EGYPTIAN DENTAL JOURNAL
www.eda-egypt.org
VOL. 69, 611:619, JANUARY, 2023
PRINT ISSN 0070-9484 • ONLINE ISSN 2090-2360
FIXED PROSTHODONTICS AND DENTAL MATERIALS
Submit Date : 25-10-2022 • Accept Date : 26-11-2022 • Available online: 1-1-2023 • DOI : 10.21608/edj.2022.170732.2321

THE EFFECT OF DIFFERENT RELINING MATERIALS ACCUMULATION ORAL FLORAL IN LATERAL MAXILLARY DEFECT

Fadwa Adel Abdelrazek Awad[*] , Ingy Amin Talaat[**]
and Noha Mohamed El Hussieny[***]

ABSTRACT

Objective: The aim of this study was to evaluate and compare the effect of silicon based soft relining material "Multisil-Soft" and the acrylic based soft relining material "COE-SOF™" accumulation oral floral in lateral maxillary defect.

Materials and Methods: Type of study: Randomized clinical Trial (RCT) fourteen patients with lateral maxillectomy defect were taken the outpatient clinic, Oral and maxillofacial Prosthodontic department Faculty of Dentistry, Ain Shams university.

Grouping: Patients were randomly divided into two equal groups. Group-I: Seven patients had received Definite obturator relined with silicon based soft relining material. Group–II: patients were rehabilitated with definite obturator relined with acrylic based soft relining material. microbiological samples were taken for bacterial count and bacterial DNA load detection by Polymerase chain reaction Real-time PCR. Microbial evaluation was performed at the time of relining, three and six months after relining of the obturator.

Results: The results of this study revealed that the bacterial count was significantly greater for group II compared to group I at time of relining - 3 months and at time of relining - 6 months. On the other hand, the bacterial DNA load was significantly greater for group I compared to group II at the intervals at time of relining - 3 months and at time of relining - 6 months.

Conclusion: Within the limitations of this study; it may be concluded that: Acrylic based relining material (COE-SOFTTM) is more heavily accumulation of oral floral than silicon based relining material (Multisil-Soft).

KEY WORDS: Obturators, Soft Relining, Real Time PCR

* Instructor of Oral and Maxillofacial Prosthodontics Department, Faculty of Dentistry, Aswan University, Egypt.
** Professor of Oral and Maxillofacial Prosthodontics Department, Faculty of Dentistry, Ain Shams University, Egypt.
*** Lecturer of Oral and Maxillofacial Prosthodontics Department, Faculty of Dentistry, Ain Shams University, Egypt

INTRODUCTION

Acquired maxillary defect is the lack in continuity of the intact palatal structures and can occur anywhere in the palate. The defect may involve the alveolar process, hard and / or soft palate, and floor of the nose. [1, 2]

Significant functional and social disabilities with acquired maxillary defect that can be minimized by obturator after surgical resection. [3, 4]

Disabilities lead to air leakage, poor obturator stability, retention and reduced obturator bearing area dramatically affect the prognosis of obturator prosthesis. [5]

Retention impedance of definitive obturators for patients with acquired maxillary defect has been improved by minimizing the movement of the obturator, reducing the weight of the obturator and engagement of the scar band. Additional retention by extending the obturator along the nasal surface of the soft palate and the use of dental implants. [6-8]

Resilient relining materials have been recommended for many years to reline the tissue surface of the obturators. Soft reliners equalize force distribution to reduce localized pressure. Obturator retention also improved by engaging undercuts and reducing the traumatic effect due to its resiliency and good adhesion to obturator base. [9]

The resilient obturator relining materials are broadly chemically classified into acrylic based relining materials and silicone based relining materials. Acrylic based resilient obturator relining materials are plasticized polyethylmethacrylate polymer. They are characterized by their bonding strength to acrylic resin base; however, their major drawbacks are high water sorption and low resiliency. [10]

Silicone-based resilient relining materials are poly-dimethyl siloxane polymer. Silicone relining materials are color stable, and more resilient than acrylic based relining materials. The polymer is an elastomer, which does not require an external plasticizer and therefore more stable over time. [11,12]

Soft relining material clinical application has been associated with many drawbacks. Among these are staining, color change, porous surface texture, degradation and decreased resiliency with time. The porous surface texture as well as deboning between the obturator and the resilient relining material favor the accumulation of food debris and encourage bacterial growth that can irritate the obturator bearing area and create an environment for the colonization of oral micro-organism. [13-15]

