

The Oral (periodontal) Systemic (cardiac) Link.

Agenda:

- **Background, (periodontitis incidence, clinical features)**
- Oral – Systemic link
- Pathogenesis (Immunology – Chronic Infection)
- Intervention
- Take home message



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**Collaboration between
 Periodontists and
 Cardiologists**
*Dentistry and Medicine Work Together to
 Improve Patient Care*



An evidence-based program

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CVD and Periodontal Disease.

- Systematic review of 12 robust studies of PD and CVD concluded:
 - Current evidence supports the notion that risk for atherosclerotic CVD, cerebrovascular disease and peripheral arterial disease is higher in people with PD than in those without PD independent of many established CVD risk factors.
 - Relationship usually stronger in younger adults than in older adults

Dietrich et al. *J Periodontol* 2013

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Consensus Papers

- Clinical recommendations for treating patients with periodontal disease or cardiovascular disease are included in the consensus paper.

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Periodontitis general facts

- Severe periodontitis is the **sixth most common** disease globally
- 1.1 billion cases of severe periodontitis
- Negative impact on general health
- Associated with significant medical and dental care costs

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Periodontal Disease: An Overview

- Chronic inflammatory disease, destroys the (alveolar) bone and gingival (gum) tissues supporting teeth.
- The American Academy of Periodontology (AAP) estimates that 3 out of 4 Americans are affected by periodontal disease, ranging from **mild gingivitis** to more **severe periodontitis**.
- If left untreated mild cases of gingivitis can lead to (chronic inflammatory) periodontitis and then to tooth loss with numerous systemic co-founding involvements.

In vivo Anaerobic Chamber

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Cardiovascular Disease: An Overview

- Cardiovascular disease generally refers to conditions that involve narrowed or blocked blood vessels that can lead to a heart attack, chest pain (angina), or stroke.
- Inflammation is major risk factor for cardiovascular disease- as much or more than cholesterol.
- The American Heart Association reports that cardiovascular disease is the leading killer of men and women in the United States.
- Cardiac arrest -???**

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Common Risk factors for Cardiovascular Diseases and Periodontitis (WHO)

- Smoking
- Diabetes
- Obesity
- Glucose
- Alcohol
- Physical inactivity
- Blood pressure
- Systemic inflammation

- Smoking and Diabetes are Grade modifiers.
- They substantially influence the rate of progression of Periodontitis.
- Emerging risk factors include specific genetic factors and nutrition.

Inflammation!

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Peer Reviewed Evidence (high impact journals)

- 1,500 Systematic reviews
- 32 Qualitative synthesis
- Heterogenous quality
- Most reports include Type 2 diabetes and CVD
- Unclear evidence of causality.

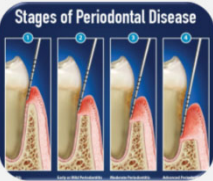

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Periodontitis: (a chronic inflammatory disease)

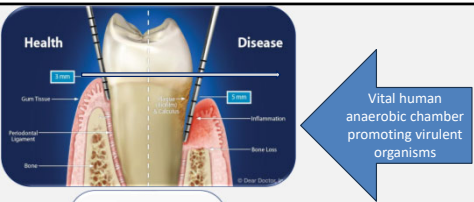
Periodontitis: "an infectious disease resulting in inflammation within the supporting tissues of the teeth, with progressive gum/alveolar bone loss and eventual exfoliation/loss of teeth."

- **Mild periodontitis:** 1 to 2 mm of clinical attachment (bone) loss
- **Moderate periodontitis:** 3 to 4 mm of clinical attachment loss
- **Severe periodontitis:** 5 mm or more of clinical attachment loss

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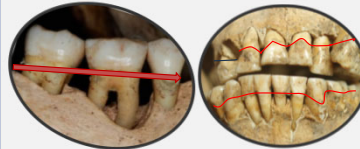
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Severe periodontal disease.
Etiology, no or **insufficient/inadequate flossing, interdental brushes or wooden toothpicks.**
Easily reversed with personal oral hygiene + professional periodontal treatment.



