

The 112th Annual Meeting of the American Academy of Periodontology
in collaboration with the Japanese Academy of Clinical Periodontology,
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Abstracts of JACP/JSP Poster Session



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The Japanese Academy of Clinical Periodontology
The Japanese Society of Periodontology

第112回アメリカ歯周病学会共催
日本臨床歯周病学会・日本歯周病学会
2026年大会

**The 112th Annual Meeting of the American Academy of Periodontology
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JACP/JSP ポスターセッション抄録集
一般演題（基礎研究，臨床研究），症例報告，歯科衛生演題

Abstracts of JACP/JSP Poster Session
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JACP/JSP ポスター発表・若手研究者支援協賛企業

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General (Basic Research)

GB-01

FGF-2 and bone graft materials in osteoporotic periodontal healing

Sho Mano^{*1,2}, Rio Hisanaga-Mokudai¹, Tasuku Murakami^{1,3}, Saki Nakane-Koyachi^{1,3},
Kentaro Imamura^{1,2}, Atsushi Saito^{1,2}

¹Department of Periodontology, Tokyo Dental College, Tokyo, Japan, ²Oral Health Science Center, Tokyo Dental College, Tokyo, Japan, ³Yurakucho Dental Office, Tokyo, Japan

Background and objective: Osteoporosis impairs periodontal tissue healing. Periodontal regeneration therapy combining fibroblast growth factor-2 (FGF-2) with scaffold has been investigated. However, the effects of combining FGF-2 with bone graft materials under osteoporotic conditions remain unclear. This study evaluated the effects of FGF-2 with carbonate apatite (CO₃Ap) or deproteinized bovine bone mineral (DBBM) on periodontal healing in an osteoporotic rat model.

Materials and Methods: Wistar rats were divided into ovariectomized (OVX) and control groups. Periodontal defects were surgically created and treated with FGF-2 and CO₃Ap or DBBM. Two weeks after surgery, defects were analyzed by micro-computed tomography and hematoxylin-eosin staining. For *in vitro* experiments, rat femur-derived bone marrow mesenchymal stromal cells (BMSCs) and bone marrow-derived macrophages (BMMs) were cultured on CO₃Ap or DBBM with FGF-2. Cell morphology was evaluated by scanning electron microscopy, and cell proliferation was assessed using a WST-8 assay.

Results: Two weeks after surgery, bone volume fraction was significantly lower in the OVX group than in the control group, with no differences between bone graft materials. BMSCs on FGF-2+DBBM showed more elongated filopodia and higher viability in the OVX group than those on FGF-2+CO₃Ap. In contrast, BMMs on FGF-2+CO₃Ap showed numerous blebs and higher viability than those on FGF-2+DBBM in both groups.

Conclusion: Periodontal healing was impaired under osteoporotic conditions *in vivo*, regardless of the bone graft material used in combination with FGF-2. *In vitro* analysis revealed that DBBM supported OVX-BMSC function, while CO₃Ap enhanced BMM activity, suggesting material-specific cellular responses under estrogen-deficient conditions.

GB-02

A novel transcriptional regulator modulating virulence in *Treponema denticola*

Rio Hisanaga-Mokudai^{*1}, Sho Mano^{1,2}, Saki Nakane-Koyachi^{1,3}, Tasuku Murakami^{1,3},
Keiko Yamashita¹, Kentaro Imamura^{1,2}, Kazuyuki Ishihara⁴, Atsushi Saito^{1,2}

¹Department of Periodontology, Tokyo Dental College, Tokyo, Japan, ²Oral Health Science Center, Tokyo Dental College, Tokyo, Japan, ³Yurakucho Dental Office, Tokyo, Japan, ⁴Department of Microbiology, Tokyo Dental College, Tokyo, Japan

Background and objective: *Treponema denticola* is a major etiologic agent of periodontitis. Among the proteolytic enzymes produced by *T. denticola*, dentilisin is considered a key virulence factor associated with tissue destruction and disease progression. We previously observed that the expression of a gene encoding an HxlR family transcriptional regulator was significantly increased in a dentilisin deficient mutant. This observation suggested that this regulator may participate in the regulation of dentilisin expression. The aim of this study was to investigate the properties of this gene, focusing on its role in the regulation of virulence of *T. denticola*.

