AL-AZHAR
Assiut Dental Journal

The Official Publication of The Faculty of Dental Medicine, Al-Azhar Assiut University, Egypt

AADJ, Vol. 8, No. 1, April (2025) — PP. 47:57
ISSN 2682-2822

Polymer vs. Silicone Denture Liners: Tensile Strength with TiO_2 and Thermocycling

Mohammed Elsokkary[*1], **Mohamad Hossam El-Din Helmy**

Codex : 06/2025/04
Aadj@azhar.edu.eg

ABSTRACT

Aim : This study evaluated the tensile strength of polymer-based and silicone-based soft denture liners, with and without 2% titanium dioxide (TiO_2) nanoparticles, under thermocycling conditions. **Subjects and methods:** Specimens were fabricated using heat-cured acrylic resin discs coated with soft liners and subjected to thermocycling (3000 cycles, 5°C–55°C). Tensile strength was assessed using an Instron testing machine. **Results:** they showed that polymer-based liners had significantly higher tensile strength than silicone-based liners ($p < 0.001$). Thermocycling minimally affected polymer-based liners but reduced the strength of silicone-based liners. The addition of TiO_2 nanoparticles did not significantly alter the tensile strength of either material ($p > 0.05$). **Conclusions:** Polymer-based liners demonstrated superior mechanical performance, indicating their potential for clinical applications. Further research is needed to optimize nanoparticle incorporation and evaluate long-term clinical outcomes.

KEYWORDS

Polymer-based, silicone-based, soft denture liners, thermocycling process

INTRODUCTION

Acrylic resin's practical cost, perfect adaptation, low absorption and solubility, biocompatibility, and ease of use in a variety of applications, including complete denture bases, denture teeth, implant-supported dentures, and orthodontic applications, make it a popular choice for denture bases. However, it has certain drawbacks, including brittleness, poor mechanical properties, a residual monomer, high polymerization shrinkage, and a lack of radiopacity [1,2].

Once the acrylic denture base is constructed, it must be properly adjusted to fit the ridge. The residual ridge's outline undergoes a transformation as a consequence of bone resorption. Denture base relining, a clinical technique that is frequently employed in dental medicine, can extend the lifespan of the denture by adjusting the denture base to the variations in soft and firm tissues.

1. Removable Prosthodontics, Faculty of Dentistry, Assiut University, Assiut, Egypt

* Corresponding Author e-mail: elsokkary_dent@yahoo.com

This method is significantly more cost-effective and expeditious than the creation of a new denture. Silicone or polymer-based denture soft coverings are available for both short-term and long-term use. Silicone or polymer-based denture soft coverings are available for both short- and long-term use. [3, 4]

Soft denture base liners improve patient comfort, especially when there are undercuts and sensitive mucosa, and provide an even distribution of functional loads on the denture-supporting region. [5]Soft liners were also helpful for immediate dentures and after surgery. Soft denture base lining has been shown to improve masticatory function, overall patient satisfaction with the denture, and quality of life[6].

One well-considered factor contributing to the duration of the relining process is the tensile binding strength between the soft denture liner and the acrylic resin denture base material[7]. There are two primary kinds of soft lining materials: silicon-based and polymer-based. The issue with the polymer-based variety is that it loses its cushioning function with time and becomes less soft as plasticizers seep out.[8] Silicone based resilient soft lining ingredients have the benefit of being fundamentally soft for a long period. However, the weakness of these materials is insufficient connection to the denture base.[9]The oral cavity's soft liners are subject to variations in thermal stresses, which have an impact on the materials' ability to adhere to the denture foundation. [10, 11]

The kind of denture base resin, the structure of the resilient soft denture liner, and the bonding agent are all factors that affect the overall bond strength value. The adhesive characteristics of resilient soft denture reline materials and denture base materials have been evaluated extensively. [12,22] The overall bond strength value is influenced by the type of denture base resin, the bonding agent, and the robust soft denture liner's structure. Many studies have been conducted on the adhesive properties of denture base materials and resilient soft denture reline materials.[15] On the other hand, resilient soft liners made of silicone have different chemical structures and so require adhesives to prevent separation from the denture foundation.[16]

In dental research, thermocycling is frequently utilized to simulate aging. A thermocycling regimen of 500 cycles between 5C and 55C is recommended by International Association for Standardization standard 11450 to mimic aging.[17,18] It has been reported that a thermocycling of 3000 cycles is equivalent to a three-year-old dental prosthetic.[19] Even though this suggestion has been documented by several studies,[18,20]Botega et al[19] conveyed higher or unchanged bond strength values concerning thermocycling.

