Functional Characterization of Autologous Platelet-Rich Plasma (PRP): A Novel Therapeutic Approach for Oral Submucous Fibrosis

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Oral submucous Fibrosis (OSMF) is a highly prevalent oral potentially malignant disorder in Asian regions, including Sri Lanka, primarily associated with the areca nut consumption. It is characterized by excessive abnormal deposition of Type I collagen within the oral submucosa due to its imbalanced fibrinogenesis and fibrinolysis, leading to reduced tissue elasticity, trismus, and an increased risk of malignant transformation in oral cancers. Autologous Platelet–Rich Plasma (PRP) therapy has recently emerged as a novel therapeutic approach to combat OSMF, with proven clinical efficacy. However, its underlying molecular mechanisms and optimal functional parameters for enzymatic actions remain undefined, limiting its standardization and utilization in clinical practice. Thus, this study aimed to functionally characterize PRP-mediated collagen degradation and identify optimal experimental conditions to establish an evidence-based therapeutic optimization. In this study, PRP was prepared using the standardized double centrifugation of whole blood obtained from clinically diagnosed OSMF patients (n=7) and age and sex matched disease-free controls (n=2). An in vitro collagen degradation assay was employed in two phases using Type I collagen as the substrate across varying collagen concentrations (30-250 µg/mL), PRP dilutions, and temperature conditions (25°C vs 37°C). Degradation was monitored at 1-hour and 4-hour time intervals via UV spectrophotometry (220 nm) followed by SDS-PAGE electrophoresis. The results revealed that PRP-mediated collagen degradation happens through an immediate PRP-collagen aggregation formation at the initial time point, resulting in an enzymatic scaffold followed by progressive proteolytic degradation. Maximum collagen degradation occurred at 0.5X PRP concentrations within the effective substrate range of 30-125µg/mL at 37º. Together, results suggest that PRP-mediated collagen degradation operates in a temperature-dependent manner, and optimal parameters to govern the collagen degradation are 0.5X PRP, 30-125 µg/mL collagen at 37 °C, providing a mechanistic rationale for standardizing PRP therapy for OSMF. Collectively, this pilot data strengthens the transformation of PRP therapy from an experimental setup to a mechanism-based clinical intervention in OSMF management.

Keywords: collagen degradation, collagen deposition, matrix metalloproteinase, oral submucous fibrosis, platelet-rich plasma

Acknowledgement: *Financial assistance from University Research Grant, University of Peradeniya, (URG/2025/36/S) is acknowledged.*