Materials and Methods: The HxlR family transcriptional regulator deficient mutant was constructed from *T. denticola* ATCC 35405 (wild type) by homologous recombination.

The growth curve was evaluated by measuring OD₆₆₀. The gene expression profile was analyzed by DNA microarray and qRT-PCR. Dentilisin activity was measured using synthetic substrate SAAPNA. Cystalyisin activity was evaluated by measuring hydrogen sulfide production.

Results: The mutant exhibited reduced growth rate compared with the wild type. DNA microarray revealed altered expression of 90 (out of 2,786) genes in the mutant relative to the wild type. Genes encoding dentilisin and dentipain were downregulated (0.7- and 0.5-fold, respectively), whereas genes encoding cystalyisin, permease, an AbgT family transporter, and peptidase were upregulated (2.8-, 3.1-, 3.1-, and 2.8-fold, respectively) in the mutant. Dentilisin activity was also significantly decreased in the mutant, whereas cystalyisin activity was increased.

Conclusion: These findings suggest that the HxlR-family transcriptional regulator coordinates the expression of virulence factors and amino acid metabolism in *T. denticola*.

GB-03

Bone sialoprotein and PLAP-1 orchestrate periodontal homeostasis

Karin Nagasaki^{*}, Tan Xueyan, Satoru Yamada

Department of Periodontology and Endodontology, Tohoku University Graduate School of Dentistry

Background and objective: Even after periodontal treatment, tooth mobility often persists due to supporting tissue loss and periodontal ligament (PDL) dysfunction. Developing new strategies to qualitatively improve residual PDL integrity requires elucidating its molecular basis. Previously, we identified two extracellular matrix proteins critical for PDL integrity: periodontal ligament-associated protein 1 (PLAP-1) and bone sialoprotein (BSP). PLAP-1 deficient (KO) mice display impaired PDL structures. Similarly, mice lacking BSP-integrin interaction (BSP-KAE) exhibit disorganized PDL fibrils and downregulated PLAP-1. These findings suggest an integrin-mediated crosstalk between BSP and PLAP-1; however, their functional interdependence in PDL modulation remains unclear. Here, we generated double-mutant mice harboring PLAP-1 deficiency and BSP-KAE mutation to analyze their periodontal phenotype and osteoclastogenic potential.

Materials and Methods: Double-mutant mice were generated by crossing PLAP-1 KO and BSP-KAE (RGD substituted with KAE) mice. Periodontal tissues of 9-week-old mice were analyzed by micro-CT (n=5) and histology (n=3). Osteoclastogenic potential was assessed *in vitro* using bone marrow-derived cells by TRAP and actin ring staining (n=3).

Results: Double mutants exhibited significantly lower alveolar bone levels compared to other genotypes. Histologically, TRAP-positive osteoclasts were increased only in BSP-KAE mice, while double mutants remained comparable to wild-type. Notably, the onset of osteoclast differentiation was delayed in all mutants, with impaired or irregular actin rings observed when mature cells eventually formed.

Conclusion: These data indicate a cooperative function of PLAP-1 and BSP in maintaining the periodontium, and that the collapse of their interdependent structural network primarily drives periodontal breakdown. Further transcriptomic analysis is underway to elucidate the detailed molecular mechanisms underlying this functional interdependence.

GB-04

The Effects of Senolytics on Aged Mice

Naoto Koyama^{*1}, Tzu Yang Kuo^{1,2}, Yuki Ohtani¹, Wenni Hsieh¹, Ko Gyokuki^{1,2},
Yuki Ozaki¹, Nobuo Yoshinari^{1,2}

¹Department of Cariology, Endodontology and Periodontology, Matsumoto Dental University,

²Oral Health Science, Department of Oral Health Promotion, Oral Science Course,
Matsumoto Dental University Graduate School of Oral Medicine

Background and Objective: Aging has recently been recognized as a common underlying factor in lifestyle-related diseases. Chronic inflammation driven by the senescence-associated secretory phenotype (SASP) of senescent cells is considered a key mechanism contributing to periodontitis (P), diabetes mellitus (DM), and atherosclerosis (AT). This study aimed to evaluate the effects of senescent cell elimination on these conditions in aged mice.

