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Material compatibility of denture cleansing tablets with removable oral appliances

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Aims

Cleaning is critical to maintain a good oral health for users of removeable oral appliances, any changes to surface morphology can cause a microbial build-up. The aim of this study was to analyse the material compatibility of commercial polymer-based removal oral appliances (ROA) after different representative cleaning regimens. Surface morphology of the materials were determined by Scanning Electron Microscopy (SEM).

Material & Methods

Materials:

Material & Manufacturer	Material composition
a) Vivera retainer, Align Technology	Thermoplastic polyurethane
b) Mouth guard, Shock doctor	Medical silicone
c) Imprelon S, Scheu-Dental GmbH	Polycarbonate
d) Bio-Art, Bio-Art Intelligent Solutions	Polyvinylchloride
e) Impact guard, GC	Polystyrene
f) Invisalign, Align Technology	Multilayer aromatic thermoplastic polyurethane / copolyester

Treatment groups:

No.	
1	Soaking in water (5 min)
2	Soaking in tablet cleanser (5 min)
3	Soaking and brushing with water
4	Soaking and brushing in tablet cleanser solution
5	Brushing with toothpaste; standard fluoride-containing toothpaste

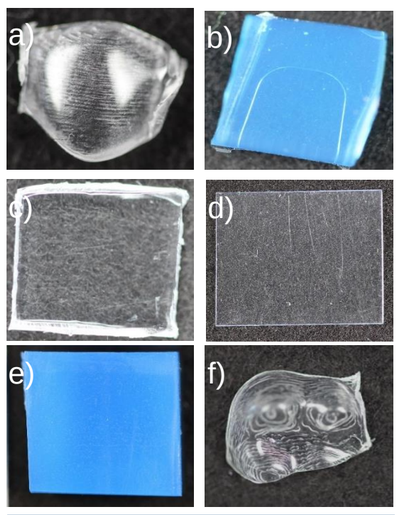

Fig. 1: Photographs of the specimens (~1.5 cm²)

Experimental approach:

- Three specimens were prepared for each material, treated in a cyclic model to mimic the amount of cleaning for an application period of 2 years (Fig. 2-4). For f), the cleaning was simulated for 4 weeks due to shorter application period. Following treatments were performed:

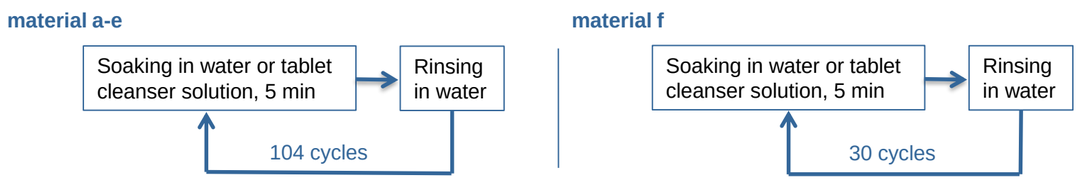

Fig. 2: Experimental approach: soaking in water (1), soaking in tablet cleanser solution (2)

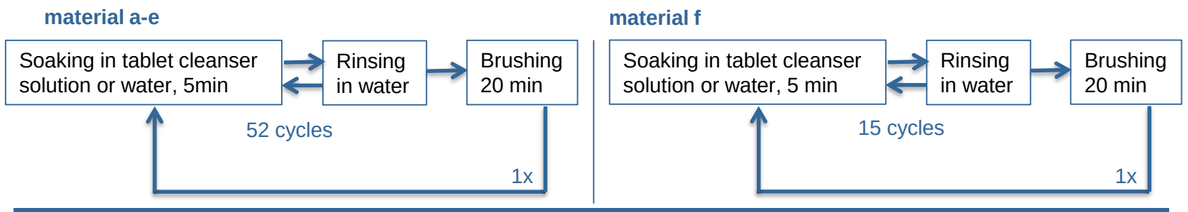

Fig. 3: Experimental approach: soaking in water & brushing (3), soaking in tablet cleanser solution & brushing (4)

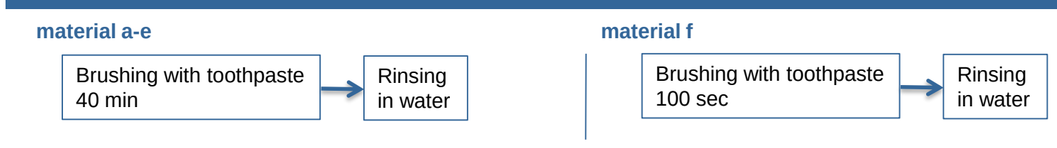

Fig. 4: Experimental approach: brushing with toothpaste (5)