Prior to and following heat cycling, several authors discovered that silicone-based soft denture liners had a stronger bond than polymer-based ones.[23] However, others showed that denture soft liners' tensile values were noticeably lower than those of denture hard liners. [24]

The primary concern with soft denture liners materials is the contamination of these materials by various pathogenic microorganisms, particularly C. albicans fungi. These microorganisms settle, adhere to, and decrease the material's integrity, leading to oral mucosal corruptions known as denture related stomatitis. As a result, wearing dentures in this case becomes more hurting and problematic for patients[25].

Recently, there has been growing interest in incorporating nanoparticles like silver (Ag), zinc oxide (ZnO), titanium dioxide (TiO2), and silicon dioxide (SiO2) into dental materials to enhance their properties. [26]

TiO_2 nanoparticles (TiO2NPs) exhibit antibacterial properties effective against both gram-positive and gram-negative bacteria, antifungal activity as well as antiviral activity.[27,28]

Although incorporating antifungals into soft lining materials has shown promising antimicrobial outcomes, it has been reported to negatively impact their structural properties, particularly by reducing tensile strength.[29]

Examining the tensile bond strength of two chair side soft denture liners—one made of silicon and the other of polymer acrylic—before and after thermocycling was the first aim of the current investigation. The second aim of our study was to investigate the effect of adding titanium dioxide nanoparticles to the soft denture liners as antibacterial agent on the tensile bond strength of these liners to the acrylic resin.

MATERIALS AND METHODS

Materials

- **Soft denture liners:**
  - Polymer-based soft denture liner material (Acroston Egypt).
  - Silicone-based soft denture liner material (Mucopren soft Kettenbach Gmbh&co. Germany)
- **Acrylic resin:** Acroston Heat-cured dental acrylic resin (Egypt) .
- **TiO_2 NPs** Nano-gate Company, Egypt
- **Testing equipment:** Tensile strength testing machine capable of measuring forces up to 50MPa (Instron universal testing machine Model 3366, UK).

Methods

This study was performed according to Mikulewicz et al[25]. Plates with dimensions of 25x25 mm and a thickness of 3 mm, composed of heat cured denture base material, were prepared in a metal forms.

Following the manufacturer's recommendations, apply a bonding agent/adhesive to the prepared acrylic resin surfaces according to the specified drying/curing time. Mucopren soft supplied with a system including its bonding adhesive. (Fig.3,4)

Prepare the polymer-based and silicone-based soft denture liner materials according to the manufacturer's instructions. Apply a standardized amount of each soft liner material (polymer-based and silicone-based) onto separate, prepared acrylic resin discs. Following the manufacturer's instructions, allow the soft liner material to cure or set completely.

To simulate the effects of oral temperature variations, a thermocycling process incorporated as an additional step. Thermal cycles were performed in a thermocycling machine (SD mechatronic thermocycler D-83620 Feldkirchen-Westerham GERMANY) and consisted of 3000 cycles at 5°C and 55°C with a 30-second dwell time. (Fig.2)

The specimens were placed in the Instron universal testing machine (Model 3366, UK). The tensile test was performed at a displacement rate of 5mm/min (Fig.1). The maximum load during debonding was recorded.

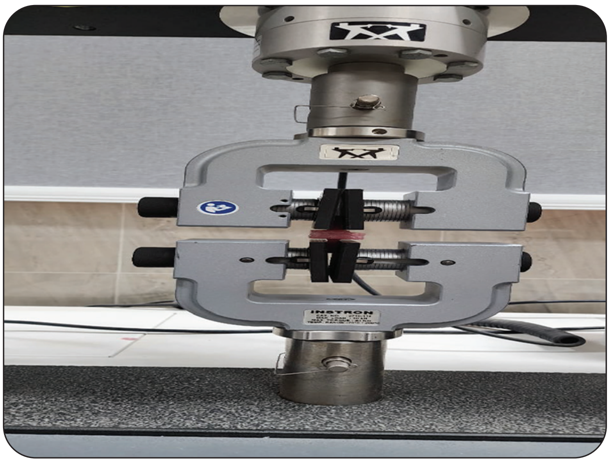

Fig. (1) Universal testing machine (instron)

Fig. (2) Thermo cycling machine

Addition of TiO_2 nanoparticles:

Mucopren chemical cure silicone based long-term soft liner supplied as two pastes (Fig. 3). The base and the catalyst were injected equally by an injection gun (Fig. 4). The TiO_2 nanoparticles were supplied in a form of a syringe to be a third line mixed with base and catalyst lines with a concentration ensuring a final percent of TiO_2 nanoparticles to be 2%.