Materials and Methods: A total of 157 C57BL/6 and ApoE^(-/-) mice were used and divided into eight groups in each mouse: control, P, DM, AT, P+DM, P+AT, DM+AT, and P+DM+AT. Each group was further subdivided into senolytic-treated and untreated groups, and maintained until 72 weeks of age. Experimental periodontitis was induced by ligature placement for two weeks. Type 2 diabetes was induced by administration of streptozotocin and nicotinamide. Atherosclerosis was modeled using ApoE^(-/-) mice. Senescent cell clearance was achieved by oral administration of dasatinib and quercetin (D+Q) for four months starting at 56 weeks of age. Assessments included SA-β-gal staining of periodontal tissues, micro-CT analysis for alveolar bone resorption, serum IL-6 levels, and quantification of vascular lipid deposition using Sudan IV staining.

Results: D+Q treatment significantly reduced the number of SA-β-gal-positive cells in periodontal tissues, alveolar bone resorption, and serum IL-6 levels. In addition, the percentage of Sudan IV-positive area was significantly decreased in the AT group.

Conclusion: These findings suggest that elimination of senescent cells improves disease-related phenotypes in aged mice and may represent a promising therapeutic strategy for periodontitis and atherosclerosis.

GB-05

Photodynamic reactions using high-intensity red LED promotes rat gingival wound healingJyumpei Ohki^{*1}, Nobuhiro Yamauchi¹, Yoichiro Taguchi², Kazutaka Imai¹, Emika Minagawa¹,
Keiju Omatsu¹, Hirohito Kato¹¹Department of Periodontology, Osaka Dental University, ²Department of Cariology, Endodontology and
Periodontology, School of Dentistry, Matsumoto Dental University

Background and objective: Photodynamic therapy (PDT), which combines a light source with a photosensitizer, generates reactive oxygen species and exhibits bactericidal effects against periodontal pathogens. High-intensity red light-emitting diodes (LEDs) have recently attracted attention as safe and cost-effective light sources. However, their effects on periodontal tissues remain unclear, and in vivo studies on photodynamic reactions are limited. This study aimed to investigate the effects of photodynamic reactions using a high-intensity red LED and a photosensitizer on rat gingival wound healing.

Materials and Methods: Gingival fibroblasts were isolated from the palatal gingiva of 8-week-old Sprague-Dawley rats. After treatment with methylene blue (MB) (1 µg/mL), cells were irradiated with a high-intensity red LED (peak wavelength: 650 nm). Cell proliferation, migration, and lactate dehydrogenase release were assessed to determine the optimal energy density. In addition, the expression of wound healing-related factors, including type I collagen, fibronectin, and VEGF-A, was analyzed. In vivo, standardized 2-mm gingival defects were created on the palatal aspect of the maxillary first molar. MB was applied followed by LED irradiation every 2–3 days, and wound healing was evaluated.

Results: At 2 J/cm² irradiation, cell proliferation and migration were significantly enhanced and no cytotoxicity was observed. Furthermore, photodynamic reactions increased expression of wound healing-related factors. In vivo, the 2 J/cm² group showed significantly accelerated wound healing compared with the untreated control group (without MB, no LED irradiation).

Conclusion: Photodynamic reactions using a high-intensity red LED at an appropriate energy density promotes gingival wound healing and represents a promising treatment with positive effects on the surrounding tissues.

GB-06

TNAP-mediated endogenous phosphate supply during enamel formationHaya Kodama^{*1}, Risako Chiba-Ohkuma², Ryuji Yamamoto², Shoji Hamanaka²,
Takatoshi Nagano¹, Yasuo Yamakoshi²¹Department of Periodontology, School of Dental Medicine, Tsurumi University, ²Department of Biochemistry and
Molecular Biology, School of Dental Medicine, Tsurumi University

Background and objective: Dental enamel formation requires a precisely regulated supply of Pi. Although phosphate transport in ameloblasts has been studied, how phosphate is generated within the enamel remains unclear. Tissue-nonspecific alkaline phosphatase (TNAP) is a key enzyme in skeletal mineralization, but its functional contribution to enamel formation has not been fully established. Herein, we examined the presence, activity, and catalytic potential of TNAP in porcine enamel matrix.