- Brushing time of 20 minutes simulates 23 sec brushing time per week or 3.25 seconds per day over one year. Brushing conditions: 2N, Oral-B 35 Indicator medium (Procter & Gamble).
- Before analyzing, the surfaces were cleaned shortly using an ultrasonic bath to remove residuals or depositions caused by the treatment. Surface characterization was performed on untreated and treated samples by SEM using a Quanta 3D FEG from FEI.

Results – Soaking treatment

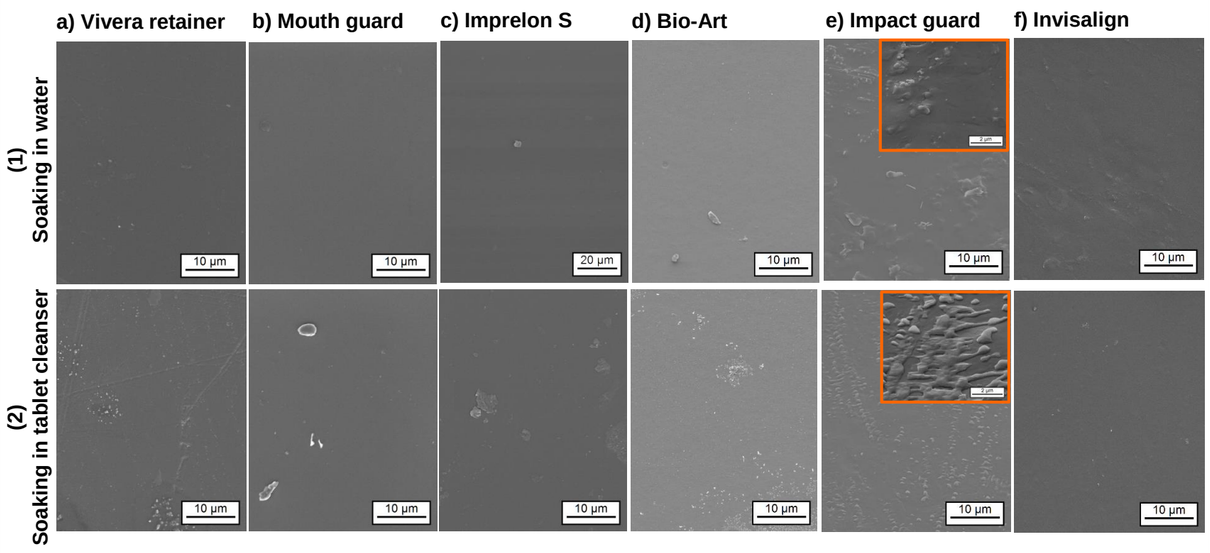

Fig. 5: SEM images after soaking only treatment

- No or negligible surface changes were observed after soaking in water (1) and tablet cleanser solution (2) on material a)-d), f).
- Material e) showed minor surface swelling after soaking in tablet cleanser solution at high magnification compared to water (Fig. 5).