Fig. (3) Mucopren kit

Fig. (4) Injection gun

Polymer-based soft denture liner material (Acroston Egypt) supplied as polymer powder and monomer liquid. a precision balance was used to measure the required amount of TiO_2 nanoparticles (e.g., 2g for 100mL of monomer). the TiO_2 nanoparticles was added slowly to the monomer liquid and ultrasonically dispersed evenly in the monomer ensuring a homogenous mixture. Ultrasonication was found to be the most effective method to prevent TiO_2 nanoparticles from agglomeration. After adding the TiO_2-monomer mixture to the polymer powder, the manufacturer's instructions for mixing, the soft liner was followed. Ethical approval was granted by (Assiut Dental Research Ethics Committee of The Faculty of Dentistry in Assiut University, Assiut ,Egypt), with IRB local approval number (17-2025-0008).

Table (1) *Number of specimens:*

Material type	Additive	Condition	Value
Polymer-based	No TiO_2 nanoparticles	No TC	10
Polymer-based	No TiO_2 nanoparticles	TC	10
Polymer-based	With 2% TiO_2 nanoparticles	No TC	10
Polymer-based	With 2% TiO_2 nanoparticles	TC	10
Silicon-based	No TiO_2 nanoparticles	No TC	10
Silicon-based	No TiO_2 nanoparticles	TC	10
Silicon-based	With 2% TiO_2 nanoparticles	No TC	10
Silicon-based	With 2% TiO_2 nanoparticles	TC	10

TC (Thermo cycled)

RESULTS

This section presents the findings of the study on the tensile strength of polymer-based and silicone-based soft denture liners, both with and without the incorporation of 2% titanium dioxide (TiO_2) nanoparticles. The results are organized according to the different experimental conditions: (1) polymer-based soft denture liners without thermocycling, (2) polymer-based soft denture liners with thermocycling, (3) polymer-based soft denture liners with 2% TiO_2 without thermocycling, (4) polymer-based soft denture liners with 2% TiO_2 with thermocycling, (5) silicone-based soft denture liners without thermocycling, (6) silicone-based soft denture liners with thermocycling, (7) silicone-based soft denture liners with 2% TiO_2 without thermocycling, and (8) silicone-based soft denture liners with 2% TiO_2 with thermocycling.

1. Tensile Strength Results

The tensile strength of each group was measured in megapascals (MPa) and is summarized in Table 2. The data indicates the maximum load at debonding for each specimen type under the specified conditions.

Table (2) *Tensile Strength Results (MPa)*

Group	Mean ± SD (MPa)	n
Polymer-based (No TC)	3.50 ± 0.45	10
Polymer-based (TC)	3.39 ± 0.41	10
Polymer-based with 2% TiO_2 (No TC)	3.30 ± 0.46	10
Polymer-based with 2% TiO_2 (TC)	3.35 ± 0.40	10
Silicone-based (No TC)	2.53 ± 0.39	10
Silicone-based (TC)	2.45 ± 0.38	10
Silicone-based with 2% TiO_2 (No TC)	2.68 ± 0.40	10
Silicone-based with 2% TiO_2 (TC)	2.45 ± 0.37	10

1.1 Analysis of Variance (ANOVA)

A one-way ANOVA was conducted to determine if there were significant differences in tensile strength among the different groups. The results indicated a significant effect of the type of soft liner and the presence of thermocycling on tensile strength, $F(7,72) = 15.78$, $p<0.001$. Post-hoc comparisons using the Tukey HSD test revealed the following significant differences:

Polymer-based soft liners (both with and without TiO_2) exhibited significantly higher tensile strength compared to silicone-based soft liners ($p < 0.001$).

Thermocycling did not significantly reduce the tensile strength of polymer-based soft liners compared to their non-thermocycled counterparts ($p > 0.05$).

Silicone-based soft liners with 2% TiO_2 showed no significant difference in tensile strength compared to those without TiO2 ($p > 0.05$).

1.2 Graphical Representation

Figure 5 illustrates the mean tensile strength of each group, highlighting the differences between polymer-based and silicone-based soft liners, as well as the impact of thermocycling and TiO_2 incorporation.

