The beneficial effect of successive Cold Atmospheric Plasma treatments on in vitro behaviour of human gingival fibroblasts

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While cutaneous wound healing is an extensively studied and well-characterized process, the understanding of intraoral tissue repair still presents major lacunae, an aspect which reduces the clinical translation of treatment alternatives [1]. Following injury, the oral mucosa is submitted to a cascade of biological events that culminate in the restoration of tissue homeostasis and while general similarities exist, there are stark differences in the genomics and kinetics of wound healing between the oral cavity and the cutaneous epithelium [2]. Moreover, the lack of a successful therapy for oral mucosal wounds, compelled researchers to take into consideration alternative treatments for an enhanced intraoral healing. With this in mind, in the last decade the newly found therapeutic properties of Cold Atmospheric Plasma (CAP) gave it special consideration in dental applications and numerous studies reported its beneficial effects on the intraoral wound healing process and tissue regeneration [1].

In this context, the aim of the present study has been to investigate by comparison the effects of CAP on human gingival fibroblasts (HGF-1 cell line) in culture and observe how different plasma jet exposure conditions can affect their in vitro behaviour. For this reason, the HGF-1 cells were assessed in terms of their viability/proliferation potentials, adhesion/cytoskeleton organization and fibronectin production and its subsequent arrangement into an extracellular fibrillar network. The obtained results revealed that the fibroblasts subjected to successive CAP treatments and for longer periods of time exhibited a better in vitro cellular behaviour when compared to the cells that have been exposed only once to the CAP treatment. Thus, the application of CAP for longer periods of time exerted a positive effect on cells' viability and proliferation. Likewise, the fluorescence images acquired after performing the LIVE/DEAD cell viability assay showed an increase in the cellular density with treatment length and number of treatments. In addition, the fibronectin immunolabelling revealed that the specific positive signals were better expressed at higher treatment times and after the cell culture has been submitted to successive CAP treatments suggesting their beneficial effect on the extracellular matrix formation.

Considering the above findings, the widespread application of CAP in dentistry can have a promising future, however, in depth additional studies still need to be conducted in order for the underlying mechanism of CAP in an oral environment to be fully elucidated.

References

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