Human In vivo Anaerobic Chamber

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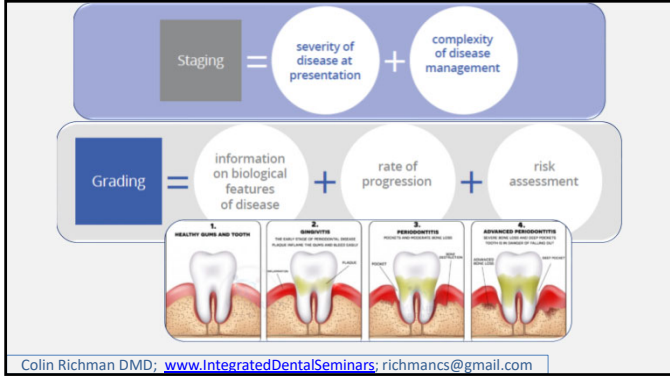
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AGENDA:

- Background (incidence PDD, clinical features)
- **(Periodontal) Oral – Systemic Link**
- Pathogenesis (Immunology – chronic infection)
- Intervention



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PUTATIVE BACTERIA. Pathogenic Dysbiotic Microbiome.

- Porphyromonas gingivalis (Pg)
- Prevotella intermedia (Pi)
- Actinobacillus actinomycetemcomitans (Aa)
- Eikenella corrodens
- Streptococcus intermedius

Red group of pathogens* Socransky

Antimicrobial therapy in Periodontics. Calif. Dent J., 21:51, 1993



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New Innovations - Inflammation

Chronic Periodontitis
Chronic Inflammation
CRP Blood Test +ve PDD



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The Link Between Gum Disease, Heart Disease, & Stroke

Research indicates gum disease may increase the risk of heart disease and stroke.

2x

People with gum disease are twice as likely to have heart disease.

Those diagnosed with acute ischemic stroke (brain injury caused by a blood vessel block) are more likely to have gum disease.

Association, but not directly causative. Every organ system in the body!

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1 Substantial research, PDD/CVD may be related.
2 Chronic infection Hyper-inflammatory state.
3 Direct bacterial invasion.

Association between periodontal diseases and cardiovascular diseases, diabetes and respiratory diseases: Consensus report of the Joint Workshop by the European Federation of Periodontology (EFP) and the European arm of the World Organization of Family Doctors (WONCA Europe)

David Herrera¹ | Mariano Sang² | Lior Shapira³ | Carlos Brotons⁴ | Ian Chapple⁵ | Thomas Frone⁶ | Filippo Grazzi⁷ | F. D. Richard Hobbs⁸ | Oliver Huck⁹ | Eva Humerus¹⁰ | Soren Jansen¹¹ | Qing Kravtchenko¹² | Phoebe Mulvany¹³ | Ana Mulya¹⁴ | Mohamed Ungar¹⁵ | Josep Vilasaca^{16,18} | Adam Wozniak¹⁷ | Shomo Vukic¹⁹

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Left healthy, Middle Bone loss + pocket

Increased magnification

Junctional epithelium (A and B), subular epithelium (D and C), long gingiva (E and D), attached gingiva (D and E), organized collagen.



BC-Bony crest, BP-Bony pocket
P-Pocket, Inflammatory cells.

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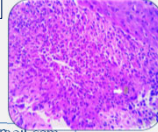



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What is Inflammation?

- Inflammation is the body's first response to an injury.
- First phase, **acute inflammation (good)**.
- **Chronic inflammation (bad)** is harmful causing (irreversible) tissue destruction (fibrosis/scar tissue).
- Can negatively affect all organs and tissues of the body.
- Prolonged process - tissue destruction + acute inflammation proceed concurrently.
- Several pro-inflammatory biomarkers of inflammation include C-reactive protein, IL6; IL18 etc.
- Research suggests that managing the inflammatory burden of one disease may help reduce the risk for the other.

