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# Impact of Denture Cleansers on Nylon Denture base properties: A Literature Review

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## Abstract

Patients with removable partial dentures have to clean and maintain their constructions. Evaluation of the impact of different denture cleansers on the mechanical and physical properties of the materials used for the fabrication of these removable dentures is important, because they affect not only the aesthetics of the construction but also its longevity and function. Thermoplastic polyamides, also known as nylons, have recently become more popular in treating partially edentulous patients with removable partial dentures.

Aim. The aim of the current review was to evaluate and compare the effect of different denture cleansers on the properties of nylon denture base materials.

Materials and methods. A literature review was conducted using PubMed, Web of Science, Google Scholar, and others including scientific papers up to February of 2025. There was no restriction on the date of publishing and language of publications. The keywords used for conducting the search were combinations of the following: “nylon dentures”, “flexible dentures”, “polyamide”, “physical properties”, “mechanical properties” and “denture cleansers”.

Conclusion. According to the results of the studies, the mechanical and physical properties of nylon-based, flexible polyamide can be altered depending on the immersion time and type of denture cleanser. The majority of authors find that these changes are within clinically acceptable ranges. Patients and dental professionals should remain vigilant, ensuring proper cleaning practices and monitoring for any long-term impacts, with further research needed to solidify these findings.

***Keywords:*** polyamide, denture base material, physical properties, mechanical properties, denture cleansers



## Introduction

Even with the advances in modern digital and implant technologies, the need for the fabrication of conventional removable dentures remains a reliable and needed method of treatment for partial and completely edentulous patients (1).

A shift towards better materials can be observed with the introduction of the more aesthetic, more comfortable and monomer free flexible non-metal clasp dentures (NMCD) such as denture base materials made from different types of nylon (polyamide).

Nylon is produced through the polymerization of monomers, specifically dibasic acid and di-amine. It possesses excellent heat and chemical resistance, along with high physical strength and flexibility, making it well suited for the fabrication of flexible, tissue-supported removable partial dentures. (2).

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Although polyamides are widely used, they tend to have rougher surfaces compared to other resin-based materials, which can negatively impact the aesthetic properties of the denture base. Furthermore, research has shown that different types of nylon used in the fabrication of removable dentures exhibit varying physical and mechanical properties. (3).

There are numerous denture cleaning products available, which can be categorized into mechanical and chemical cleaners. It is important for dental professionals to have a good understanding of denture cleaning products in order to provide patients with appropriate information and advice (4).

It is essential to follow the manufacturer's instructions for each product to ensure safe use and prevent damage to the denture. Additionally, it is important to be aware that some patients may experience hypersensitivity and mucosal irritation with certain products—therefore; regular patient check-ups are crucial (5).

Therefore, selecting the appropriate denture cleanser depending on the type of Nylon base material remains an important factor in maintaining the aesthetic and longevity of the prosthetic construction.

The current review focuses on the effects of different types of denture cleansers on the mechanical and physical properties of the thermoplastic polyamides used in the fabrication of removable partial dentures, and more specifically on their impact on color stability, surface roughness and hardness.

## Aim

The aim of this study is to review the available literature on the effect of denture cleansers on the physical and mechanical properties of nylon denture base materials, and more specifically on color stability, surface roughness and hardness.

## Material and methods

The research relied primarily on the use of Google Scholar as well as other databases such as PubMed, ResearchGate and Web of Science, the language of the publications used was primarily in English.

## Results

Just like natural teeth, dentures develop a pellicle, which can lead to the accumulation of plaque and calculus over time. Inadequate denture hygiene increases the risk of complications such as stomatitis, dental caries, and periodontal disease, while also contributing to issues like unpleasant odour and an unsatisfactory aesthetic appearance. Therefore, patients should always receive guidance on proper denture cleaning methods upon receiving a prosthesis (5).

A recent meta-analysis has emphasized that active cleaning methods (such as using a toothbrush with a less-abrasive paste) are preferable to passive approaches (immersion in denture cleansers) for maintaining optimal denture hygiene (6). The majority of studies suggest that a combination between these cleaning methods yield the best results when it comes to cleaning of the removable denture (7–9). The most commonly used denture cleaners are bleach-based and effervescent-type.