Smears and swabs are the most commonly used methods for isolation and detection of oral microbial flora, recently molecular-based diagnostics such as polymerase chain reaction (PCR), finger printing (RAPD-PCR) and reverse transcriptase polymerase chain reaction (RT-PCR) were used. [16-17]

Polymerase chain reaction (PCR), strategy enables bacterial enumeration independent of growth characteristics with superiority to quantify uncultivable. Quantitative real time PCR is a recent modification of regular PCR; which allows the detection of product accumulation during the PCR process without probe thus reducing the assay set-up and cost. [18]

Awareness of the susceptibility of relining material to bacterial accumulation should be taken in consider on selecting obturator relining material to preserve, maintain the health of oral mucosa and improve patients with acquired palatal defect quality of life.

The purpose of this study therefore was to evaluate and compare the effect of silicon based soft relining material "Multisil-Soft" and the acrylic based soft relining material "COE-SOF™" on accumulation oral floral in lateral maxillary defect.

PATIENTS AND METHODS

Patients' Selection

Inclusion criteria: fourteen patients with lateral maxillectomy defectt were selected in the age range 35-60 years with average range of age 45 years from the outpatient clinic, oral and maxillofacial Prosthodontic department Faculty of Dentistry, Ain Shams University . All patients had undergone surgery at least 6-12 months earlier. Patients with adequate mouth opening, adequate salivary flow, good oral hygiene and co-operative were selected and all patients were informed in detail about the nature of the investigation and the purpose of the study. They agreed to take part in the study and signed on an informed consent form. The faculty's ethics committee approved the research protocol (FDASU-REC. No. 877)

Exclusion criteria: patients receiving chemotherapy, radiotherapy, any medication or antiseptic mouth washes that could affect bacterial balance during the study period, having bad oral hygiene and showing any signs or symptoms of fungal infection of the tissues lining the defect were excluded .

Prosthetic Procedures:

For all selected patients the following prosthetic procedures were carried out: definite hollowed obturator was constructed in conventional manner for all patients where preliminary impressions of the maxillary & mandibular arches were made with irreversible hydrocolloid alginate (Zhermack, Italy) after blocking-out the defect with Vaselinized gauze fig (1a). Study casts were poured with dental stone. GH Stone, Misr for Trading and Distribution, Egypt). Unnecessary medial undercuts were blocked out and upper and lower self-cure acrylic resin special trays were constructed. Final impression for the defect was taken by an elastic impression material medium body elastomer (Elite HD and Light Body Normal: addition silicone, Zhermack, Italy) fig(1b).

Upper and lower occlusion blocks were fabricated on the master cast. The upper wax rim was adjusted to provide proper lip support. After adjustment of the occlusal planes, centric relation was recorded following the interocclusal wax technique at the predetermined vertical dimension of occlusion**.** Occlusion blocks were mounted on simple hinge articulator**.** Try-in of the waxed-up obturator and lower denture were then made in the patient's mouth to ensure proper facial contour, extension, retention, stability of the obturator, correct vertical dimension and and even contact of posterior teeth in centric relation fig. (1c).

Hollowed heat cured acrylic obturator processed with conventional water bath technique was constructed. At the time of obturator insertion, pressure-indicating paste (PIP) was used to delineate areas of excessive tissue displacement and any necessary adjustments were done. Adequate closure and sealing of the defect was examined by checking proper breathing, swallowing, mastication, speech fig. (1d).

Patients were instructed to maintain a strict oral and obturator hygiene measures. Patients were recalled after three days and one week to perform any needed adjustments and inspection of the tissue lining the defect. After one month, patients were recalled for relining of the obturator and microbial evaluation.

Patients' Grouping: patients were randomly divided into two equal groups following the closed envelop technique according to the relining material.

