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Investigation of Diamond-Like Carbon Coating for Orthodontic Archwire

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A diamond-like carbon (DLC) film-coated nickel-titanium (Ni-Ti) orthodontic archwire was fabricated by an arc-discharge ion-plating process. The purpose of such a coating was to prevent Ni ion release and the toxic effects of the Ni-Ti archwire. The stability of the DLC film coating during the brushing of teeth and its effect on Ni ion release were investigated. The surface morphology of the DLC/Ni-Ti archwire and the amount of Ni ion released were determined by scanning electron microscopy (SEM) and microwave-induced plasma mass spectroscopy (MIP-MS), respectively. The SEM images show that there was no significant damage such as cracking or corrosion of the DLC film at the archwire surfaces. In the immersion test, the amount of Ni ion release was reduced by 80% using a DLC film coating. In addition, the relationship between cytotoxicity and DLC film coating was investigated. The DLC film coating inhibited the effect of the Ni-Ti archwire on cell growth. Accordingly, the DLC film coating is expected to provide multiple improvements to the properties of Ni-Ti archwires, and is applicable to dental materials to improve the stability of orthodontic archwires.

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