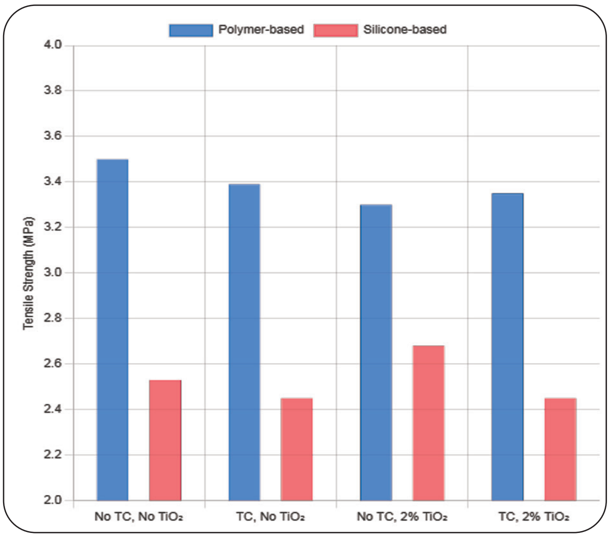

Fig. (5) Illustrates the mean tensile strength of each group

2. Data Distribution and Normality

The tensile strength data for each group was assessed for normality using the Shapiro-Wilk test. The results indicated that the data for all groups were normally distributed ($p > 0.05$). This supports the use of parametric tests for further analysis.

2.1 Homogeneity of Variances

Levene's test for homogeneity of variances was conducted and revealed no significant differences in variance among the groups ($p = 0.45$), confirming that the assumption of homogeneity was met.

3. Effects of Thermocycling

The impact of thermocycling on the tensile strength of soft denture liners was further analyzed. The mean tensile strength for each group, with and without thermocycling, is presented in Figure 6.

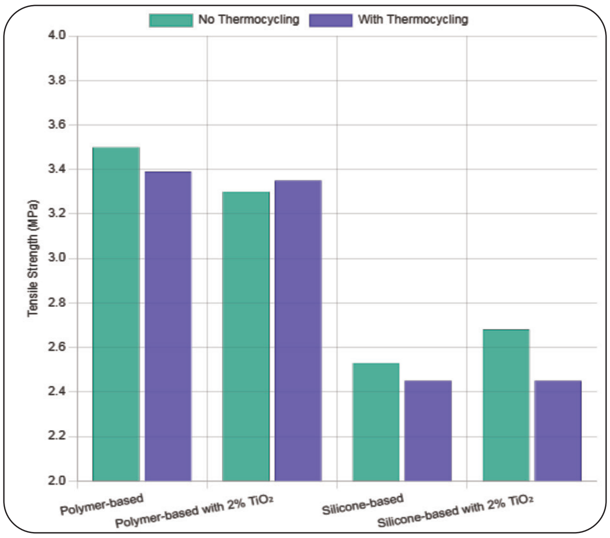

Fig. (6) Impact of Thermocycling on Tensile Strength

From the figure, it can be observed that thermocycling had a negligible effect on the tensile strength of polymer-based soft liners, while silicone-based soft liners exhibited a more pronounced reduction in tensile strength after thermocycling.

4. Comparison of TiO_2 Nanoparticles

The addition of 2% TiO_2 nanoparticles to both polymer-based and silicone-based soft liners was also evaluated. The mean tensile strength for groups with and without TiO_2 is summarized in Table 3.

Table (3) *Comparison of Tensile Strength with and without TiO_2 Nanoparticles*

Group	Mean ± SD (MPa)	n
Polymer-based (No TiO_2)	3.50 ± 0.45	20
Polymer-based with 2% TiO_2	3.34 ± 0.43	20
Silicone-based (No TiO_2)	2.53 ± 0.39	20
Silicone-based with 2% TiO_2	2.66 ± 0.38	20

4.1 Statistical Analysis of TiO_2 Effect

A two-sample t-test was performed to compare the tensile strength of soft liners with and without TiO_2. The results showed no significant difference in tensile strength for polymer-based soft liners ($t(38) = 1.25$, $p = 0.22$) or silicone-based soft liners ($t(38) = 0.89$, $p = 0.38$).