Results – Soaking & brushing treatment

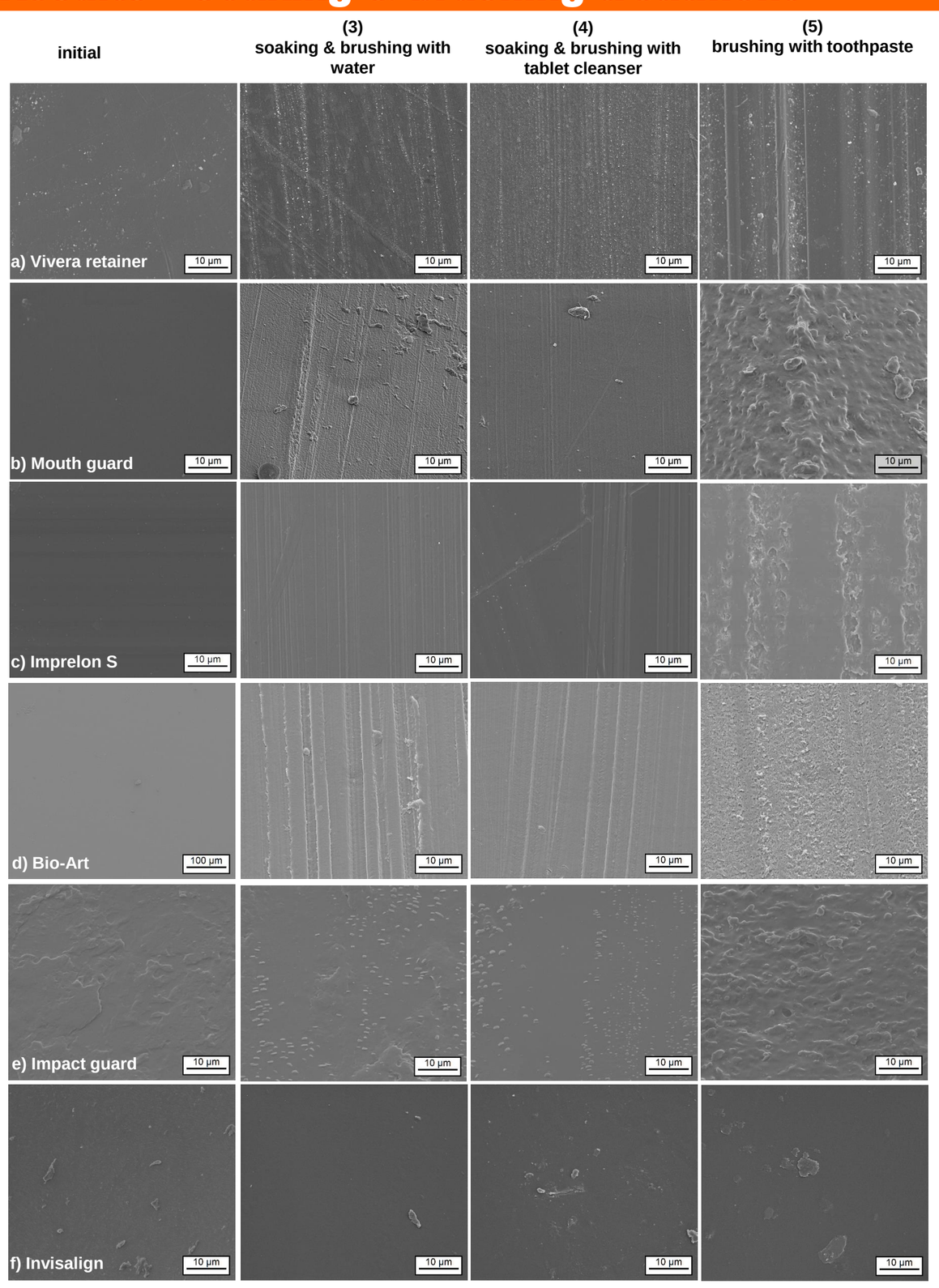

Fig. 6: SEM images before and after treatment including brushing

- The largest effects was detected for brushing with toothpaste (5). The surface changes at soaking & brushing with water (3) or tablet cleanser solution (4) were less pronounced and in a comparable order of magnitude.
- Due to the short brushing time of material f), no or negligible significant surface changes were observed (Fig. 6).

Summary

strongly damaged | slightly damaged | not affected

	I Soaking in water	II Soaking in tablet cleanser	III Soaking & brushing in water	IV Soaking & brushing in tablet cleanser	V Brushing with toothpaste
Vivera retainer	surface is not affected, local depositions	surface is not affected, local depositions	local brushing traces	local brushing traces	brushing traces
Mouth guard	surface is not affected, local depositions	surface is not affected, local depositions	local brushing traces	local brushing traces	brushing traces
Imprelon S	surface is not affected, local depositions	surface is not affected, local depositions	local brushing traces	local brushing traces	brushing traces
Bio-art	surface is not affected, local depositions	surface is not affected, local depositions	local brushing traces	local brushing traces	brushing traces
Impact guard	surface is not affected, local depositions	slightly swelling	local brushing traces	local brushing traces	brushing traces
Invisalign	surface is not affected	surface is not affected, local depositions	surface is not affected	surface is not affected, local depositions	surface is not affected, local depositions

Conclusions

- All tested materials exhibited a good material integrity and compatibility after testing with the tablet cleanser.
- Brushing can result in surface changes in the majority of appliances.

Acknowledgement

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