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OrthoFresh® PROFESSIONAL COLD WATER CLEANER

PREVENTS DISCOLORATION OF NYLON DENTAL APPLIANCES

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Introduction:

Nylon is a generic name for certain types of thermoplastic polymers belonging to the class known as polyamides. These polyamides are produced by the condensation reactions between a diamine NH2-(CH2)6-NH2 and a dibasic acid, CO2-H-(CH-2)4-COOH.[1] Many dental appliances are made from medical-grade nylon-12 polyamide due to their biocompatibility.

Advantages of Nylon[1]

1. Nylon is a crystalline polymer which accounts for its lack of solubility in solvents.
2. High heat resistance.
3. High strength.
4. Ductility.
5. Higher elasticity than other heat-polymerizing resins.
6. Toxicological safety for patients with resin monomer and metal allergy.
7. Uses heat-molding instead of chemical polymerization to control polymerization shrinkage and its related deformation.

Disadvantages of Nylon[1]

1. Warpage.
2. Discoloration or color deterioration: UV discoloration… Polyamide-12 [Nylon-12] seems to be more susceptible to discoloration by staining liquids compared to PMMA. On the other hand, it has been proven that adequate dental hygiene and professional care can substantially reduce the problem of staining.
3. Surface roughness: A rougher surface can cause discomfort to patients and discoloration of the prosthesis; it may contribute to microbial colonization and biofilm formation.[1] Abuzar et al. in 2010 evaluated the surface roughness of a polyamide denture base material (Flexiplast) in comparison with PMMA (Vertex RS) and found that polyamide specimens produced a rougher surface than PMMA, both before and after the polishing process.[2] See Fig. 1 below.

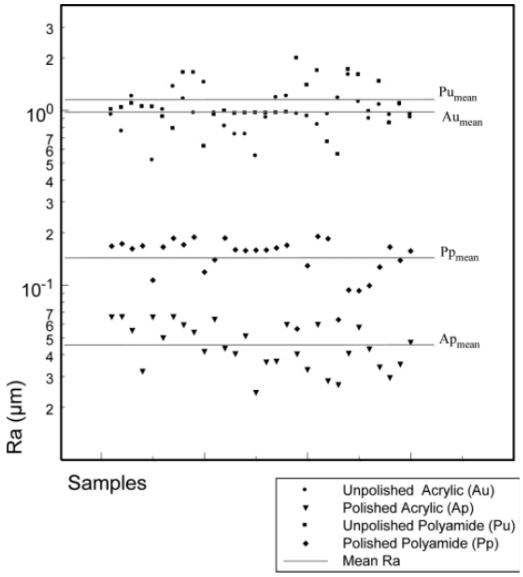

Fig. 1: *Surface roughness (Ra) values measured from polished and unpolished surfaces of polyamide and acrylic samples. Note: The nylon (polished polyamide) is 3 times rougher than the acrylic (PMMA).*[2]

4. Bacterial contamination: It was demonstrated that polyamides have rougher surfaces than other resin materials, and it causes more bacterial and fungal colonization.[1] For this reason cold water cleaning makes much more sense for nylon appliances.
5. Difficulty polishing.
6. Water sorption: The larger color changes for nylon denture base materials would be related to their hygroscopic and higher water sorption properties.[4,5.]

While OrthoFresh Professional Cold Water Dental Appliance Cleaner addresses many of the drawbacks of nylon-12, this article will focus on the aesthetic impact of discoloration and the remedy OrthoFresh provides.

How does nylon-12 discoloration happen?

Nylon dental appliances undergo degradation when exposed to environmental stressors; like heat, oxygen, moisture, and ionizing radiation (mostly ultraviolet radiation.)[6]

The breakdown of nylon-12 could happen through the following pathways: photo-oxidative, thermal, ozone-induced, mechano-chemical, catalytic, and biodegradation.

Taking a closer look at the photo-oxidative pathway which is a common cause of discoloration; the UV light in the range of 280 to 400 nm, breaks down chemical bonds in nylon polymers giving off free radicals as a byproduct. The free radicals react with oxygen and other radicals, causing a chain reaction of chemical changes. This process stops only when the radicals or molecules combine into stable, nonreactive forms.[6]

Degradation of polymers leads to weakened mechanical properties, reduced tensile strength, and brittleness, which is visibly evident through surface discoloration, loss of gloss, yellowing, and chalking.[6]

Although most will recognize sunlight as a primary source of UV light, another ubiquitous source is home lighting. Such fluorescent lamps and light-emitting diode (LED) bulbs emit UV light in the range that causes discoloration of nylon-12 dental appliances.[7,8]

How does OrthoFresh prevent nylon-12 discoloration?

Karimi et al offer a detailed summary of photostabilization mechanisms. Depending on the mode of action, the additive substances are categorized either as antioxidants, fillers, nucleating agents, quenchers, UV absorbers, or UV screeners.[9]

The active ingredients in OrthoFresh halts the radical chain reactions by converting their products into nonreactive forms. OrthoFresh when used daily keeps dental appliances clean and looking new! See Fig. 2 below.

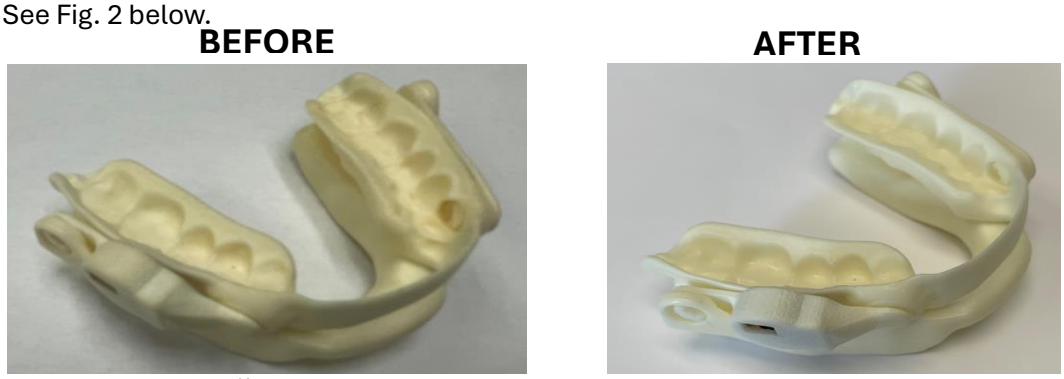

Fig. 2: *A nylon appliance[10] before and after cleaning with OrthoFresh. Note: The whiter color after repeated OrthoFresh use.*

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