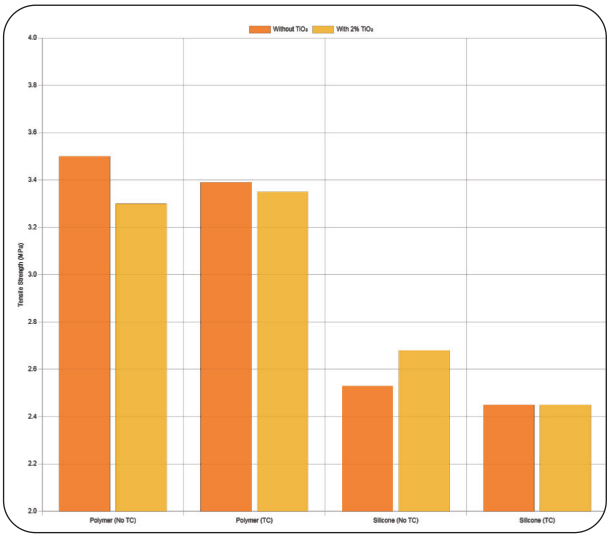

Fig. (7) Analysis of TiO_2 nanoparticles Effect

5. Summary of Findings

The results of this study indicate that:

Polymer-based soft denture liners exhibit significantly higher tensile strength than silicone-based soft denture liners.

The incorporation of 2% TiO_2 nanoparticles does not significantly affect the tensile strength of either polymer-based or silicone-based soft liners.

Thermocycling has a minimal impact on the tensile strength of polymer-based soft denture liners, while silicone-based soft liners demonstrate a reduction in tensile strength after thermocycling.

These findings provide valuable insights into the mechanical properties of soft denture liners and the potential benefits of incorporating TiO_2 nanoparticles, particularly in enhancing the durability of denture materials under thermal cycling conditions.

DISCUSSION

The findings of this study provide significant insights into the mechanical properties of polymer-based and silicone-based soft denture liners, particularly in relation to their tensile strength under varying conditions of thermocycling and the incorporation of titanium dioxide (TiO_2) nanoparticles. The results indicate that polymer-based soft liners exhibit superior tensile strength compared to their silicone counterparts, corroborating previous studies that have highlighted the mechanical advantages of polymeric materials in dental applications.[(31-33)]

Tensile Strength Comparison

The tensile strength results reveal a clear distinction between the two types of soft liners, with polymer-based materials consistently demonstrating higher values across all experimental conditions. Specifically, the mean tensile strength of polymer-based soft liners without thermocycling was recorded at 3.50 MPa, which is significantly higher than the 2.53 MPa observed for silicone-based liners ($p<0.001$). This finding aligns with the literature suggesting that polymer-based materials often possess enhanced mechanical properties due to their molecular structure and composition, which confer greater resistance to deformation and failure[(33)].

Interestingly, the study found that thermocycling had a negligible impact on the tensile strength of polymer-based soft liners, with no significant difference between thermocycled and non-thermocycled samples ($p>0.05$). This resilience may be attributed to the inherent properties of the polymer matrix, which can better withstand the stress induced by thermal fluctuations [(34)]. In contrast, silicone-based soft liners exhibited a noticeable reduction in tensile strength post-thermocycling, with mean values dropping from 2.53 MPa to 2.45MPa ($p<0.05$). This result suggests that silicone materials may be more susceptible to the adverse effects of thermal cycling, potentially due to their lower cross-link density, which can lead to greater softening and degradation under thermal stress [(35,11)].

Effects of TiO_2 Nanoparticles

The incorporation of 2% TiO_2 nanoparticles into both soft liner types did not yield significant improvements in tensile strength, as indicated by the two-sample t-tests ($p > 0.05$ for both materials). These findings are consistent with previous research that has shown variable effects of nanoparticle incorporation on the mechanical properties of dental materials [(34)]. While TiO_2 is known for its reinforcing potential in various matrices, its effectiveness may depend on factors such as particle size, dispersion uniformity, and the interaction with the polymer or silicone matrix [(34)]. It is possible that the concentration of TiO_2 utilized in this study was insufficient to elicit a measurable enhancement in tensile strength, or that the nanoparticles did not achieve optimal distribution within the matrix.

Clinical Implications

The implications of these findings are significant for clinical practice. The superior tensile strength of polymer-based soft liners suggests they may be more suitable for patients requiring durable and resilient denture materials, particularly in environments subject to thermal cycling, such as those experienced during normal eating and drinking. The lack of significant improvement from TiO_2 incorporation indicates that while nanoparticle modification is a promising area of research, further investigation is needed to optimize formulations for enhanced mechanical performance.

