ABSTRACT SUBMISSION

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Surface topography characterization and in vitro fibroblast cellular responses of additive manufactured titanium for prosthetic application in dentistry.

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ABSTRACT

In prosthetic dentistry, elements of implant-supported fixed partial dental prosthesis such as superstructures, bars and trans-gingival pillars are conventionally manufactured in Ti6Al4V (1). This titanium alloy is traditionally manufactured using subtractive processes (numerically controlled milling of a casted Ti6Al4V block). Additive manufacturing such as selective laser melting (SLM) appears to be a promising alternative because it creates the opportunity to produce objects with complex geometries, strong individualization and less material waste (2).
A previous study has shown that SLM manufactured Ti6Al4V fulfilled the mechanical requirements of the ISO 22674 standard related to the manufacturing of prosthetic parts in dentistry (3). However, this process modifies surface properties and topography (4,5) which are essential parameters affecting gingiva reaction (6) and plaque retention (7). Since abutments overdenture and implants bars are in direct contact with the gingiva, their surface has to be highly polished in order to limit bacteria accumulation responsible for gingiva inflammation (8). This final polishing step is usually performed by a dental technician before clinical application.
The present work explores the influence of the manufacturing process and of the surface finishing of Ti6Al4V on the response of fibroblasts human cells in order to conclude on the potential of SLM manufacturing in prosthetic dentistry on a biological point of view.
Four groups of 6 samples were included in this study:

- SLM manufacturing
- SLM manufacturing associated with mechanical polishing
- Numerically controlled milling
- Numerically controlled milling associated with mechanical polishing

Surface roughness was measured using Alicona Infinite focus microscope on 3 locations of 3 samples from each group. Filtering parameters were chosen so as to observe the specifications of the ISO 4288 standard. Samples were seeded with human gingival fibroblasts in a density of 40.000 cells/ml (first

passage). Direct cytotoxicity was assessed at day 1 and 3 according to the 10993-5 standard. Cell proliferation and viability were analyzed using *Live/Dead™ Cell viability* kit and metabolic activity was measured using rezaruzine test (*Alamar Blue®*).
No statistically significant difference was observed between SLM manufactured and numerically controlled milled samples after mechanical polishing: 68 nm ± 26 nm vs. 94 ± 63 nm. Thus, surface finishing erases the difference in surface topography introduced by the chosen process. Biological results are being analyzed but the first results are promising as to use SLM technique to manufacture dental prosthesis parts in close contact with gingiva.

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