### Bleach-Based Denture Cleaners

Bleach-based denture cleaners typically contain sodium hypochlorite at concentrations of 1.5% or 2% w/v and/or sodium hydroxide (1.7% w/v), offering broad-spectrum antimicrobial efficacy. These cleaners can be

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used for short-term disinfection (10–20 minutes) or overnight immersion, following the manufacturer's guidelines, which vary based on dilution ratios. The main drawback of these cleaners is their potential to cause discoloration and hardening of the polyamide denture base materials, though the extent of damage depends on both concentration and immersion duration (10–12).

**Effervescent-Type Denture Cleaners**

Effervescent denture cleaners are formulated with oxidizing agents such as sodium bicarbonate, sodium percarbonate, and sodium persulfate, which generate carbon dioxide bubbles upon dissolution in water. Additionally, cleaners containing hydrogen peroxide release oxygen, enhancing their cleaning action. Although effervescent cleaners are less effective in antimicrobial action compared to bleach-based alternatives, they can lead to increased hardness and porosity of the nylon denture base materials (12–14).

**Color stability**

The color stability of polyamide-based removable dentures can be affected by several factors, including the patient's oral hygiene practices, the cleaning methods employed, the manufacturing process, and dietary habits (15).

The structure of the material can be viewed as a predisposition to an increase in the surface roughness, due to its more flexible nature, which implies less wear resistance (16,17).

A 2013 study by Durkan et al. examined the impact of three sodium perborate-based denture cleansers (CO-Corega, PR-Protefix, and VA-Valclean) on the color stability of different denture base materials. The materials tested included two polyamides (Valplast and Deflex), a butadiene-styrene copolymer PMMA (Rodex), and a PMMA polymer (Paladent) as a control. The results indicated that despite changes in the mechanical properties, the study found no significant color alterations in polyamide materials. This may be attributed to the relatively short immersion period of 20 days, which was insufficient to induce noticeable discoloration (18).

A 2017 study by Porwal et al. concluded that polyamide denture base resin exhibited greater color changes when exposed to sodium perborate-based denture cleansers compared to sodium hypochlorite-based cleansers. This difference was attributed to the chemical action of sodium perborate, combined with oxygen release through the effervescent effect, which contributed to the observed discoloration. (19).

Ozyilmaz et al. also confirm the discoloration properties of the most widely available denture cleansers (Corega and Protefix) in a study carried out in 2019. They concluded that for polyamide-based prosthesis, the use of citric acid-based cleansers might be more recommended than sodium perborate-containing cleansers because of its clinically acceptable color changes on polymers in terms of color stability (20).

The majority of the authors share the same opinion that long-term daily use of the denture cleansers affects the color stability of all denture base polymers, although the level of color changes, in the majority of the cases, is acceptable (21).

**Surface roughness and Hardness**

The primary drawback of thermoplastic polyamides is associated with their surface characteristics, making them more susceptible to scratching, rapid loss of gloss, and discoloration over time (22,23). These surface characteristics are a result of the hardness of the material, which is directly related to the structure, and polymerization of the material (24).

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The rough surface of dentures made from thermoplastic polyamides may also result from manufacturing errors. Surface defects can occur due to imperfections during the flasking process, as well as the higher temperature and pressure applied during the fabrication process (25). This low wear-resistance is also investigated in a study done by Hamanaka in 2016 (26).

A 2013 study by Durkan et al. examined the impact of three sodium perborate-based denture cleansers (CO-Corega, PR-Protefix, and VA-Valclean) on the surface roughness and hardness of different denture base materials. The materials tested included two polyamides (Valplast and Deflex), a butadiene-styrene copolymer PMMA (Rodex), and a PMMA polymer (Paladent) as a control. The results indicated that polyamide surface roughness increased after 20 days of repeated immersion, regardless of the cleaning solution used. Notably, the polyamide material initially exhibited greater surface roughness, which further increased after immersion. A reduction in hardness was also observed.

Polychronakis et al. studied the effect of oxidizing denture cleansers in 2015. They report that the effect of Corega Extradent (peroxide) on a polyamide denture base material led to an increase in the surface roughness as well as a reduction in gloss (27). These results are similar to those obtained by Abdel-Hamid et al., where a similar method of disinfection was used (28).

