shay, 2000)

In addition to it, insufficient polishing of the denture surface leads to the adhesion of edible residues, microorganisms and yeast, including *Candida albicans*, to the surface of a prosthetic construction (**Ali et al., 2013; Arutiunov et al., 2014**)

The denture's fitting surface cannot be mechanically polished and thus presents irregularities and microscopic pores that facilitate bacterial and fungal colonization (**Jagger et al., 2002**). Some glazes have been used for sealing dentures. According to the manufacturers, a glaze would make the acrylic resin surface smoother, decreasing accumulation of residual food and plaque adhesion, and providing improved oral hygiene conditions. (**Sesma et al., 2005**)

1.3 Effect of RPD design on Plaque retention:

Many partial denture framework designs contribute to increased or altered oral bacterial flora and formation of dental plaque. Some textbooks advocate either a linguoplate or a continuous bar major connector when a lingual bar cannot be utilized. Some investigators suggest that linguoplate major connectors, which have increased coverage of gingival and dental tissues, may increase food retention and promote plaque formation. The alternative to this extensive coverage is the cingulum, or dental bar major connector, introduced by Carlsson et al. It is possible to reduce the negative effects of removable partial dentures on the periodontium and perform good oral hygiene. (**Orr et al., 1992**)

Also in RPD design, it has been suggested that clasps should be placed as far as possible from gingival margins and that the number of minor connectors should be kept to a minimum. They suggest direct minor connectors approaching from the base areas, with open proximal spaces, instead of palatally or lingually approaching

minor connectors and mention that gingival relief can be further achieved by designing the first replacement tooth of a base as a pontic. (Öwall B. et al., 2002)

1.4 Denture education and motivation about denture hygiene:

The dentist should follow up their patients in initial adjustment and aftercare and should give them thorough instructions regarding denture cleansing and wearing habits. Inadequate denture hygiene combined with aging physiological changes has substantial negative effect on supporting tissues of the oral mucosa and may further impair the function of removable prostheses. The biofilm accumulation and colonization of the intaglio surface of prostheses by microorganisms provoke the prevalence of denture-related stomatitis (Kulak-Ozkan et al., 2002).

1.5 Methods of denture cleaning:

The major target of all the hygiene interventions in the field of Removable Prosthodontics is to eliminate pathogenic microorganisms' counts preventing the reestablishment of a pathogenic biofilm, as well. Denture biofilm removal can be achieved via the application of different types of hygiene practices including mechanical methods, chemical agents and microwave or combination of the aforementioned methods. (Boscato et al., 2009; Nalbant et al., 2008)

1.5.1 Mechanical hygiene method

1.5.1.1 Manual mechanical method

The commonest method is brushing with conventional and specific dentifrices (Peracini et al., 2010).

The dentist, when fitting the removable partial denture, should instruct patients about its proper use, especially when they do it for the first time in their

lives. Important information concerns the necessity to take out of the mouth the RPDs for at least 6-8 hours per day and store them in a dry environment. **(Zissis et al., 2006).**

Fitting of RPDs does not mean the final stage of treatment and the patient should remain under the constant control of a dentist. The person wearing the RPD should keep to the designated check-ups, and not just in case of discomfort associated with its use, or sudden events such as fracture/cracking of RPD. **(Andrade et al, 2010; Marchini et al., 2004).**

Natural teeth of a denture wearer, as well as RPDs require necessary cleaning procedures that allow for maintaining residual teeth and the RPD in good hygienic condition. **(Naik et al., 2011).**