- ***Group I:*** Definite obturator for patients of this group was relined by silicon based soft relining material (Multisil-Soft, Bredent GmbH & Co. KG. Weissenhorner Str. 2. 89250Senden. Germany.)
- ***Group II:*** Definite obturator for patients of this group was relined by Acrylic based relining material (COE-SOFT, COE-SOFT, soft denture reline material, GC America INC, USA)

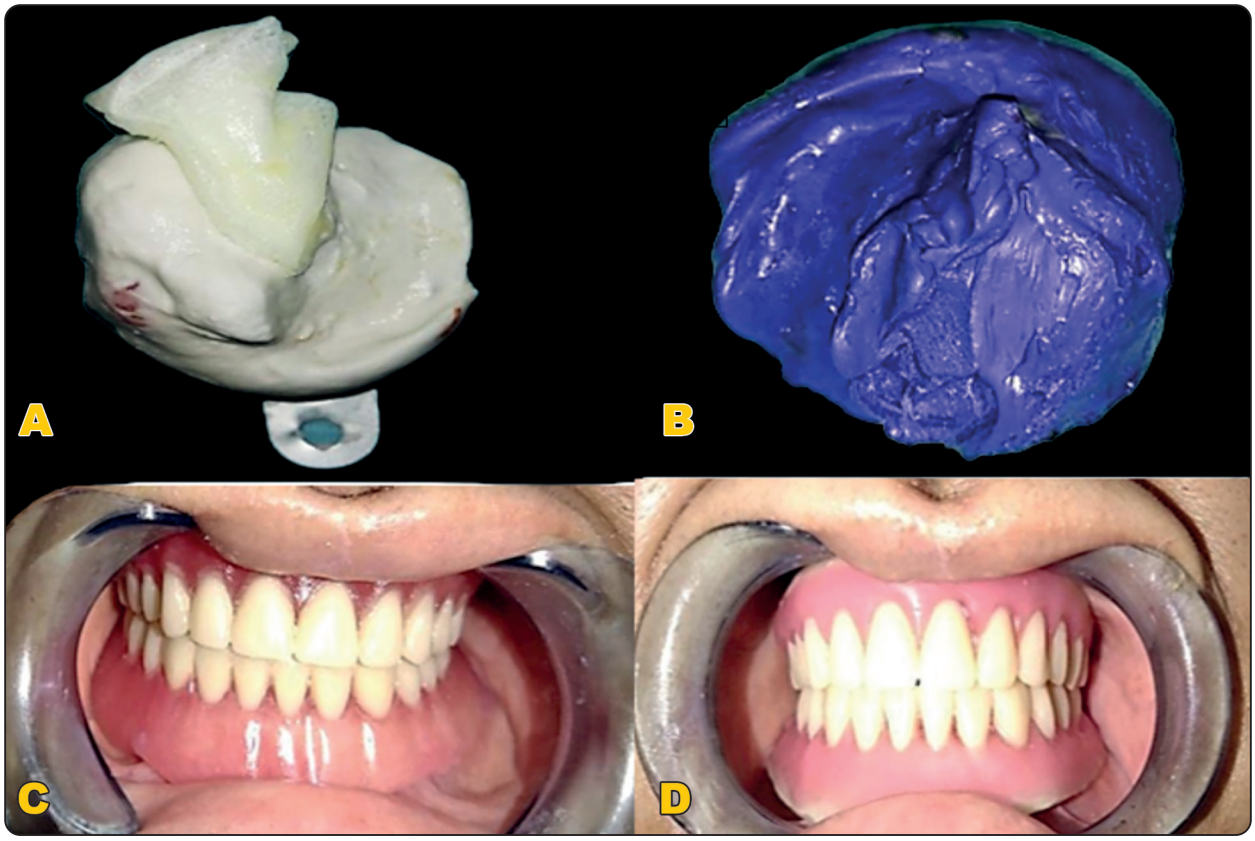

Fig (1): Construction of definite obturator :(a) primary impression, (b) secondary impression,(c) try in, (d) delivered definite obturator