In a similar study carried out by Shinawi et al. in 2017, they conclude that conventional chemical cleansing can adversely affect the surface roughness of the polyamide material and that further research is required to establish the effect of longer immersion times as well as effect of denture cleansing on other properties such as flexural strength (29).

## Conclusion

After reviewing the available literature, it can be stated that the color stability, surface roughness and hardness are connected, and that in most cases when one is impacted negatively it reflects on the other two properties.

Chemical composition, manufacturing technique, degree of polymerization, surface treatment, and finishing and polishing methods of the denture base resins are the factors which significantly affect the color stability, surface roughness, and hardness of denture base resins.

Chemical structure, immersion time, temperature of solution, and mechanism of action of a denture cleanser are the factors, which affect the color stability, surface roughness, and hardness of denture base resins immersed in them. Both major groups of denture cleansers lead to some degree of discoloration.

The majority of authors find that the surface roughness and hardness of the polyamide denture base materials increases; however, it remains in the clinically acceptable range. When it comes to the color stability, it can be stated that the degree of discoloration depends on the concentration and immersion time of the material in the denture cleansers.

## References

1. Peres MA, Macpherson LMD, Weyant RJ, Daly B, Venturelli R, Mathur MR, et al. Oral diseases: a global public health challenge. The Lancet. 2019 Jul;394(10194):249–60.
2. Binaljadm TM. Flexible Denture: A Literature Review. Cureus. 2024 Mar;16(3):e55425.
3. Le Bars P, Bandiaky ON, Le Guéhennec L, Clouet R, Kouadio AA. Different Polymers for the Base of Removable Dentures? Part I: A Narrative Review of Mechanical and Physical Properties. Polymers (Basel). 2023 Aug 22;15(17):3495.
4. Mylonas P, Milward P, McAndrew R. Denture cleanliness and hygiene: an overview. Br Dent J. 2022 Jul 8;233(1):20–6.