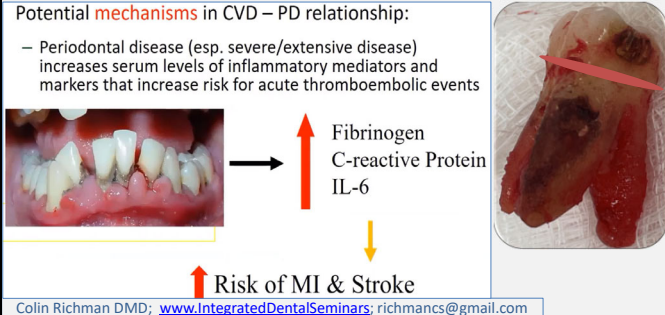
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CVD and Periodontal Disease.

Potential **mechanisms** in CVD – PD relationship:

- Periodontal disease (esp. severe/extensive disease) increases serum levels of inflammatory mediators and markers that increase risk for acute thromboembolic events



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CVD and Periodontal Disease.

- Potential **mechanisms** in CVD – PD relationship:
 - **Atherosclerosis:** bacteria (and their products) commonly associated with periodontitis are frequently found in distant arterial atheromas (e.g., carotid artery, epicardial arteries, internal mammary artery, etc.)
 - 40-50% of atheromas from patients with periodontitis have periodontal pathogens in the atheroma
 - Intravascular bacterial products adversely affect vascular endothelium and its normal function
 - bacteremia/endotoxemia following toothbrushing, chewing, etc. is much more common in people with gingival inflammation or periodontitis than in periodontally healthy people

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Literature + Evidence.

> Am J Med. 2023 Nov 18;S0002-9343(23)00706-4. doi: 10.1016/j.amjmed.2023.11.001. Online ahead of print.

Effect of periodontal treatment on reducing chronic inflammation in systemically healthy patients with periodontal disease: a multicenter study

Shinji Matsuda¹, Tomoaki Shintani², Tsuyoshi Miyagawa³, Hiromichi Yumoto⁴, Yasutaka Komatsu⁵, Nanae Dewake⁶, Takao Iwata⁷, Takatoshi Nagano⁸, Toshiya Morozumi⁹, Ryoma Goto¹⁰, Satoru Kato¹¹, Masahito Kikamura¹², Kiyotaka Sato¹³, Satoru Saito¹⁴, Akiko Yamashita¹⁵, Koiko Yamashita¹⁶, Atsutoshi Yoshimura¹⁷, Tsutomu Sugaya¹⁸, Shogo Takashiba¹⁹, Yoichiro Taguchi²⁰, Eiji Nemoto²¹, Hiromi Nishi²², Noriyoshi Mizuno²³, Yukihito Numabe²⁴, Hiroyuki Kawaguchi²²

Affiliations + expand
PMID: 37984772 DOI: 10.1016/j.amjmed.2023.11.001

Periodontal treatment decreased both IL6 and Hs-CRP levels.

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pmid: Neutrophils' contribution to periodontitis and periodontitis-associated cardiovascular diseases
B Bassani, M Cucchiara, A Butera, O Kayal, A Chiesa, MT Palano, F Olivero, M Galassi.
International Journal of Molecular Sciences. 2023 - ijmj.com

- This review underscores the crucial role of neutrophils in the pathogenesis of periodontitis and the complex link between neutrophil dysfunction, local inflammation and systemic comorbidities.
- The persistent inflammatory state in periodontitis can lead to aberrant neutrophil activation and a sustained release of proinflammatory mediators, finally resulting in tissue damage, bone resorption, and disease progression.
- Growing evidence (2023) now points to the correlation between periodontitis and systemic comorbidities.
- **The release of inflammatory mediators, immune complexes, and oxidative stress by neutrophils, bridge the gap between local and systemic immunity, thus highlighting neutrophils as key players in linking periodontal inflammation to chronic conditions, including cardiovascular diseases, diabetes mellitus, and rheumatoid arthritis**

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antibiotics MDPI

The Preoperative Inflammatory Status Affects the Clinical Outcome in Cardiac Surgery

D'Agostino D, et al. (2019)
<https://doi.org/10.3390/antibiotics8040176>

- **(470) Cardiac surgery patients**
- **3 inflammatory groups based on CRP and Fibrinogen: Low (<CRP <0.39mg/dL and FBG <366 mg/dL), medium, and high (>CRP 0.39mg/FBG >366 mg/dL)**
- **Post operative mortality similar for all groups.**
- **Post operative infections more prevalent in the high inflammatory group.**
- **>48 months survival, worse for high inflammatory group, including LVEF.**

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J Clin Periodontol. 2024 May;51(5):538-546. doi: 10.1111/jcpe.13942. Epub 2024 Jun 5.