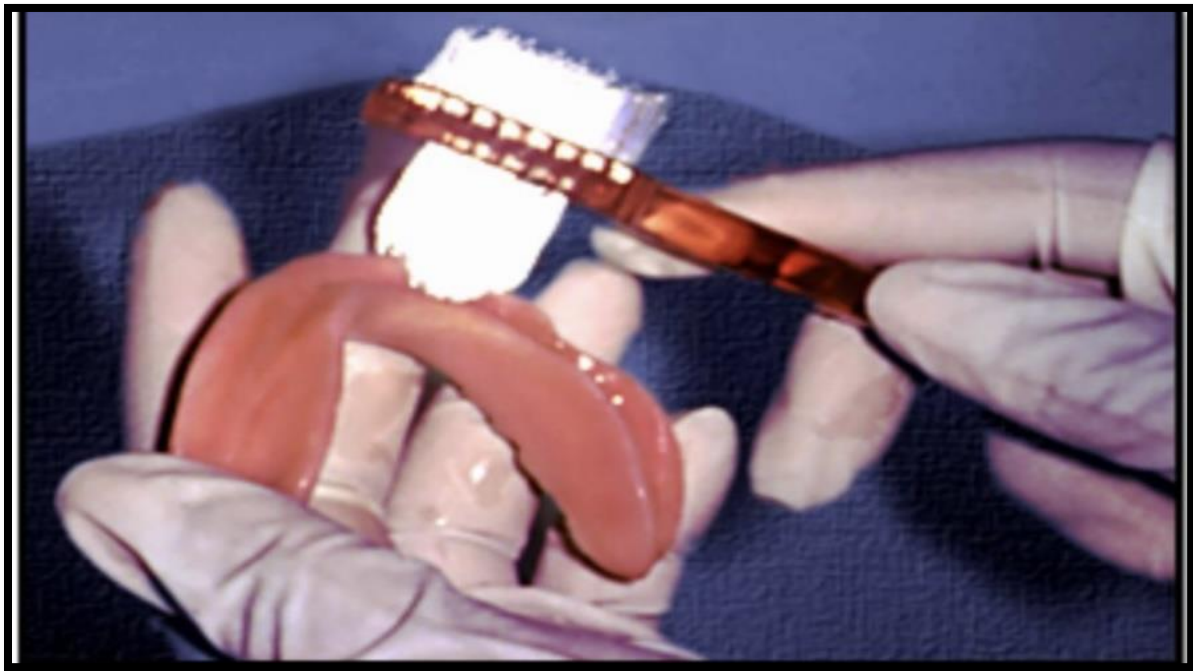


Figure1. Manual Mechanical Cleaning (Brushing). (Shay, 2000)

1.5.1.2 Ultrasonic cleaning

As dentures subjected only to ultrasonic vibration in distilled water did not result in remarkable alterations of *C. albicans*, Mutans streptococci or total bacterial counts, it can be assumed that the effect of cavitation bubbles in the aqueous solution is inefficient to diminish the number of the examined microbial species (**Nalbant et al., 2008**).

Therefore, the effectiveness of the ultrasonic cleaning method is associated with the supplementary chemical action of the immersion solution rather than with the mechanical impact of the ultrasound device. (**Duyck et al., 2016**).

1.5.2 Chemical hygiene method

chemical cleansing was found by some researchers to be superior to brushing alone for denture plaque control and treatment of prosthesis-related stomatitis. In contrast, other study suggested that brushing is better than the chemical method of removing denture plaque. Other denture hygiene behavior, which could adversely affect the prosthesis hygiene level and associated with denture-related lesions, is keeping dentures at night. They found that 64% and 58% respectively slept with their dentures. In contrary others found only 9.2% slept with their denture The difference in the findings could be attributed to variance in oral hygiene instructions given by the dentists. (**Milward et al., 2013**).

From the reviewed scientific evidence in the field of hygiene approaches in Removable Prosthodontics, some conclusions can be drawn. With regard to the first and second PICO questions of this systematic review, the available comparative RCTs investigating the effectiveness of mechanical hygiene interventions including brushing in conjunction with immersion in alkaline peroxide solutions advocate the

combination of the aforementioned in order to achieve optimal sanitation outcomes **(Naik et al., 2011)**.

Taking into consideration the design of all the available RCTs relative to the frequency and the duration of different type of hygiene interventions, these correspond to 2 min/3 times daily for brushing, 5- to 20-minutes immersion of dentures in warm (37-50°C) alkaline per - oxide solutions daily and 15-minute vibration for ultrasound cleansing method. With regard to the investigation of brushing along with a short-term (5-20 minutes) denture immersion in alkaline per - oxide or sodium hypochlorite or chlorhexidine gluconate or sodium lauryl sulphate (SLS) solutions, this was also documented to be superior to exclusive brushing, indicating the need for introduction of an adjunctive chemical agent to enhance sanitation **(Andrade et al., 2012;Silva-Lovato et al., 2010)**.

From the scope of biochemistry, the resistance of both *Streptococcus mutans* and *C. albicans* is ascribed to their morphological features which involve a thick cell wall made up of peptidoglycan and a thick multilayered cell wall, respectively. With respect to the findings of all the available CCTs investigating the effectiveness of exclusively 1 type of hygiene practices, these can be summarized by the following endpoints. In terms of biofilm percentage reduction, 2 studies demonstrated that brushing with dentifrice displayed superior performance over brushing with neutral soap **(Salles et al., 2007)**.

The type of the assisted brushing product or toothbrush has no crucial impact on the hygiene outcomes considering the results from microbiological analysis. With respect to the available chemical hygiene agents, denture immersion in 0.2% Di gluconate chlorhexidine, 0.5% sodium hypochlorite and/or effervescent alkaline

peroxide solutions led to a significant reduction in total CFUs (Srinivasan et al., 2010; Duyck et al., 2013).