Materials and Methods: To determine the localization and functional contribution of TNAP within the enamel matrix during the secretory and maturation stages, we performed histochemical staining, gene expression analysis, and immunohistochemistry. TNAP activity, low-molecular-weight phosphate-related compounds, and levamisole-sensitive Pi production were quantified in enamel matrix extracts and *ex vivo* reactions. Purified enamel proteins were incubated with recombinant human TNAP (rhTNAP) to assess phosphate release.

Results: TNAP was detected and showed catalytic activity. PPi and ATP were present; Pi generation was significantly suppressed by levamisole, indicating TNAP dependence. rhTNAP directly hydrolyzed phosphorylated enamel proteins, including amelogenins and enamelin, as well as ATP, and TNAP-dependent hydrolysis of PPi was observed. Proteolytic processing of amelogenins enhanced TNAP-dependent phosphate release. Stage-dependent differences in enzyme distribution and substrate availability suggested regulation during enamel formation.

Conclusion: These findings demonstrate that the enamel matrix is not merely a passive site of mineral deposition, but a functionally active compartment of phosphate metabolism, and identify TNAP as a central integrator that coordinates phosphate generation with protease-dependent processing of enamel proteins to support proper enamel mineralization.

GB-07

Ligature-induced periodontitis potentially accelerates CD4⁺T-cell senescence and exacerbates rheumatoid arthritis

Miyu Shida^{*}, Terukazu Sanui, Jinfeng Li, Mwannes Ahmad, Ziyu Wang, Meng Xiao, Yomna Serageldin, Chikako Hayashi, Takao Fukuda, and Fusanori Nishimura

Department of Periodontology, Division of Oral Rehabilitation, Faculty of Dental Science, Kyushu University

Background and objective: Thymic involution after puberty reduces naïve T cells, promoting senescent CD4⁺T cells. The reason is that senescent T cells attempt to complement this reduction by proliferating to their limits, maintaining their absolute numbers through “homeostatic proliferation.” These cells, characterized by PD-1/CD153 expression, show reduced proliferation and increased senescence-associated secretory phenotype (SASP) cytokines. This study investigates how periodontitis in mice affects CD4⁺T-cell senescence and subsequent systematic disease.

Materials and Methods: BALB/c mice aged 5, 10, 18, 26, 34, and 42 weeks received LIP by silk ligation around maxillary second molars. Splenic CD4⁺T cells were extracted and cultured with IL-2, anti-TCR β , and anti-CD28 for 1 to 3 days to mimic homeostatic proliferation.

Results: No significant difference was observed in PD-1/CD153 double-positive cells between the LIP and control groups at any age of mice. However, after *in vitro* stimulation, the LIP group showed a higher proportion of PD-1/CD153 double-positive cells, peaking at 18 weeks. SASP cytokines in the LIP group were higher than that in the control group. RNA-seq analysis revealed numerous differential expressed genes related to senescence in naïve helper T cells from the LIP group. Finally, nude mice transplanted with senescent CD4⁺T cells from the LIP group showed an exacerbation of collagen antibody-induced arthritis.

Conclusion: These results suggest that severe periodontal inflammation that can resorb alveolar bone potentially promotes the aging of CD4⁺T cells, and that these senescent cells may circulate throughout the body and worsen rheumatoid arthritis, a systemic disease related to periodontal medicine.

GB-08

Multi-Omics Reveals Kidney Signaling Alterations in Ligature-Induced Periodontitis

Mari Sugimoto^{*1,2}, Hiroaki Kikuchi¹, Koji Mizutani³, Takanori Matsuura², Risako Mikami⁴, Takefumi Suzuki¹, Tomohiro Tsuboya¹, Ayako Matsunaga¹, Tamami Fujiki¹, Yutaro Mori¹, Fumiaki Ando¹, Yohei Arai¹, Shintaro Mandai¹, Takayasu Mori¹, Koichiro Susa¹, Takanori Iwata², Shinichi Uchida¹ and Eisei Sohara¹

¹Department of Nephrology, Graduate School of Medical and Dental Sciences, Institute of Science Tokyo, ²Department of Periodontology, Graduate School of Medical and Dental Sciences, Institute of Science Tokyo, ³Department of General Dentistry, Graduate School of Medical and Dental Sciences, Institute of Science Tokyo, ⁴Department of Advanced Biomaterials, Graduate School of Medical and Dental Sciences, Institute of Science Tokyo, Tokyo, Japan.