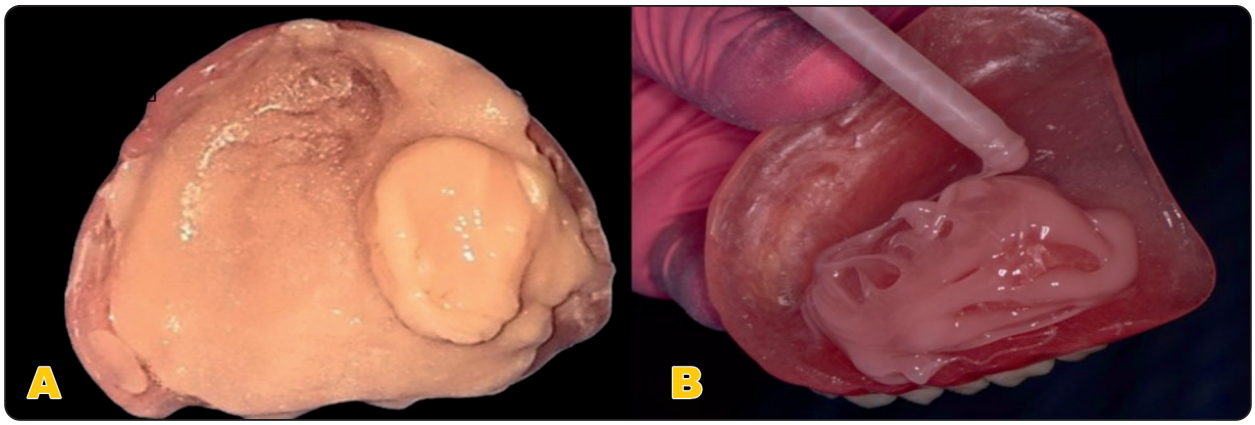

Fig. (2): (a) acrylic soft relining material, (b) silicon soft relining material

For group I: two mm of the heat cured acrylic resin bulb was reduced with acrylic bur. Adhesive primer (Multisil –Primer) with a solvating effect was painted by adhesive brush on the fitting surface of the bulbal part. material was applied on the fitting surface of the obturator fig. (2a). Obturator was positioned, seated patient was instructed to activate lips and cheeks for proper molding of relining material especially at the lateral side of the defect and the patient was guided to close in centric occlusion for 5-7 minutes.

For group II: two mm of the heat cured acrylic resin bulb was reduced with acrylic bur. Acrylic based relining material was mixed following the manufacturer instructions. The mixture was left to reach a honey-like consistency, then was applied on the fitting surface of the obturator fig(2b). obturator was seated and manipulated as same manner as group I.

Microbial evaluation: for all patients, microbiological samples were taken for bacterial count and bacterial DNA load detection by Real-time PCR. Microbial evaluation was performed at the time of relining, three and six months after relining of the obturator.

Microbial count

Microbial Sampling: bacterial isolation for counting of the total microbial oral flora (staphylococcus, streptococcus, actinomycins and candida) was done using gamma sterilized disposable cotton swabs which were collected with a circular motion from both inside and the lateral side of the defect then immediately inoculated into a tube containing 1 ml sterile saline. All samples were done by same operator every time to have the same force and transferred to the lab within 1hour (hr).

Culturing, incubation & counting of colonies: serial dilution 1/10 to 1/100,000 were made in sterile saline. 0.02of each dilution was spread over the surface of blood agar plate which was incubated at 37^0C aerobically for 48 hrs. Colonies were counted and the number of organisms (colony forming unit/swab) CFU/swab were calculated.

Bacterial DNA load detection by Real-time PCR

Microbial Sampling: Swab was taken using absorbent paper point that was dipped in 0.2 ml sterile Eppendorf containing 0.5 ml Phosphate-buffer saline (pH 7.4) for 30 seconds then was placed in the lateral side of the defect for five seconds. After removal of the swab it was placed in the saline for thirty seconds. This procedure was repeated three times and the sample was labelled and stored in -20^0C until analyzed.

Bacterial DNA load detection by Real-time PCR: the sample was centrifugated at 12,000rpm for 3 minutes, pellets were re-suspended in clear water and centrifugated at the same speed for 2 min. The supernatants were removed, and the bacteria pellets were used for microbial DNA extraction. The genomic bacterial DNA were extracted from the samples using QIAamp DNA mini kit (Qiagen, Hilden, Germany) according to the manufacturer instructions and the 16S ribosomal RNA (16S rRNA) was used to amplify the bacterial DNA genome using Real-Time PCR technique. The test was performed by Microbial DNA qPCR Assay kit (Qiagen, Hilden, Germany).The test was conducted according to the manufacturer instruction. The detection of bacterial species targets the 16s rRNA gene and were designed using the Green Genes database for 16s sequences.

Statistical analysis

Data from the two groups were collected, tabulated and statistically analysed and illustrated in tables and figures. The data were summarized as means and standard deviations. Collected data were analysed using a SPSS statistical package (Version 20, Chicago, IL, U.S.A.). Mean values were compared by independent t-test to compare between the groups. The ANOVA test used to compare the effect of time in different follow-up periods. The level of significance was set at 5% for all statistical analyses.