Periodontitis and hypertension are linked through systemic inflammation: A 5-year longitudinal study

Kim Songunghang ¹, Park Vahanoutghil ², Rangsim Mahawongse ³, Jittiratt Thienpratsam ⁴

Affiliation: ¹PMID: 38196119; DOI: 10.1111/jcpe.13942

- **5-year monitor PDD + changes in hypertension and systemic inflammation.**
- **Monitored inflammatory biomarkers, WBC and CRP**
- **Poor PD health patients demonstrated elevated systolic BP + increased hypertension risk.**
- **Higher WBC and CRP associated systemic inflammation**

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Review J Dent. 2024 Apr; 18:104974. doi: 10.1016/j.jdent.2024.104974. Online ahead of print.

Effect of non-surgical periodontal therapy on hemoglobin A1c in periodontitis patients without diabetes mellitus: A systematic review and meta-analysis

Yongyong Sun ¹, Weiya Zhang ¹, Lijie Lu ¹, Dian Zhao ², Songlin Wang ², Yaping Pan ³, Chen Li ⁴

Affiliation: PMID: 38642823; DOI: 10.1016/j.jdent.2024.104974

- **This systematic review and meta-analysis evaluated the effect of NSPT on HbA1c in periodontitis patients without DM.**
- **A significant reduction in the HbA1c is noted.**

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Journal of the American College of Cardiology
Volume 65, Issue 1, August 2015, Page 414-426

Original Investigation
C-Reactive Protein and Risk of Incident Heart Failure in Patients With Cardiovascular Disease

Paresh D. Bhatti MD*, Stefan Koenig MD PhD^{2,3}, Aron Milinkovic MD PhD^{4,5}, Aronmil T.L. Frider MD PhD⁶, Martin Tepe MD PhD⁶, Hans-Joachim Schirmer MD PhD⁶, Jitender S. Chahal MD PhD⁶, Douglas A. Morrison MD PhD⁶, Paul M. Heidenreich MD PhD⁶, Jitender S. Chahal MD PhD⁶, Richard H. Stewart MD PhD⁶, and the ACC-HAART study group

<https://doi.org/10.1016/j.jacc.2015.05.015>

CRP levels are substantially elevated in patients with periodontal disease (periodontitis).

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Variations of Serum CRP Levels in Periodontal Health and Diseases: A Clinico-Biochemical Study

Sudhakar Shankar¹, Shiva Marimuth¹, Saad Muhammad Alqabani², Kiran Kumar Ganji^{3,4,5,6}, Rajaganesan Roshni⁷, Nisha L. Choudhary^{8,9}, Anil Kumar Nagalingam¹⁰, Muktadar Ahmad Javali¹¹, Shreyas Erikar¹² and Moharshi Abhishek Khosla¹³

Diagnostics 2023, 13, 2483. <https://doi.org/10.3390/diagnostics13152483>

3 groups:
Group A, 50 periodontally healthy subjects, CRP 0.04820mg/dl.
Group B1+B2: 25 each, periodontally diseased, CRP 1.678mg/dl.
Group B1 no periodontal treatment – CRP remained elevated.
Group B2 received treatment – CRP reduced to 0.9992 2 months post periodontal treatment.
 (Range of CRP in health, 0.3-1.0mg/dl)
 BL: Periodontitis (chronic inflammatory disease enhances systemic inflammatory markers (incl. CRP, reduced by appropriate periodontal treatment).

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THE NEW ENGLAND JOURNAL OF MEDICINE

Systemic inflammation may impair vascular function, and epidemiologic data suggest a possible link between periodontitis and cardiovascular disease.