Background and Objective: Chronic kidney disease (CKD) and periodontitis are both associated with accelerated decline in renal function; however, the underlying mechanisms have not been sufficiently investigated. Advances in omics technologies enable comprehensive analysis of molecular pathways. This study aimed to identify kidney signaling alterations induced by periodontitis using next-generation sequencing.

Materials and Methods: A folic acid-induced CKD mouse model (FAN-CKD) and a ligature-induced experimental periodontitis model (LIG) were employed. Renal function was assessed by measuring blood urea nitrogen (BUN) and creatinine levels, and periodontal destruction was evaluated by micro-computed tomography (μ CT). Kidney tissues were analyzed by Western blotting and RNA sequencing (RNA-seq). Human renal tubular epithelial cells (HK-2) were used for *in vitro* experiments.

Results: μ CT confirmed consistent periodontal destruction in LIG mice. Ligature-induced periodontitis significantly worsened renal function in FAN-CKD mice. RNA-seq analysis (FAN vs. FAN+LIG) revealed upregulation of interferon (IFN)- α/β signaling (including IRF7, STAT1, and ISG20), activation of β -catenin signaling, and suppression of AMPK signaling in the kidney. β -catenin target genes were also upregulated in FAN-CKD mice compared to controls. LIG reduced phosphorylation of β -catenin at Ser552, indicating enhanced β -catenin activity. In HK-2 cells, IFN- γ treatment similarly decreased β -catenin Ser552 phosphorylation.

Conclusion: Periodontitis exacerbates renal function decline in the CKD mouse model through activation of β -catenin signaling with possible involvement of IFN signaling. These findings suggest that shared molecular pathways may link periodontitis and CKD progression.

GB-09

FGF2 promotes mineralization of HUCPVCs by modulating ALP and ENPP1/PPi pathwaysSakurako Asada^{*1}, Risako Chiba-Ohkuma², Takeo Karakidab, Ryuji Yamamoto², Shun Nonoyama¹, Kazuhiro Gomi¹, Takatoshi Nagano¹, Yasuo Yamakoshi²,¹Department of Periodontology, Tsurumi University, ²Department of Biochemistry and Molecular Biology, Tsurumi University

Background and objective: This study aimed to investigate the role of fibroblast growth factor 2 (FGF2) in promoting osteogenic differentiation and mineralization of human umbilical cord perivascular cells (HUCPVCs), and to elucidate the underlying molecular mechanisms, particularly the involvement of the matrix vesicle-mediated mineralization pathway.

Materials and Methods: HUCPVCs were cultured under osteogenic conditions with (FGF2 (+)) or without (FGF2 (-)) FGF2 in the presence of vitamin D₃, LDN-193189, and TGF- β 1. Mineralization was assessed using alkaline phosphatase (ALP) activity assays, Alizarin Red S staining, ALP staining, and calcium quantification. The selective FGF receptor inhibitor (LY2874455) and exogenous tissue-nonspecific alkaline phosphatase (TNAP) were used to evaluate the effect of FGF2. Transcriptomic analysis and the expression profiling of matrix vesicle-mediated mineralization- and myofibroblast-related markers were performed using RNA sequencing (RNA-Seq), quantitative polymerase chain reaction, and immunofluorescence staining. Extracellular pyrophosphate (PPi) was quantified using colorimetric assays. The mineralization capacity of HUCPVCs on titanium and zirconia disks was also tested.

Results: FGF2 significantly enhanced ALP activity and mineralization. LY2874455 abrogated these effects. FGF2 upregulated TNAP and phosphate transporter 1, while suppressing ectonucleotide pyrophosphatase/phosphodiesterase 1 (ENPP1) and α -smooth muscle actin expression. Elevated ENPP1 and PPi in FGF (-) HUCPVCs correlated with impaired mineralization, which was rescued by TNAP. RNA-Seq revealed enrichment of matrix vesicle-mediated mineralization-related genes. Significant mineralization was observed in FGF (+) HUCPVCs on both titanium and zirconia disks.