RESULTS

Bacterial count: the results obtained from this table shown that mean difference of bacterial count was significantly greater for group II compared to group I at the intervals (Baseline – After 3 months) and (Baseline -After 6 months) $P \leq 0.05$ and there were statistically significant differences of Microbial count means at different follow-up periods for both group I and group II, as shown in table (1), ($P \leq 0.05$).The mean values of bacteria count showed statistically significant increase throughout the study period in the two studied groups but on comparing group I to group II at the intervals (Baseline – After 3 months) and (Baseline -After 6 months) group II showed higher bacterial count than group I. However, at the interval (3months – After 6 months) statistical analysis revealed insignificant differences ($P > 0.05$) as indicated by independent t-test.

Bacterial DNA load: there were statistically significant differences of bacterial DNA load means at different follow-up periods for both group I and group II, as shown in table (2), ($P \leq 0.05$).The mean values of bacterial DNA load showed statistically significant increase throughout the study period in the two studied groups but on comparing group I to group II at the intervals (Baseline – After 3 months), (3months – After 6 months) and (Baseline -After 6 months) group I showed higher bacterial DNA load than group II.

TABLE (1): Mean values, SD and Independent t-test of Bacterial count for the studied groups.

	Group I		Group II		
	M	**SD**	**M**	**SD**	**t-test (significance)**
Baseline – After 3months	-0.81	0.10	-0.43	0.08	0.0001*
After 3 months – After 6 months	-0.17	0.08	-0.20	0.10	0.54
Baseline – After 6 months	-0.98	0.01	-0.63	0.05	0.0001*

TABLE (2): Mean values, SD and Independent t-test of Bacterial DNA load for the studied groups

	Group I		Group II		
	M	**SD**	**M**	**SD**	**t-test (significance)**
Baseline – After 3months	3.14	0.99	-0.22	1.86	0.001*
After 3 months – After 6 months	2.55	0.95	-2.66	1.89	<0.0001*
Baseline – After 6 months	5.69	1.56	-2.87	0.83	<0.0001*

DISCUSSION

Although very effort was made during construction of the obturators to avoid excessive soft tissue displacement that may cause mucosal inflammation and affect the degree of bacterial accumulation in this study, occlusal contact will tend to displace the obturator superiorly, with tendency to downward drop with release of occlusal contact. Movement of the during function might function most probably traumatize the mucosal lining of the defect and favor adhesion of bacteria to the mucosal cell.

Resilient obturator relining materials have been used to line the tissue surface of the obturator. Retention of the obturators were improved and pressure on the mucosa was reduced by using relining material. Resilient obturator relining materials also provide a more uniform load distribution, reducing the impact force on the supporting tissues of the defect, preserving the residual oral structures and maintaining the oral health as much as possible. [19]

Obturator relining materials are widely used to engage more undercuts in the lateral maxillary defects and enhance the retention of the obturator. Additionally, they act as a cushion to reduce irritation to the tissues and reduce discomfort to the patients. [19-22] This study was conducted to evaluate the effect of different relining materials on accumulation oral floral in lateral maxillary defect.

The results obtained from this study showed that there was marked decrease in bacterial count and increase in bacterial DNA load in patients rehabilitated with the obturators lined with silicon based relining material (Multisil-Soft) compared to acrylic base soft lining material (COE-SOF) where samples obtained after relining of the acrylic obturators exhibited marked decrease in bacterial count and increase in bacterial DNA load.

Microbial adhesion on biomaterial surfaces depends on the surface structure, surface roughness, surface free energy and composition of biomaterials, and on the physicochemical properties of the microbial cell surface, and its surface charge and hydrophopicity[23]. Components of the resilient obturator relining materials may reduce the adhesion and inhibit the growth of microorganisms to that surface. [24-26]

Although soft relining materials exhibit excellent tissue tolerance, one of the problems is the colonization of Candida and bacterial accumulation within the material [27]. Bacterial accumulation and Fungal growth destroy the surface properties of the relining material, and this may lead to irritation of the oral tissues. This is due to a combination of increased surface roughness and high concentrations of exotoxins and metabolic products which may account for the results of this study [28, 29]

The study results might be attributed to the inevitable porosity and surface roughness of the acrylic resin that favor the accumulation food debris and encourage bacterial growth. However, silicon based relining material physical property maintains its viscoelastic properties for long periods of time without being adversely affected. In addition, the inhibited microbial accumulation in silicone relining material may be due to lack of nutrients within the material to support the growth of the organism. [30, 32].

