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Tissue Engineered Oral for Previous Results and Future Prospects

Tom Antonelli*

Department of Clinical Dentistry University of Sheffield, Sheffield, UK

Introduction

In the oral mucosa, macrophages play an important role in regulating the host immune response to invading organisms or non-self chemicals. Three-dimensional oral mucosal equivalents incorporating oral fibroblasts and keratinocytes are widely utilised to simulate the human oral mucosa and have been used to study innate immune responses to bacterial and fungal infections as well as biomaterials. Although the presence of immune cells is essential for eliciting an immunological response, relatively few studies have included leukocytes in OME, and none have included primary human macrophages to date. In this paper, we describe the creation of an immunocompetent OME for studying immunological responses to bacterial challenge [1].

Description

Primary human monocyte-derived macrophages were just as susceptible to bacterial lipopolysaccharide challenge when grown in a 3D hydrogel as when cultured in two-dimensional monolayers in terms of proinflammatory cytokine gene expression and protein release [2]. To create a containing, MDM were mixed into a collagen hydrogel with oral fibroblasts and the apical surface seeded with oral keratinocytes. Full thickness revealed a stratified squamous epithelium and fibroblast populated connective tissue including CD68 positive cells that could be easily separated to a single-cell population for further investigation using collagenase followed by flow cytometry. When stimulated with, the response was enhanced proinflammatory cytokine release, which rose 12 fold when compared to alone [3].

Furthermore, pre-treatment with dexamethasone decreased this proinflammatory response, indicating that they are similarly susceptible to inhibition. These findings demonstrate the functional activity of and demonstrate their utility in research aiming at monitoring the immunological response of the oral mucosa to infections, biomaterials, tissue toxicity, and anti-inflammatory medication delivery. Three-dimensional in vitro models of the oral mucosa have been widely utilised to study the host response to infections, but few have included primary leukocytes to yet. We describe the effective insertion of primary human macrophages into oral mucosal counterparts in our research. These macrophage-containing models had histological similarities to the oral mucosa and responded to bacterial lipopolysaccharides by upregulating major proinflammatory markers. These enhanced OME will greatly assist studies into host pathogen interaction and biomaterial toxicity. Tissue-engineered oral mucosal equivalents have been widely employed to investigate the oral mucosa as better model systems than in vitro cultured oral keratinocytes grown as two-dimensional monolayers can be in the form of a reconstituted human epithelium in which keratinocytes alone are cultivated over a porous membrane, or as full thickness cultures consisting of fibroblast-populated connective tissue topped by stratified squamous oral epithelium. These OME have been utilized in a variety of research to investigate oral mucosal microbial infection, wound healing, cancer progression, and oral mucositis, as well as to analyze the response of the oral mucosa to biomaterials and to monitor toxicity, medication delivery, and efficacy.

Resident and recruited immune cells are vital in driving host responses to external assaults, whereas deregulation of the immune response can induce chronic conditions leading to severe oral lesions or poor outcomes in the case of oral squamous cell carcinoma. Macrophages are important innate immune cells found in almost all tissues. By phagocytosis, presenting antigens to T lymphocytes, and secreting a variety of inflammatory factors, these leukocytes directly guard against invading foreign pathogens. Macrophage activation can occur through identification of pathogen-associated molecular patterns, such as in response to gram-negative bacteria lipopolysaccharides by cell surface pattern recognition receptors such as and Toll like receptors [4]. This contact causes intracellular signalling, which leads to to increased gene expression and secretion of proinflammatory cytokines such as that can be inhibited by anti-inflammatory therapeutics such as glucocorticoids Addition of immune cells, such as macrophages, to current OME would increase their sensitivity to detect and respond to foreign molecules, making them more representative of the native oral mucosa.

Previous research has used primary monocytes, peripheral blood mononuclear cells, or myeloid cancer cell lines to create immunological oral gingival models and observed increases in inflammatory markers and proteases in response to bacterial biofilms and X-ray treatment. While myeloid cancer cell lines have fewer technical limitations and reproducibility when compared to primary immune cells, there is good evidence that their phenotype and function are markedly altered, with commonly used cells expressing aberrant levels of key macrophage phenotypic markers and thus responding differently to stimuli. Furthermore, as they travel into tissues, peripheral blood monocytes rapidly convert into macrophages, making the inclusion of macrophages rather than monocytes into OME preferable [5].

Conclusion

We describe the development of a tissue-engineered immune model of no keratinized oral mucosa containing primary human monocyte-derived macrophages. When stimulated with Escherichia coli, these immune produced functional responses in the form of increased secretion of proinflammatory cytokines, which were inhibited by dexamethasone treatment. These will be particularly useful for research into macrophage behaviour in disease and cellular toxicity, as well as the immunological response to drug and biomaterial exposure.

References

1. Gong, Ting, Boon Chin Heng, Edward Chin Man Lo and Chengfei Zhang. "Current advance and future prospects of tissue engineering approach to dentin/pulp regenerative therapy." *St Cel Inter* (2016).

2. Ghezzi, Chiara E., Jelena Rnjak Kovacina and David L. Kaplan. "Corneal

***Address for Correspondence:** Tom Antonelli, Department of Clinical Dentistry University of Sheffield, Sheffield, UK; E-mail: tomantonelli@gmail.com*

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tissue engineering: Recent advances and future perspectives." *Tis Engin Part B Revi* 21 (2015): 278-287.

3. Shu, Weina, Lin Liu, Guangjie Bao and Hong Kang. "Tissue engineering of the temporomandibular joint disc: Current status and future trends." *Inter J Arti Org* 38 (2015): 55-68.
4. Chen, Fa Ming and Yan Jin. "Periodontal tissue engineering and regeneration: Current approaches and expanding opportunities." *Tis Engin Part B Revi* 16 (2010): 219-255.
5. Izumi, Kenji, Hiroko Kato, and Stephen E. Feinberg. "Tissue engineered oral mucosa." *St Cel Bio Tis Engin Den Sci* 12 (2015): 1-4.

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