Treatment of Periodontitis and Endothelial Function

Authors: Mouton S, Saverio, DM.D., Ph.D., Francesco Di Biase, M.D., Ph.D., Luigi Nishi, D.M.D., Ph.D., Ann Driscoll, Clive S. Lewis, M.D., Mohammed Fakhri, M.D., John Steyer, M.D., Joseph D. Hargrett, Ph.D., David Vaccaro, M.D., and John D'Avella, M.D., B.S., et al. Author Info & Affiliations
Published March 1, 2022 | In *NEJM* | <https://doi.org/10.1056/NEJMoa2107161> | VOL. 386, NO. 5

6 months, significant improvement in endothelial function (assessed by measurement of the diameter of the brachial artery during flow). Improvement was noted in periodontal health status and plasma levels of soluble E-selectin.

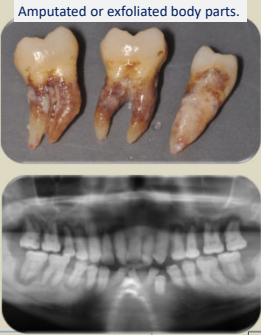
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- **Intervention**

Amputated or exfoliated body parts.



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INTERNATIONAL DENTAL JOURNAL 73 (2023) 854-860

Scientific Research Report
Periodontal-Systemic Disease: A Study on Medical Practitioners' Knowledge and Practice

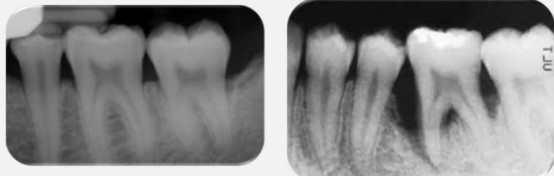
Sameena Parveen¹, Ahmed Shaher Al Qahtani², Esam Halboub³, Reem Ali Ahmed Hazzazi⁴, Imtihan Ahmed Hussain Madkhali⁵, Aalaa Ibrahim Hussain Mughals⁶, Safeyah Abdulrahman Ali Baeshen⁷, Aamani Mohammed Moaidi⁸, Mohammed Sultan Al-Ak'hali⁹

Medical practitioners revealed low levels of knowledge on the oral and systemic disease interrelationship. Conducting webinars on the oral-systemic health interrelationship seems to improve the overall knowledge and understanding of medical practitioners. Reverse holds true for dentists.

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Healthy tooth with great bone, left side
 Periodontitis afflicted tooth with bone loss and a very deep pocket right side.
 Both situations might be **equally asymptomatic** with no patient awareness.



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AGENDA:

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Courtesy Dr Lin Kim.
Periodontist, California

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- The deeper the pocket, the more anerobic the environment fostering more virulent anaerobes.
- Associated with a hyper-immunological response, pro-inflammatory cytokines, resulting in alveolar bone destruction.

Stages of Periodontal Disease

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- Healthy on the left, severe disease, right.
- Etiology, < flossing, toothpicks or Interdental Plaque Control.
- Easily reversed with personal/professional treatment.

Healthy vs **Periodontal Disease**

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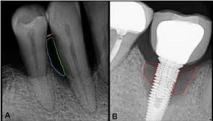
Literature abundant.

<ul style="list-style-type: none"> 1-123-50326303203027-main.pdf Association between periodontitis and mortality... Contribution of Period health and CVD prevent... DD Proinflammatory Status Affects th... IPF Syst Fails Systemic.pdf IP MD Knowledge of PeriSystemic Link.pdf Integrated analysis of the oral and intestinal mi... Oral microflora mediate inflammation, a pa... POD Metabolic syndrome.pdf Periodontitis and the incidence of metabolic s... Py Ab resistance.pdf Redden AJJ 2nd yr.pdf % CVD POD.pdf 	<ul style="list-style-type: none"> 1-1-123-50326303203028-pr_179.jpg atherosclerotic_plaque.jpg Cytokine and abd sr.jpg Dental health can affect your brain and is link... Evaluation of morphological, histological, and... HighAngiitis-Interconnection of periodontal... J Clin Periodontology - 2023 - Herrera - Asso... PO CVD DM Bidirectional Sep 2023.pdf POD Tooth Loss Systemic conditions.pdf Periodontitis and the incidence of metabolic s... PG and GI Dysbiosis Atherosclerosis .pdf STAT6-0702.jpg Vitamin B and Periodontal Health_A Systemati... 	<ul style="list-style-type: none"> 2023 Periodontitis and systemic inflammation... Bibliometric research on analysis of links betw... Cytokine level and abdominal sr outcomes.jpg Effect of chlorhexidine mouthwashes on perio... Evidence on the Use of Mouthwash for the G... Head and neck cancer patients show poor oral... Miller Peter C-Reactive Protein and Cancer—D... PG Systemic exp heart.pdf POD T00204 CVD Systemic link.pdf Periodontitis and the incidence of metabolic s... PI Syst Inflammation .pdf STAT6-0702.jpg White matter abnormalities mediate the associ... 	<ul style="list-style-type: none"> Association between peri-implantitis and syste... Cardio-Inflammatory.jpg DD Postoperative cytokine levels and their pre... Estimation of serum C-reactive protein activity... Evidence that periodontal treatment improves... Ideal resident case PeriSystemic.pdf Mouth-Heart Connection, A Systematic Revie... POD Pulmonary function.pdf POD Tooth Loss Systemic Oct 2023 10 Hr.pdf PeriSystemic.pdf POD_CVD association.jpg Systemic and POD % .pdf
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Future directions, but already available in 2023. AI for detection of periodontal disease.