The components of silicon relining material were mixed, the hydrolyzation reaction was begun and the addition of SI-H from the hybrid functional siloxanes resulted in bonds across the unsaturated bonds, forming vinyl functional siloxanes. This curing reaction did not produce by- products. [33] Silicone rubbers characterized with the relatively good durability in oral cavity with a significant level of patient satisfaction and they were color stable, and more resilient than acrylic based liners. [34]

CONCLUSION

Within the limitations of this study; it may be concluded that: acrylic based relining material (COE-SOFTTM) is more heavily accumulation of oral floral than silicon based relining material (Multisil-Soft).

REFRENCES

1. Al Ani HA, Arajy ZY, Abood AA. Cleft palate repair without Fracture of the Pterygoid Hamulus. Postgraduate Medical Journal. 2006;5(3).
2. D'Souza KM, Dessai SS, Barretto ES, Swamy D, Aras MA. Contemporary treatment modalities for definitive rehabilitation of acquired maxillary defects-A review. International Journal of Oral Health Dentistry. 2020; 6(2):81-8.
3. Sun J, Shen Y, Li J, Zhang ZY. Reconstruction of high maxillectomy defects with the fibula osteomyocutaneous flap in combination with titanium mesh or a zygomatic implant. Journal of Plastic and Reconstructive surgery. 2011; 127(1):150-60.
4. Schusterman MA, Kroll SS, Weber RS, Byers RM, Guillamondegui O, Goepfert H. Intraoral soft tissue reconstruction after cancer ablation: a comparison of the pectoralis major flap and the free radial forearm flap. The American journal of surgery. 1991; 162(4):397-9
5. Rasidi MQ, Pandurangan KK, Prabu D. Assessment of partial edentulism of kennedy's class iv and its association to age and arch-a retrospective analysis. International Journal of Dentistry Oral Sci. S. 2019; 5:11-4.
6. Beumer J, Marunick MT, Esposito SJ. Maxillofacial Rehabilitation: Prosthodontic and Surgical Management of Cancer-Related, Acquired, and Congenital Defects of the Head and Neck. Quintessence Pub.; 2011
7. Buckner H. Construction of a denture with hollow obturator, lid, and soft acrylic lining. Journal of Prosthetic Dentistry. 1974 Jan 1;31(1):95-9.
8. Oh WS, Roumanas E. Dental implant–assisted prosthetic rehabilitation of a patient with a bilateral maxillectomy defect secondary to mucormycosis. The Journal of Prosthetic Dentistry. 2006 Aug 1;96(2):88-95.
9. Ghorab SA. Comparative study between two different types of soft liners used for patients with maxillary obturators. Egyptian Dental Journal. 2018 Apr 1;64(2-April (Fixed Prosthodontics, Dental Materials, Conservative Dentistry & Endodontics)):1805-12.
10. Abdelnabi MH, Swelem AA. Silicone versus acrylic resilient long term soft liners; a cross-over clinical study. Curr Sci Int. 2020;9:1-1. Doi.org/ 10.36632/csi/2020.9.1.1
11. Zayed SM, Alshimy AM, Fahmy AE. Effect of surface treated silicon dioxide nanoparticles on some mechanical properties of maxillofacial silicone elastomer. International Journal of Biomaterials. 2014 Dec 9;2014.
12. Mutluay MM, Oguz S, Fløystrand F, Saxegaard E, Dogan A, Bek B, Ruyter IE. A prospective study on the clinical performance of polysiloxane soft liners: one-year results. Dental Materials Journal. 2008;27(3):440-7.
13. Yankova M, Peev T, Yordanov B, Dimova-Gabrovska M, Todorov R. Application of resilient denture lining materials: Literature Review. Journal of IMAB–Annual Proceeding Scientific Papers. 2021 Apr 2;27(2):3676-81.
14. Boscato N, Radavelli A, Faccio D, Loguercio AD. Biofilm formation of Candida albicans on the surface of a soft denture-lining material. Journal of Gerodontology. 2009 Sep;26(3):210-3.
15. Shakir DA, Abdul-Ameer FM. Effect of nano-titanium oxide addition on some mechanical properties of silicone elastomers for maxillofacial prostheses. Journal of Taibah University Medical Sciences. 2018 Jun 1;13(3):281-90.
16. Ferone M, Gowen A, Fanning S, Scannell AG. Microbial detection and identification methods: Bench top assays to omics approaches. Comprehensive Reviews in Food Science and Food Safety. 2020 Nov;19(6):3106-29.
17. Jervøe-Storm PM, Koltzscher M, Falk W, Dörfler A, Jepsen S. Comparison of culture and real-time PCR for detection and quantification of five putative periodontopathogenic bacteria in subgingival plaque samples. Journal of Clinical Periodontology. 2005 Jul;32(7):778-83.
18. Kristensen T, Vestergaard H, Møller MB. Improved detection of the KIT D816V mutation in patients with systemic mastocytosis using a quantitative and highly sensitive real-time qPCR assay. The Journal of Molecular Diagnostics. 2011 Mar 1;13(2):180-8.
19. Bhasin AS, Singh V, Mantri SS. Rehabilitation of patient with acquired maxillary defect, using a closed hollow bulb obturator. Indian Journal of Palliative Care. 2011 Jan;17(1):70.
20. Wu YL, Schaaf NG. Comparison of weight reduction in different designs of solid and hollow obturator prostheses. The Journal of Prosthetic Dentistry. 1989 Aug 1; 62(2):214-7.
21. Adisman IK, Desjardins RP, Benington IC, Clifford T. An injection impression technique for palatal defects. The Journal of Prosthetic Dentistry. 1982 Apr 1;47(4):414-8.
22. Davenport JC. Clinical and laboratory procedures for the production of a retentive silicone rubber obturator for the maxillectomy patient. British Journal of Oral and Maxillofacial Surgery. 1984 Oct 1;22(5):378-86.