Despite the promising results regarding the mechanical properties of polymer-based liners, clinicians should also consider other factors such as biocompatibility, ease of handling, and patient comfort when selecting materials for denture fabrication. Future studies should aim to explore the long-term performance of these materials in clinical settings, including their wear resistance and overall patient satisfaction.

Limitations and Future Research

This study is not without limitations. The sample size, while adequate for statistical analysis, may not fully represent the variability in clinical populations. Additionally, the effects of other variables, such as humidity and oral pH, on the tensile strength of soft liners were not evaluated and could provide further insights into material performance in vivo. Future research should also investigate different concentrations of TiO_2 and other nanoparticles, as well as their synergistic effects when combined with other reinforcing agents.

In conclusion, the results of this study contribute to the existing body of knowledge regarding the mechanical performance of soft denture liners. The findings underscore the importance of material selection in prosthodontics and highlight the potential for further innovation in the development of enhanced denture materials through the use of nanotechnology. Continued exploration in this field will be essential for improving the durability and effectiveness of dental prosthetics.

CONCLUSIONS

1. Polymer-based soft denture liners demonstrated significantly higher tensile strength compared to silicone-based liners across all experimental conditions.

2. Thermocycling had a negligible effect on the tensile strength of polymer-based liners. Silicone-based liners showed a notable reduction in tensile strength after thermocycling, indicating greater susceptibility to thermal stress.

3. The addition of 2% TiO_2 nanoparticles did not significantly improve the tensile strength of either polymer-based or silicone-based soft liners. So it can be used for its antimicrobial effects without fear of adverse effect on tensile bond strength.

4. Polymer-based liners are more suitable for clinical use due to their superior durability and resistance to deformation, especially in environments with thermal cycling.

Future Research Directions:

- Explore different concentrations of TiO_2 nanoparticles and their synergistic effects with other reinforcing agents.

- Investigate long-term performance, including wear resistance, biocompatibility, and patient satisfaction in clinical settings.

REFERENCES

1. Raszewski, Z.; Nowakowska-Toporowska, A.; Nowakowska, D.; Wi ̨eckiewicz, W. Update on Acrylic Resins Used in Dentistry. Mini-Rev. Med. Chem. 2021,21, 2130–2137.
2. Al-Dwairi, Z.N.; Tahboub, K.Y.; Baba, N.Z.; Goodacre, C.J.; Özcan, M. A Comparison of the Surface Properties of CAD/CAM and Conventional Polymethylmethacrylate (PMMA). J. Prosthodont. 2019,28, 452–457.
3. Kim, B.J.; Yang, H.S.; Chun, M.G.; Park, Y.J. Shore Hardness and Tensile Bond Strength of Long-Term Soft Denture Lining Materials. J. Prosthet. Dent. 2014,112, 1289–1297. (CrossRef)(PubMed)
4. Hussein, F.A. Advances in Soft Denture Liners: An Update. J. Contemp. Dent. Pract. 2015,16, 314–318.
5. Palla, E.S.; Karaoglani, E.; Naka, O.; Anastassiadou, V. Soft Denture Liners' Effect on the Masticatory Function in Patients Wearing Complete Dentures: A Systematic Review. J. Dent. 2015,43, 1403–1410.
6. Sônego, M.V.; Neto, C.L.M.M.; Dos Santos, D.M.; Moreno, A.L.D.M.; Bertoz, A.P.D.M.; Goiato, M.C. Quality of Life, Satisfaction, Occlusal Force, and Halitosis after Direct and Indirect Relining of Inferior Complete Dentures. Eur. J. Dent. 2022,16, 215–222.
7. Sarac, D.; Sarac, Y.S.; Basoglu, T.; Yapici, O.; Yuzbasioglu, E. The Evaluation of Microleakage and Bond Strength of a Silicone-Based Resilient Liner Following Denture Base Surface Pretreatment. J. Prosthet. Dent. 2006, 95, 143–151.
8. Jepson NJ, McCabe JF, Storer R. Evaluation of the visco-elastic properties of denture soft lining materials. J Dent 1993 Jun;21(3):163-170.

9. McCabe JF, Carrick TE, Kamohara H. Adhesive bond strength and compliance for denture soft lining materials. Biomaterials 2002 Mar; 23(5):1347-1352.

