

COLOR STABILITY OF PET-G IN CLEAR ALIGNERS: Impact of Prolonged Exposure to Everyday Substances and its Psychological and Social Implications

Fabiana Nicita ¹, Joseph Lipari ², Frank Lipari ², Arianna Nicita ³

¹ Department of Biomedical, Dental Sciences and Morphofunctional Imaging, University of Messina, Italy

² Private practitioner, Capo d'Orlando, Messina, Italy

³ Department of Health Sciences, University of "Magna Græcia" of Catanzaro, Italy

BACKGROUND

The transparency and aesthetics of clear aligners are critical factors that influence patient satisfaction and psychological and social well-being. Based on our previous research on the chemical-physical characterization of polyethylene terephthalate glycol (PET-G) aligners exposed to staining agents and cleaning solutions, this study aimed to evaluate the color stability of PET-G after prolonged exposure to everyday substances, potentially due to chemical interactions affecting aligner transparency.



Fig.1. (a) Clear aligners. (b) Flat samples were cut after thermoforming the PET-G sheets.



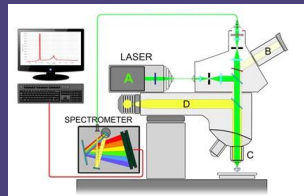
Fig.2. Exposure of thermoformed samples in daily use substances (coffee, tea, Coca-Cola, red wine, colloidal silver-based disinfectant, nicotine, artificial saliva, cigarette smoke, and saliva solutions with smoke, coffee, and nicotine) up to 10 and 15 days.

MATERIALS AND METHODS

1. Preparation and staining of PET-G thermoformed samples

Substances contained in a plastic container of 5 ml each:

1. Coffee
2. Sugar-free tea
3. Coca Cola
4. Red wine
5. Colloidal silver
6. Nicotine solution
7. Artificial saliva
8. Cigarette smoke
9. Saliva and smoke solution
10. Saliva and nicotine solution
11. Saliva and coffee solution



GROUPS based on immersion times in a water bath at 37 °C (N = 220)
1. 10 days (n = 110)
2. 15 days (n = 110)

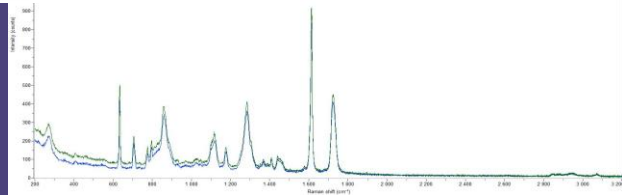


Fig.3. Post-immersion Raman spectra did not alter PET-G peaks and did not differ at 10 and 15 days.

2. Colorimetric evaluation

L*a*b* parameters were measured before and after immersion for colorimetric assessment, and the total color change (ΔE) was calculated for evaluation. To perceive the color change at a clinical level, the scale developed by the National Bureau of Standards (NBS) was used, converting ΔE into NBS units.

Fig.4. Mean ΔE values for each group before and after exposure of the substance concerned: (a) up to 10 days; (b) up to 15 days.

$$\Delta E^* = [(\Delta L^*)^2 + (\Delta a^*)^2 + (\Delta b^*)^2]^{1/2}$$

$$NBS = \Delta E^* \times 0.92$$

RESULTS

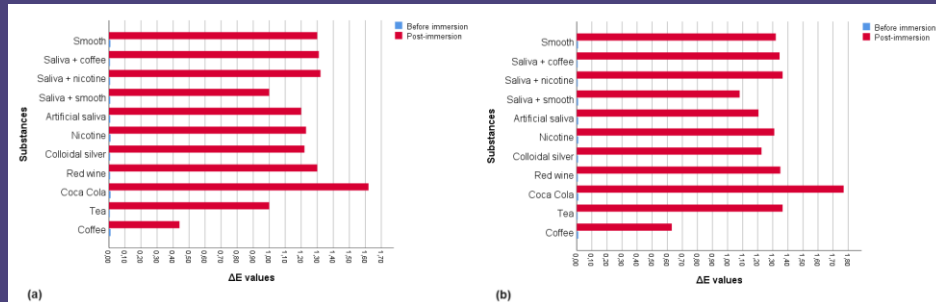
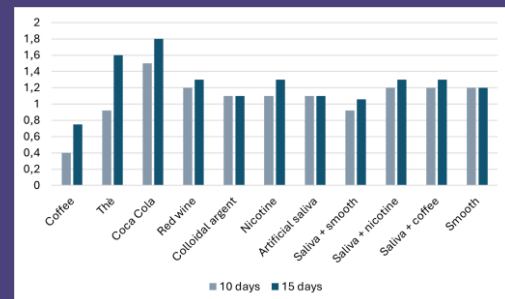


Fig.5. Colorimetric measurements after 10 and 15 days of immersion into different solutions according to the NBS Units.



CONCLUSIONS

Prolonged exposure to certain substances significantly affects PET-G's color stability, likely due to chemical adherence and degradation mechanisms, which has important psychological and social implications for patients undergoing orthodontic treatment. The study underscores the need for proactive strategies to maintain aligner transparency and enhance patient satisfaction.