23. Varshney S, Pandey P, Gupta D, Sharma S. Role of fabric properties, moisture and friction in transfer of bacteria from fabric to fabric. Textile Research Journal. 2020; 90(3-4):478-85.

24. Hayran Y. Determination of the effective time of denture cleanser tablets on the removal of Candida Albicans on denture base resins. Cumhuriyet Dental Journal. 2019; 22(3):325-35.

25. Waltimo T, Tanner J, Vallittu P, Haapasalo M. Adherence of Candida albicans to the surface of polymethylmethacrylate. E glass fiber composite used in dentures. International Journal of Prosthodontics. 1999; 12:83-6

26. Schmalz G, Cieplik F. Biofilms on restorative materials. Monogr Oral Sci. 2021;29:155-194.

27. Tournu H, Van Dijck P. Candida biofilms and the host: models and new concepts for eradication. International Journal of Microbiology. 2012; 2012

28. Douglas WH, Walker DM. Nystatin in denture liners- an alternative treatment of denture stomatitis. British Dental Journal. 1973; 135:55-9.

29. Wright PS. The effect of soft lining materials on the growth of Candida albicans. Journal of Dentistry. 1980; 8:144-51.

30. Nikawa H, Chen J, Hamada T, Nishimura M, Polyzois G. Candida albicans colonization on thermal cycled maxillofacial polymeric materials in vitro. J Oral Rehabil. 2001a;28(6):526-533.

31. Holmes AR, Rodrigues E, van der Weilen P, Lyons KM, Haigh B, Wheeler T, Dawes PJD, Cannon RD. Adherence of Candida albicans to silicone is promoted by the human salivary protein SPLUNC2/PSP/BPIFA2. Mol Oral Microbiol. 2014;29(2):90-98.

32. Chladek G, Żmudzki J, Kasperski J. Long-term soft denture lining materials. Materials (Basel). 2014;7(8):5816-5842.

33. Zayed SM, Alshimy AM, Fahmy AE. Effect of surface treated silicon dioxide nanoparticles on some mechanical properties of maxillofacial silicone elastomer. International Journal of Biomaterials. 2014; 2014.

34. Mutluay MM, Oguz S, Fløystrand F, Saxegaard E, Dogan A, Bek B, Ruyter IE. A prospective study on the clinical performance of polysiloxane soft liners: one-year results. Dental Materials Journal. 2008; 27(3):440-7.