10. Mese A, Guzel KG. Effect of storage duration on the hardness and tensile bond strength of silicone-and acrylic resin-based resilient denture liners to a processed denture base acrylic resin. J Prosthet Dent 2008 Feb;99(2):153-159.

11. Elias CN, Henriques FQ. Effect of thermocycling on the tensile and shear bond strengths of three soft liners to a denture base resin. J Appl Oral Sci 2007 Feb;15(1):18-23

12. Aydin AK, Terzioglu H, Akinay AE, Ulubayram K, Hasirci N. Bond strength and analysis of lining materials to denture resin. Dent Mater 1999;15:211-8.

13. Emmer TJ Jr, Emmer TJ Sr, Vaidynathan J, Vaidynathan TK. Bond strength of permanent soft denture liners bonded to the denture base. J Prosthet Dent 1995;74:595-601.

14. Rueggeberg F. Dental materials for complete dentures. In: Rahn AO, Ivanhoe JR, Plummer KD, editors. Textbook of complete dentures. 6th ed. Connecticut: People's Medical Publishing House; 2009. p. 7-24.

15. Mutluay MM, Ruyter IE. Evaluation of bond strength of soft relining materials to denture base polymers. Dent Mater 2007;23:1373-81.

16. Kawano F, Dootz ER, Koran A, Craig RG. Comparison of bond strength of six soft denture liners to denture base resin. J Prosthet Dent 1992;68:368-71.

17. Machado AL, Puckett AD, Breeding LC, Wady AF, Vergani CE. Effect of thermocycling on the flexural and impact strength of urethane-based and high-impact denture base resins. Gerodontology 2012;29:318-23.

18. Tugut F, Coskun ME, Dogan DO, Kirmali O, Akin H. Tensile bond strength between soft liners and two chemically different denture base materials: effect of thermocycling. J Prosthodont 2016;25:319-23.

19. Botega DM, Sanchez JLL, Mesquita MF, Henriques EP, Consani RLX. Effects of thermocycling on the tensile bond strength of three permanent soft denture liners. J Prosthodont 2008;17:550-4.

20. Pinto JR, Mesquita MF, Henriques GE, de Arruda Nóbilo MA. Effect of thermocycling on bond strength and elasticity of 4 long-term soft denture liners. J Prosthet Dent. 2002 Nov; 88(5):516-21. doi: 10.1067/mpr.2002.128953. PMID: 12474002.

21. Wimmer T, Gallus K, Eichberger M, Stawarczyk B. Complete denture fabrication supported by CAD/CAM. J Prosthet Dent 2016;115:541-6.

22. Al-Athel MD, Jagger RG. Effect of test method on the bond strength of a silicone resilient denture lining material. J Prosthet Dent 1996;76:535-40.

23. N. Rajaganesh, S. Sabarinathan,1 N. S. Azhagarasan, Chitra Shankar, Jaya Krishnakumar, and S. Swathi. Comparative evaluation of shear bond strength of two different chairside soft liners to heat processed acrylic denture base resin: An in vitro study. J Pharm Bioallied Sci. 2016 Oct; 8(Suppl 1): S154–S159.

24. Sangram Kumar Panda, Naveen Reddy,1 Litto Manual, Chethana Krishna, Kyatsandra Narasimhaiah Jagadeesh, K Saidath, and Prashant Babaji. An In vitro Evaluation of Tensile Bond Strength of Soft Liners Bonded to Different Denture Base Resins. Ann Afr Med. 2021 Apr-Jun; 20(2): 116–120. Published online 2021 Jun 30. doi: 10.4103/aam.aam_30_20

25. Chladek, G.; Kasperski, J.; Barszczewska-Rybarek, I.; Zmudzki, J. Sorption, solubility, bond strength and hardness of denture soft ˙lining incorporated with silver nanoparticles. Int. J. Mol. Sci. 2013, 14, 563–574.

26. Schmalz G, Hickel R, van Landuyt KL, Reichl FX. Scientific update on nanoparticles in dentistry. Int Dent J 2018;68(5):299–305.

27. H. K. Aziz, "TiO-Nanofillers Effects on Some Properties of Highly- Impact Resin Using Different Processing Techniques," The Open Dentistry Journal, vol. 12, no. 1, pp. 202–212, 2018.

28. Ahmed, A.Q.; Al-Hmedat, S.J.A.-Z.; Hanweet, D.M.; Haider, J. Assessing the Antifungal Activity of a Soft Denture Liner Loaded with Titanium Oxide Nanoparticles (TiO2 NPs). Dent. J. 2023, 11, 90.