Conclusion: FGF2 enhances HUCPVC-mediated mineralization through dual regulation of ALP induction and ENPP1-PPi suppression. These findings support its utility in bone tissue engineering and implant surface integration.

GB-10

Effects of *Fusobacterium nucleatum* on Lung Cancer ProgressionEiki Omine^{*1,2,3}, Shogo Okazaki³, Muneaki Tamura³, Akira Hasuike², Shuichi Sato², Kenichi Imai³¹Division of Applied Oral Sciences, Nihon University Graduate School of Dentistry, ²Department of Periodontology, Nihon University School of Dentistry, ³Department of Microbiology and Immunology, Nihon University School of Dentistry

Background and objective: Lung cancer is one of the leading causes of cancer-related mortality, and elucidating the factors involved in its progression remains an important challenge. Although periodontitis has been associated with an increased risk of lung cancer, the underlying mechanisms remain unclear. In this study, we focused on *Fusobacterium nucleatum* (Fn), a periodontal pathogen implicated in several malignancies, and investigated its effects on lung tumor growth and inflammatory and immune-related responses.

Materials and Methods: Lewis lung carcinoma (LLC) cells were subcutaneously implanted into C57BL/6J mice, followed by intratumoral administration of live Fn, and tumor volume was measured over time. In vitro, Fn culture supernatant was applied to LLC cells and the human lung cancer cell line A549. The expression levels of inflammatory factors and PD-L1 were analyzed by real-time PCR. Fn culture supernatant was further fractionated according to molecular weight, and the inflammatory-inducing activity of each fraction was evaluated.

Results: The Fn-treated group showed significantly enhanced tumor growth compared with the control group. In vitro, Fn culture supernatant upregulated inflammation-related genes and PD-L1 in both LLC and A549 cells. Fractionation analysis revealed inflammatory-inducing activity in both low- and high-molecular-weight fractions, suggesting the involvement of multiple Fn-derived factors.

Conclusion: These findings suggest that Fn may promote lung tumor growth by inducing inflammatory responses and upregulating immunosuppressive molecules in lung cancer cells. Fn-derived factors may therefore represent one mechanism linking periodontitis to lung cancer progression.

GB-11

Ionic silver coated Implants Suppress Peri-implantitis in a Murine Model

Mana Nasu^{*1}, Tomoya Soma¹, Hidetaka Miyashita¹, Takazumi Yasui¹, Fuka Homma¹, Kitaru Suzuki², Takeshi Miyamoto³, Taneaki Nakagawa¹, Mamoru Aizawa⁴, Satoru Morikawa¹

¹Department of Dentistry and Oral Surgery, Keio University School of Medicine, ²Department of Materials Science and Technology Faculty of Advanced Engineering, Tokyo University of Science, ³Department of Orthopedic Surgery, Kumamoto University, ⁴Department of Applied Chemistry, School of Science and Technology, Meiji University

Background and objective: Peri-implantitis, an inflammatory condition caused by bacterial infection around an implant, is currently the leading cause of dental implant failure. *Porphyromonas gingivalis* (*P. gingivalis*), an anaerobic bacterial pathogen associated with periodontitis, is known to play a key role in peri-implantitis. To address this issue, the present study examined the antibacterial properties of ionic silver (Ag^+)-coated titanium implants against *P. gingivalis* and their ability to prevent bone loss.

Materials and Methods: Titanium implants were coated with ionic silver (Ag^+) using a hydroxyapatite film chelated with inositol hexaphosphate. Antibacterial efficacy against *P. gingivalis* was validated via inhibition zone assays. Clinically, a murine model of ligature-induced peri-implantitis was employed to compare bone resorption between Ag^+ -coated and uncoated implants.

Results: Ag^+ -coated implants demonstrated significant antibacterial activity and clinical stability, markedly reducing bone resorption (19–25% vs. 15–20% in controls). Radiographic and histological analyses confirmed attenuated inflammation and bone loss. While inflammatory cytokine expression showed non-significant downward trends, the coating effectively suppressed ligature-induced peri-implantitis progression in this murine model.

