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The Oral-Systemic Link

Plausible routes of interaction

- 1. Microorganisms enter long (gut-lact) to blood circulation
- 2. Bacteremia leads to distant organ damage
- 3. Local cancer risk via seeding of bacteria

Activating Tumor Signaling Pathways

- micro-RNAs (miRNAs) are single-stranded, non-coding short oligonucleotide sequences of ~22 bases that regulate gene expression at the post-transcriptional level
- Increasing evidence suggests that micro-RNA (miRNA) plays an important role in carcinogenesis
- Certain miRNAs are induced during the macrophage inflammatory response and have the ability to regulate host cell responses to pathogens
- In addition, pathogens themselves may regulate miRNA expression



Periodontitis and Pancreatic Cancer: Links and Mechanisms of Action

Presenting by:
 Mohammad Hassan Parvizi Mashhadi

Supervisor: Dr. Mohammad Motamedifar

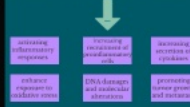
Metabolism Regulation

- Advanced periodontal disease is often accompanied by tooth loss
- It leads to the incidence of chewing tough foods like fruits and diverse vegetables
- These foods are often more nutritious and rich in cancer-fighting agents such as antioxidants
- High-calorie diets are described as inadequate because they are associated with higher levels of C-reactive protein and IL-6



Inflammation

- Inflammation is the most important mechanism



Induction of Innate and Adaptive Immune Suppression

We found that bacteria can trigger their virulence factors to get well above their gut environment. This is by oral antibiotics → 10^{10} CFU → 10^{12} CFU in 10^6 cells.

MI macrophages → MI macrophages → 10^6 IL-1, IL-6, TNF- α , IL-17 and IL-22

Modulation of Immune Therapy

- Oral and gut microbes can affect responses to chemotherapy in mice and human

• The relationship between microbes and immunity in carcinogenesis could be described as dual action: boosting cancer immunity or exerting a pro-oncogenic effect by microbiota.



Cancers with Periodontitis Association

- Gastric cancer
- Pancreatic cancer
- Oral cancer
- Head & neck cancer
- Prostate cancer
- Liver cancer
- Lung cancer
- Breast cancer
- Esophageal cancer



Periodontitis and Pancreatic Cancer

Authors	Study Design	Pancreas Cancer Cases	RR (relative risks)
Wahlberg, 2007	Case-control	100	1.56
Hopwood, 2007	Case-control	10	2.07
McQuinn, 2007	Case-control	100	1.56
McQuinn, 2007	Case-control	100	1.56
Wahlberg, 2007	Case-control	100	1.56
Hopwood, 2007	Case-control	10	2.07
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