Journal of Dental Sciences 18 (2023) 1301–1309
Available online at www.sciencedirect.com
ScienceDirect
Journal homepage: www.elsevier.com

Original Article
Automatic recognition of teeth and periodontal bone loss measurement in digital radiographs using deep-learning artificial intelligence

Chin-Chang Chen ^{a,b}, Yi-Fan Wu ^c, Lwin Moe Aung ^c, Jerry C.-Y. Lin ^{a,d}, Jin Ting Ngo ^e, Jo-Ning Su ^e, Yuan-Min Lin ^{a*}, Wei-Jen Chang ^{a,f,g,h}

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^d Department of Oral Medicine, Infection and Immunity, Harvard School of Dental Medicine, Boston, USA
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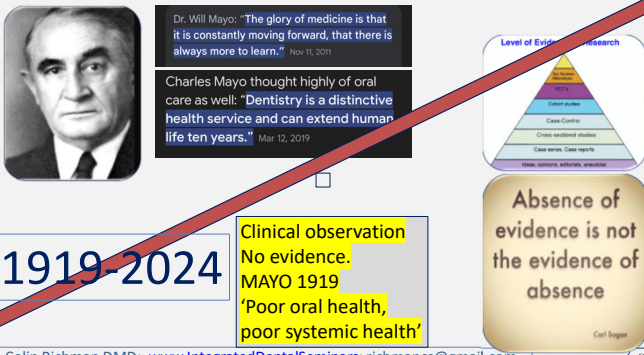
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Dr. Will Mayo: "The glory of medicine is that it is constantly moving forward, that there is always more to learn." Nov 11, 2011

Charles Mayo thought highly of oral care as well: "Dentistry is a distinctive health service and can extend human life ten years." Mar 12, 2019

Level of Evidence Research

- 1. RCTs
- 2. Cohort studies
- 3. Case-control
- 4. Cross-sectional studies
- 5. Case series, Case reports
- 6. Meta-analysis, editorial, anecdotal


1919-2024

Clinical observation
No evidence.
MAYO 1919
'Poor oral health,
poor systemic health'

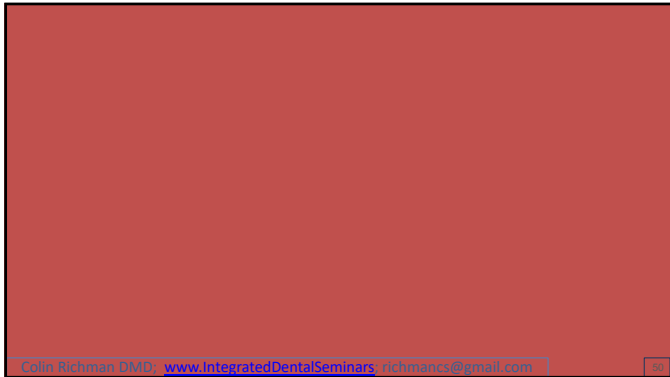
Absence of evidence is not the evidence of absence

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