Role of the CD5 T Cell Coreceptor in T Cell Activation in Periodontal Disease

Kimble Mahler[1], Yuko Ketch[1], Jessica Townsend[1], Dallin Cardon[2] | Claudia M. Tellez Freitas[2], K. Scott Weber[1]
[1] Brigham Young University, Molecular Biology and Microbiology Department, [2]Roseman University of Health Sciences

Introduction:

According to the CDC, 46% of all adults 30 years or older show signs of gum disease[1] which can come from poor oral hygiene and tobacco use. One form of gum disease is periodontitis, a disease caused by the inflammation in the mouth due to abnormal amounts of bacteria. Lymphocytes infiltrate the site of inflammation and cause tooth loss and risk of heart and lung disease[2]. Recent studies observed that individuals with periodontitis tend to have more autoreactive B cells with high levels of CD5[7]. The activation state of these B cells is influenced by T cells[7]. CD5 is also found on T cells but its role is unclear. Because of this association between CD5, B cells, and periodontitis, we are investigating how CD5 affects inflammation in the mouth.

Purpose:

The purpose of our project is to identify how CD5 contributes to the development of periodontal disease. To answer this question, we investigated how CD5 affects early and late activation.

Hypothesis:

We hypothesize that T cells that lack CD5 will have increased activation when incubated with the supernatant of oral epithelial cells when compared to T cells that express CD5.

Materials and Methods:

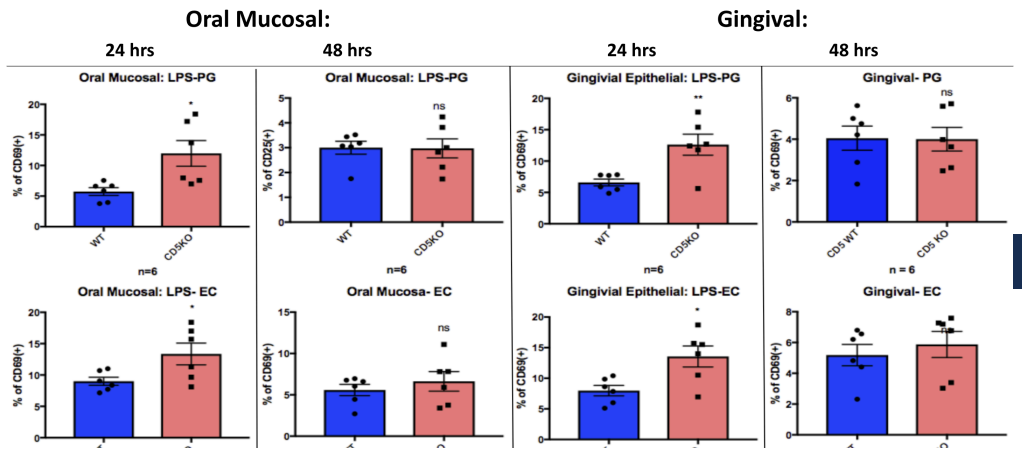
Cell lines used: Oral mucosa epithelial cells, and Gingiva epithelial cells from mice (C57BL/6).
Cells were exposed to P. *gingivalis* (LPS-PG) and LPS from E. *coli* (LPS-EC) for 24 hours.

Splenocytes were taken from CD5KO and CD5WT mice (CD57BL/6) were isolated and co-cultured by:

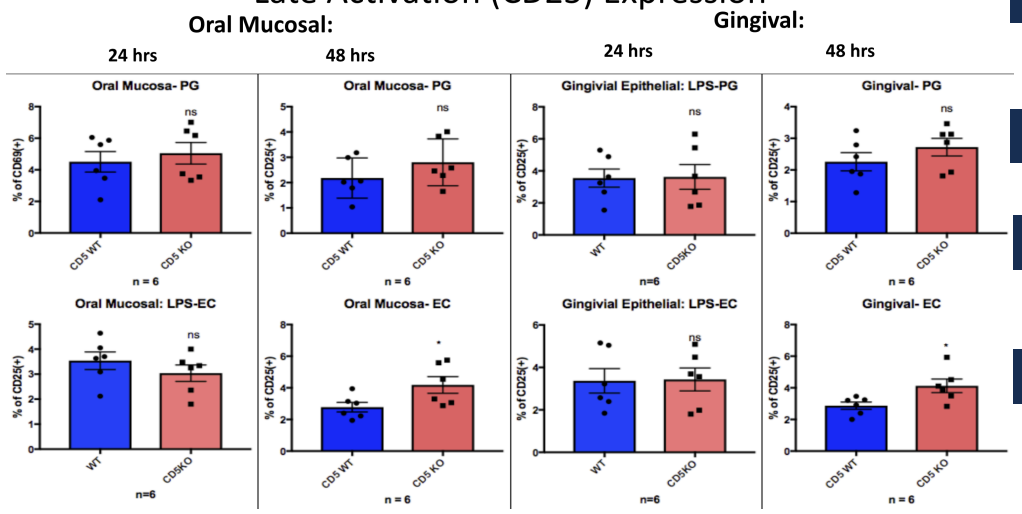
1. Incubating the oral epithelial cells were with their supernatant for 24 hours

2. Observed differences in T cell activation through using flow cytometry and analyzing the expression of early (CD69) and late (CD25) activation markers.

Early Activation (CD69) Expression



Late Activation (CD25) Expression



Periodontal Disease:

Periodontal disease is caused by inflammation in the gums due to a high level of bacteria that leads to destruction of teeth and bone loss[4]. However, it can be prevented through good oral hygiene that balances the interactions between oral bacteria and the host[6]. If there is an excessive amount of microbiota, inflammatory cytokines are produced which attract T cells[6]. Helper T cells are recruited to help destroy the microbes. The inflammation can also destroy bone and assist with resorption. This is done by increasing inflammation and drawing in more immune cells to the site of infection, which as stated before, can lead to destruction of teeth and bone loss[4,5,6].

Results:

Our data suggests that CD5 affects early and late stages of activation. We observed that for oral mucosal cells and gingival cells exposed to either LPS from E. coli or P. gingivalis, CD5 KO T cells had significantly more CD69 expression at 24 hours but not at 48 hours. In addition, when oral cells (mucosal and gingiva) were treated with LPS from E. coli or P. gingivalis, the group of CD5 KO T cells that had a higher CD25 expression were those incubated with the supernatant of oral cells exposed to E. coli at 48 hours.

Conclusions:

Upon T cells activation many cells surface markers are upregulated. As CD69 and CD25 (activation markers) were upregulated in CD5 KO T cells when stimulated, we suggest that CD5 plays an important role in periodontal disease development.

Acknowledgments:

Study was completed with funding from **Roseman University of Health** and **Brigham Young University.**

Contact:

Kimble Mahler, Brigham Young University,
College of Microbiology and Molecular Biology, Class of 2022,
kimblemahler@gmail.com

Works Cited:

1. Control and Prevention, 19 Dec. 2019, www.cdc.gov/oralhealth/basics/adult-oral-health/index.html.
2. Page, R.C. & Schroeder, H. E. Pathogenesis of inflammatory periodontal disease. A summary of current world. Laboratory investigation; a journal of technical methods and pathology 34, 235-249 (1976).
3. Freitas, C. M. T., Johnson, D. K. & Weber, K. S. T Cell Calcium Signaling Regulation by the Co-receptor CD5. Int J Mol Sci 19, 1295, doi:10.3390/ijms19051295 (2018).
4. Tsukasaki, M. et al. Host defense against oral microbiota by bone-damaging T cells. Nature Communications 9, 701, doi:10.1038/s41467-018-03147-6 (2018).
5. Teng, Y.-T. A. et al. Functional human T cell immunity and osteoprotegerin ligand control alveolar bone destruction in periodontal infection. The Journal of Clinical Investigation 106, R59-R67, doi:10.1172/JCI10763 (2000).
6. Silva, N. et al. Host response mechanisms in periodontal diseases. J Appl Oral Sci 23, 329-355, doi:10.1590/1678-775720140259
7. Berglundh, T., Liljenberg, B., Tarkowski, A. & Lindhe, J. The presence of local and circulating autoreactive B cells in patients with advanced periodontitis. Journal of clinical periodontology 29, 281-286 (2202).