The antimicrobial properties of NaOCl are attributed to the action of hydroxyl ions and chlorination including irreversible inactivation of bacteria enzymatic sites and dissolution of mucin and other organic substances (Estrela et al., 2002).

On the other hand, in the cases of soft denture-lining materials, the effect of NaOCl can be deleterious as the irregularities created on the lining surface enhance the adherence of *C. albicans* and consequently the formation of increased amount of biofilm (Quirynen et al., 1990).

The lethal mechanism of action of chlorhexidine is attributed to the disruption of cell osmotic equilibrium. In particular, chlorhexidine binds to the negatively charged bacterial wall, disrupts bacteria cell membrane and leads to cytoplasmatic precipitation (Gomes et al., 2005; Mohammadi, Abbott., 2009).

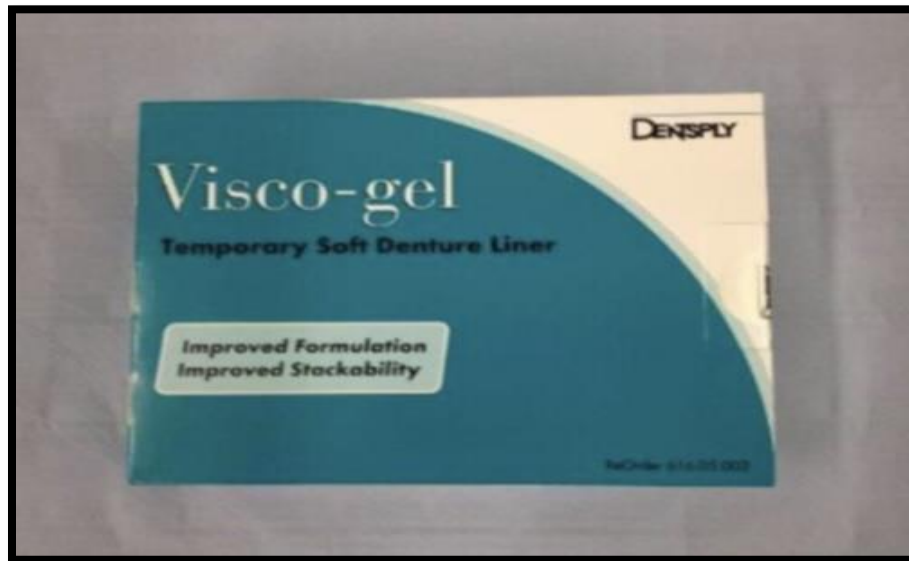


Figure.2 Visco-gel is a suitable tissue conditioner (Puryer, 2016)

The results of this systematic review corroborate with the current guidelines of American college of prosthodontists, suggesting that removable dentures be

cleaned daily by soaking and brushing with an effective and non-abrasive denture cleanser. In the event of denture wearers with restricted motor capacity or cognitive impairment mainly elderly and/or nursing home residents a denture cleaning method such as ultrasound cleaning that reduces the manual effort is recommended. Although an ultrasonic device requires cost to be expensed, it can be assumed that ultrasonic cleaning combined with immersion in a denture cleanser solution is indicated in hospitals and nursing homes for the elderly. Comparing the biofilm levels between the maxillary and mandibular complete dentures, it was observed that the mandibular protheses presented greater biofilm levels (**Fernandes et al., 2007**).

The higher retention of maxillary denture in conjunction with its shape could be a reasonable explanation of this fact. Based on clinical findings, higher biofilm deposits were greater in regions such as palatal rugae, maxillary tuberosities and anterior vestibular regions. In mandibular complete dentures, greater biofilm levels were observed in the region of the retromolar pad and the anterior internal regions (vestibular and lingual). (**Papadiochou and Polyzois, 2018**).

1.5.3 Microwave hygiene method

Microwaving at 650 W for 3 minutes resulted in clinical sterilization of complete dentures. Besides, microwave irradiation at 650 W for 2 minutes produced also denture disinfection eliminating the total microbial counts. Up to date, the exact mechanism of action of microwave irradiation has not been specified. The lethal effect of irradiation has been attributed either to the heat produced by the microwaves (thermal effect) or the interaction between the electromagnetic field created by the microwaves and the cell molecules, resulting in molecular,

mechanical or selective heating mechanisms (**Fitzpatrick et al., 1978; Watanabe et al., 2000**).

Photodynamic therapy represents an innovative method for disinfection of removable prostheses reducing over 90% of the micro-organisms on the dentures. The basic principle of this disinfection method relies on the irradiation of a substance known as a photosensitizer (PS) with a light source, which causes cell death via the production of reactive oxygen species such as singlet oxygen (**Ribeiro et al., 2012**).

