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Excessive stiffness of meshes for oral guided bone regeneration may cause mucosal dehiscence: an in-vitro comparative loading study between titanium alloy and polycaprolactone

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Tooth loss leads to anatomical modification of the alveolar bone impairing the rehabilitation of the masticatory function by endosseous dental implants. Guided bone regeneration (GBR) aim to rebuilt lost bone with CAD designed 3D printed titanium alloy (Ti6Al4V) or polycaprolactone (PCL) meshes, which act both as space maintainers and barriers to separate the oral mucosa from the growing bone[1]. Nevertheless, a common drawback in GBR occurring in 30-50% of cases is mesh exposure (ME) through the mucosal tissue after the surgical procedure[2], which may cause of oral bacteria spreading in the wound resulting in infection and lost of the regenerated bone. A possible explanation could be the accidental loading of covering oral mucosa associated with an excessive stiffness of the underlying mesh. To investigate this occurrence we designed and 3D printed five Ti6Al4V and ten PCL meshes. All meshes were 10 mm x 30 mm, while thickness was 0.2 mm for Ti6Al4V and 0.8 mm for PCL, respectively. Before loading, five PCL meshes were sterilized using ethanol solution (70%). All meshes were fixed in four point at the ends and loaded centrally with a universal testing machine (MTS 810) at 130N and 10 mm/min speed using a spherical point of 10 mm diameter until the first failure, i.e. a fracture of a part of the mesh. First failure of not-sterilized and sterilized PCL meshes occurred at similar loading value, although slightly higher for the former, while was almost twice for Ti6Al4V. PCL showed also low stiffness compared with Ti6Al4V, but it is more than adequate to act as space maintainer. Furthermore, PCL and keratinized mucosa stiffness values reported in literature appeared comparable[3]. In conclusion, similar stiffness between meshes for GBR and the covering oral mucosa appears to be a prerequisite to avoid dehiscence and ME.

References

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