DOI: 10.18044/MEDINFORM.2025121.2047 ISSUE 1, 2025

5. Cinquanta L, Varoni EM, Barbieri C, Sardella A. Patient attitude and habits regarding removable denture home hygiene and correlation with prosthesis cleanliness: A cross-sectional study of elderly Italians. J Prosthet Dent. 2021 May;125(5):772.e1-772.e7.
6. de Souza RF, de Freitas Oliveira Paranhos H, Lovato da Silva CH, Abu-Naba'a L, Fedorowicz Z, Gurgan CA. Interventions for cleaning dentures in adults. Cochrane Database of Systematic Reviews. 2009 Oct 7;
7. Oliveira Paranhos HF, Silva-Lovato CH, De Souza RF, Cruz PC, De Freitas-Pontes KM, Watanabe E, et al. Effect of three methods for cleaning dentures on biofilms formed in vitro on acrylic resin. Journal of Prosthodontics. 2009 Jul;18(5):427–31.
8. JC RJ. Effects of Aging and Denture Cleansers on the Flexural Strength and Surface Microhardness of Two Flexible Denture Materials. Int J Dent Oral Health. 2015;1(6).
9. Freitas-Fernandes FS, Cavalcanti YW, Ricomini Filho AP, Silva WJ, Del Bel Cury AA, Bertolini MM. Effect of daily use of an enzymatic denture cleanser on Candida albicans biofilms formed on polyamide and poly(methyl methacrylate) resins: An in vitro study. J Prosthet Dent. 2014 Dec;112(6):1349–55.
10. Davi LR, Peracini A, De Queiroz Ribeiro N, Soares RB, Da Silva CHL, De Freitas Oliveira Paranhos H, et al. Effect of the physical properties of acrylic resin of overnight immersion in sodium hypochlorite solution. Gerodontology. 2010 Dec;27(4):297–302.
11. De Sousa Porta SR, De Lucena-Ferreira SC, Da Silva WJ, Del Bel Cury AA. Evaluation of sodium hypochlorite as a denture cleanser: A clinical study. Gerodontology. 2015 Dec 1;32(4):260–6.
12. Mylonas P, Milward P, McAndrew R. Denture cleanliness and hygiene: an overview. Br Dent J. 2022 Jul 8;233(1):20–6.
13. Uludamar A, Özkan YK, Kadir T, Ceyhan I. In vivo efficacy of alkaline peroxide tablets and mouthwashes on Candida albicans in patients with denture stomatitis. Journal of Applied Oral Science. 2010 Jun;18(3):291–6.
14. Awing MM, Koyama AT. Stabilitas warna basis gigitiruan resin termoplastik nilon yang direndam dalam larutan pembersih gigitiruan peroksida alkalin Color stability of thermoplastic nylon denture base material immerse in alkaline peroxide denture cleanser. Journal of Dentomaxillofacial Science. 2013 Jun 30;12(2):98.
15. Sampaio-Fernandes M, Galhardo J, Campos S, Oliveira SJ, Reis-Campos JC, Stegun RC, et al. Colour changes of two thermoplastic resins used for flexible partial dentures. Comput Methods Biomech Biomed Eng Imaging Vis. 2022 Sep 3;10(5):460–5.
16. Shatta M, Badawy M, Haddad D. Surface Hardness Evaluation of a Thermoplastic Nylon Denture Base Material. Al-Azhar Journal of Dental Science. 2020 Oct 1;23(4):343–6.
17. Shakiba M, Rezvani Ghomi E, Khosravi F, Jouybar S, Bigham A, Zare M, et al. Nylon—A material introduction and overview for biomedical applications. Vol. 32, Polymers for Advanced Technologies. John Wiley and Sons Ltd; 2021. p. 3368–83.
18. Durkan R, Ayaz EA, Bagis B, Gurbuz A, Ozturk N, Korkmaz FM. Comparative effects of denture cleansers on physical properties of polyamide and polymethyl methacrylate base polymers. Dent Mater J. 2013 May 30;32(3):367–75.
19. Porwal A, Khandelwal M, Punia V, Sharma V. Effect of denture cleansers on color stability, surface roughness, and hardness of different denture base resins. The Journal of Indian Prosthodontic Society. 2017;17(1):61.
20. Ozyilmaz OY, Akin C. Effect of cleansers on denture base resins' structural properties. J Appl Biomater Funct Mater. 2019 Jan 25;17(1):228080001982779.
21. Tekin S. In Vitro Effect of Denture Cleansers on the Color Stability of Polyetheretherketone and Other Denture Base Polymers. Odovtos - International Journal of Dental Sciences. 2021 Jun 9;284–93.
22. Fueki K, Ohkubo C, Yatabe M, Arakawa I, Arita M, Ino S, et al. Clinical application of removable partial dentures using thermoplastic resin—Part I: Definition and indication of non-metal clasp dentures. J Prosthodont Res. 2014 Jan;58(1):3–10.
23. Kawara M, Iwata Y, Iwasaki M, Komoda Y, Iida T, Asano T, et al. Scratch test of thermoplastic denture base resins for non-metal clasp dentures. J Prosthodont Res. 2014 Jan;58(1):35–40.

DOI: 10.18044/MEDINFORM.2025121.2047 ISSUE 1, 2025

24. Mansour MM, Wagner WC, Chu TG. Effect of Mica Reinforcement on the Flexural Strength and Microhardness of Polymethyl Methacrylate Denture Resin. Journal of Prosthodontics. 2013 Apr 17;22(3):179–83.
25. Stafford GD, Huggett R, MacGregor AR, Graham J. The use of nylon as a denture-base material. J Dent. 1986 Feb;14(1):18–22.
26. Hamanaka I, Iwamoto M, Lassila LVJ, Vallittu PK, Takahashi Y. Wear resistance of injection-molded thermoplastic denture base resins. Acta Biomater Odontol Scand. 2016 Dec 19;2(1):31–7.
27. Polychronakis NC, Polyzois GL, Lagouvardos PE, Papadopoulos TD. Effects of cleansing methods on 3-D surface roughness, gloss and color of a polyamide denture base material. Acta Odontol Scand. 2015 Jul 4;73(5):353–63.
28. Mohamed Abdel-Hamid D. Microhardness of flexible denture base materials: effect of microwave and chemical disinfection methods [Internet]. 2013. Available from: https://www.researchgate.net/publication/273123368
29. Shinawi LA. The Effect of Denture Cleansers on the Hardness of Denture Base Resins, Polyamides and Copolymers. EC Dent Sci. 2017;110–9.

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