Color stability of removable dentures represents a physical property that is affected to a certain degree by factors such as the salivary pellicle in conjunction with foods and beverages consumption. As no in vitro study design can duplicate these conditions, further and more longitudinal clinical trials investigating the impact of hygiene interventions on color stability of dentures are required. As only 2 clinical studies have investigated the effect of microwave irradiation on the dimensional stability of removable dentures,^{58,59} further longitudinal clinical trials should be conducted in order to extrapolate more clear conclusions about the effect of hygiene interventions on dimensional stability of removable prostheses. From the available scientific evidence, brushing of the removable dentures represents the most commonly applied cleansing method of removable denture wearers. Although the frequency of cleaning does not necessarily indicate efficiency, most denture wearers, and especially elderly, are not sufficiently informed about proper denture care. Taking into consideration the registered values for the frequency of the applied hygiene methods and the continuous or nocturnal wearing of removable dentures, it can be concluded that evidence-based hygiene guidelines should be communicated to the patients. A significant portion of denture wearers—exceeding 50 per cent—did not remove their removable prostheses overnight (**Papadiochou and Polyzois, 2018**).

1.6 Oral lesions induced by complete denture:

1.6.1 Denture stomatitis

Denture-induced stomatitis is the most common oral fungal infection among elderly denture wearer. It has been found to develop in between 25% and 67% of denture wearers. The frequency of denture stomatitis is greater amongst women than men, and it has also been found to increase with age. **(Fenlon et al., 1998).**



Figure.3 denture stomatitis (Samaranayake et al., 2009)

Many factors have been anticipated in the development of denture stomatitis, including neglecting of denture hygiene, the age of the prosthesis wearing complete dentures at night, traumatic occlusion, tobacco and alcohol consumption Irradiation and oral dryness. **(Hand et al., 1986).**

The role of stomatitis disease found to be related to the pathogenesis of Candida biofilm, which assists the survival of fungal cells and contributes to the disease process. Different clinical presentations of denture stomatitis could also contribute to the host immune response. Many classifications have been proposed to assess the clinical forms, with Newton's classification being the most generally

accepted. Other denture-related lesions, namely, traumatic ulcers, could present among elderly denture wearers (3.9 to 29%) (**Webb et al., 1998**).

1.6.2 Traumatic ulcers

Traumatic ulcers develop within 1-2 days after the insertion of dentures, but may also be found in subjects with old, ill-fitting dentures, overextended or unbalanced occlusion. The purpose of this study was to evaluate the denture hygiene level and to analyze the behaviors and hygiene habits of maxillary complete denture patients in the local population of Suleimani city. Furthermore, the study explored any possible relationships between these habits and oral mucosa conditions (**Budtz-Jørgensen, 1981**).



Figure.4 traumatic ulcer (Michael and Lewis Nairn, 2019)

1.7 Caries and periodontal diseases:

Longitudinal studies indicate that RPDs have been associated with increased gingivitis, periodontitis, and abutment mobility. It also found that RPDS were associated with increased plaque accumulation, not only on tooth surfaces in direct contact with the denture, but also on teeth in the opposing arch, and in some cases, even on buccal surfaces of teeth. RPDs may increase the incidence of caries, damage the periodontium, and increase the amount of stress on natural teeth. These alterations are attributed to poor oral hygiene, increased plaque and calculus accumulation, and transmission of excessive forces to the periodontal structures from occlusal surfaces of the framework of RPDs. Only minor periodontal effects were noted in patients recalled regularly for supportive treatment, including professional oral hygiene. Studies suggest that the insertion of a partial denture constitutes a risk factor for abutment and sometimes even for non-abutment teeth. **(Knezovic et al., 2002)**

Chapter two

conclusion

CONCLUSIONS: -

2.1 Conclusion:

1- hygiene effectiveness: Within the limitations of this systematic review, the current project demonstrated that the combined application of different types of hygiene practices in removable prostheses, namely mechanical interventions in conjunction with chemical agents, achieves optimal outcomes in terms.

2- color and dimensional stability of removable dentures: Despite the limited number of existing clinical trials investigating the effect of hygiene practices on color and dimensional stability of removable dentures, it seems that microwave disinfection leads to insignificant alterations in dimensional stability of prostheses. Color instability of dentures subjected to hygiene interventions is dependent on the critical concentration of chemical solutions as well as the duration of the chemical agent application.

3- Denture brushing is the most commonly applied hygiene practice among denture wearers worldwide.

4-The registered denture wearers' habits and attitudes towards the hygiene of their removable prostheses indicate that evidence-based removable prostheses hygiene guidelines should be communicated to patients.

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