Inorganic Fullerene Coating for Medical Devices (Yeda)

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Summary

Novel nanoparticle lubricants can significantly reduce friction of different dental devices and enable reduction of treatment times. Different dental applications suffer from excessive friction, which severely compromise their function. For orthodontic procedures, friction significantly reduces effectiveness and thereby leads to prolonged treatments. In root canal treatments, NiTi (Nickel-Titanium) endodontic files are prone to fatigue-induced and incidental failure. This invention presents coating with inorganic fullerene-like nanoparticles of WS2 (IF-WS2) impregnated in a metal matrix, as an effective friction-reducing agent. The unique structure of these particles provides them with high lubricity. Consequently, the problem of friction during orthodontic treatment could be minimized, enhancing anchorage control, reducing duration of treatment and decreasing the risk of root resorption. The same coating is shown to significantly improve the lifetime of endodontic files by alleviating fatigue and failure, having vast implications on duration, safety and consequences of root canal treatments.

Applications

Friction-reducing coating for orthodontic wires.
Friction-reducing coating for NiTi endodontic files.

Advantages

Efficient - a significant reduction in the applied friction forces.
May be applied on several appliances (wire and bracket or Efs and dental implant) for maximal friction-reducing effect.
The coating may be incorporated in the manufacture process of the appliance, and may not require additional manufacture step.
Biocompatible - Initial tests in animals suggest safety from toxic effects
Does not change the unique characteristics of the NiTi shape memory alloy.

echnology's Essence

'S2 fullerene-like nanostructures (IF-WS2) are 20-200nm particles that are formed under certain reducing and ulfidizing conditions and elevated temperatures, from tungsten oxide (WO3) nanoparticles. Good lubricity is ttributed to their multiple-layered structure. As the load between rubbed surfaces increases, nanoparticles radually deform and exfoliate to coat the asperities at the interface. The weak forces between the thin sheets f the exfoliated nanoparticles allow a very low shear force sliding motion between the two contacting odies.Experimental testing showed significant reduction in the static friction resistance to sliding in IF-WS2 oated archwires at the different angles, especially in the 10? tilt. At initial stages of treatment, IF-WS2 anoparticles act as spacers and reduce the number of asperities that come into contact resulting in a lower oefficient of friction. As the angle grows and the load at the edges of the slot increases, the exfoliation of ome of the nanoparticles occurs, resulting in the dry lubrication of the sliding. Furthermore, IF-WS2 anoparticles act as a protection against oxidation of the metal surface

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