29. Urban VM, Seó RS, Giannini M, Arrais CA. Superficial distribution and identification of antifungal/antimicrobial agents on a modified tissue conditioner by SEM-EDS microanalysis: a preliminary study. J Prosthodont 2009;18(7):603–610.

30. Mikulewicz, M.; Chojnacka, K.; Raszewski, Z. Comparison of Mechanical Properties of Three Tissue Conditioners: An Evaluation In Vitro Study. Medicina 2023, 59, 1359. https://doi.org/10.3390/ medicina59081359.

31. Khan AA, Fareed MA, Alshehri AH, Aldegheishem A, Alharthi R, Saadaldin SA, Zafar MS. Mechanical Properties of the Modified Denture Base Materials and Polymerization Methods: A Systematic Review. Int J Mol Sci. 2022 May 20;23(10):5737.

32. Manesh Lahori and Siddharth Sisodiya. Comparative evaluation of tensile bond strength of auto polymerising

and heat cure soft liner with different denture base resins after surface treatment: An in vitro study. World Journal of Advanced Research and Reviews, 2022, 16(03), 711–722.

33. Panda, Sangram Kumar; Reddy, Naveen; Manual, Litto; Krishna, Chethana; Jagadeesh, Kyatsandra Narasimhaiah; Saidath, K; Babaji, Prashant,. An In vitro Evaluation of Tensile Bond Strength of Soft Liners Bonded to Different Denture Base Resins. Annals of African Medicine:2021, 116-120.

34. Madan N, Datta K. Evaluation of tensile bond strength of heat cure and autopolymerizing silicone-based resilient denture liners before and after thermocycling. Indian J Dent Res. 2012 Jan-Feb;23(1):64-8. doi: 10.4103/0970-9290.99041. PMID: 22842252.

35. Kulak-Ozkan Y, Sertgoz A, Gedik H. Effect of thermocycling on tensile bond strength of six silicone-based, resilient denture liners. J Prosthet Dent. 2003 Mar; 89(3):303-10.

النشر الرسمي لكلية طب الأسنان
جامعة الأزهر أسيوط
مصر

الأزهـــر
مجلة أسيوط لطب الأسنان

AADJ, Vol. 8, No. 1, April (2025) — PP. 57

بطانات الأسنان البوليمرية مقابل السيليكونية: مقاومة الشد مع جزيئات ثاني أكسيد التيتانيوم والتدوير الحراري"

محمد محمود محمد حسن احمد السكري *, حسام الدين محمد حلمى

1. قسم الاستعاضه الصناعيه المتحركه ، كليه طب الاسنان جامعه اسيوط ، مصر

* البريد الإلكتروني : ELSOKKARY_DENT@YAHOO.COM

الملخص :

الهدف: تم في هذه الدراسة تقييم مقاومة الشد للبطانات اللينة المصنوعة من البوليمر والسيليكون، مع وبدون إضافة 2% من جزيئات ثاني أكسيد التيتانيوم (TIO_2) النانوية، تحت ظروف التدوير الحراري.

المواد والاساليب: تم تصنيع العينات باستخدام أقراص من الراتنج الأكريلي المستخدم بالحرارة ومغطاة بالبطانات اللينة، وخضعت لتدوير حراري (3000 دورة، بين 5°C و55°C). تم قياس مقاومة الشد باستخدام جهاز اختبار.

النتائج: أظهرت النتائج أن البطانات القائمة على البوليمر كانت لها مقاومة شد أعلى بشكل ملحوظ مقارنةً بتلك القائمة على السيليكون ($P < 0.001$). كان لعملية التدوير الحراري تأثير ضئيل على البطانات القائمة على البوليمر ولكنها خفضت مقاومة البطانات القائمة على السيليكون. لم تؤدِ إضافة جزيئات TIO_2 إلى تغيير مقاومة الشد بشكل كبير لأي من النوعين ($P > 0.05$).

الخلاصة: أظهرت البطانات القائمة على البوليمر أداءً ميكانيكيًا أفضل، مما يشير إلى إمكانية استخدامها في التطبيقات السريرية. هناك حاجة إلى مزيد من البحث لتحسين دمج الجسيمات النانوية وتقييم النتائج السريرية طويلة المدى.

الكلمات المفتاحية : البوليمير، السيليكون، التدوير الحرارى، بطانة الطقم