Conclusion: These findings underscore the potential of Ag^+ coatings as a preventive strategy to enhance long-term implant stability. While Ag^+ effectively suppresses *P. gingivalis* and bone loss in murine models, clinical translation warrants further investigation. Key limitations include the inherent lack of microbial diversity in rodents and the absence of histomorphometric data, such as bone-to-implant contact (BIC). Future research should prioritize optimizing release kinetics and evaluating initial osseointegration to establish this technology as a robust, localized preventive paradigm.

GB-12

Yoda2 reinforces epithelial integrity and attenuate Porphyromonas gingivalis virulence

Tomoya Ueda^{*1}, Satoru Shindo¹, Shohei Yamashita¹, Takumi Memida², Pardis Vakili³, Robert Lemberg³, Maiko Suzuki¹, Kazuhisa Ohara², Saynur Vardar³, Shinji Matsuda⁴, Xiaozhe Han¹, Noriyoshi Mizuno², Toshihisa Kawai¹

¹Department of Oral Science and Translational Research, College of Dental Medicine, Nova Southeastern University, FL USA, ²Department of Periodontal Medicine, Graduate School of Biomedical and Health Science, Hiroshima University, Hiroshima, Japan, ³Department of Periodontology, College of Dental Medicine, Nova Southeastern University, Fort Lauderdale, FL USA, ⁴Division of Periodontology, Department of Regenerative Science in Conservative Dentistry, Kyushu Dental University Fukuoka Japan

Background and Objective: Periodontitis arises from dysregulated host-microbial interactions, in which keystone pathogens such as *Porphyromonas gingivalis* drive tissue destruction through virulence factors, including gingipains. The gingival epithelium is a critical frontline barrier; however, the role of mechanosensing in maintaining epithelial integrity and host defense remains undefined. We hypothesized that activation of the mechanosensor Piezo1 by the chemical agonist Yoda2 enhances epithelial barrier function and attenuates *P. gingivalis* virulence.

Materials and Methods: Human gingival epithelial cells (OBA9) were treated with Yoda2 $\pm$ *P. gingivalis*. Epithelial migration was assessed using an ibidi (tm) Culture-Insert wound healing assay. Barrier integrity was quantified by transepithelial electrical resistance (TEER) and FITC-dextran permeability assays. Antimicrobial effects were evaluated by colony-forming assays under anaerobic conditions. Arginine-specific gingipain activity was measured using a BAPNA assay. The effects of oral Yoda2 administration were examined in a mouse model of ligature-induced periodontitis over 7 days. Alveolar bone loss and gingival inflammation were monitored by micro-CT and qPCR, respectively.

Results: Yoda2 enhanced epithelial migration and preserved barrier integrity, preventing *P. gingivalis*-induced TEER reduction and limiting FITC-dextran permeability. Notably, Yoda2 exerted direct anti-virulence effects by suppressing bacterial growth and reducing gingipain activity in a dose-dependent manner. In vivo, Yoda2 attenuated alveolar bone loss and reduced gingival TNF- α expression, indicating diminished inflammatory burden.

Conclusion: These findings identify mechanosensing Piezo1 as a previously underappreciated regulator of epithelial barrier function and host defense in periodontitis. Yoda2 simultaneously reinforces epithelial integrity and suppresses *P. gingivalis* virulence, representing a novel dual-functional therapeutic strategy for periodontal disease.

GB-13

Expanded Free Gingival Graft: Ex Vivo Analysis with Clinical Cases

Masaki Nambu^{*}, Takeaki Yui, Risa Niinuma, Shunsuke Fukuba, Makoto Ono, Eriko Marukawa, Shogo Maekawa

Department of Periodontology, Institute of Science Tokyo, Department of Regenerative and Reconstructive Dental Medicine, Institute of Science Tokyo

Background and objective: Free gingival grafting (FGG) is useful for increasing keratinized tissue width; however, graft size and donor-site morbidity are limitations in extensive defects. This study evaluated Expanded FGG, in which a free gingival graft is extraorally expanded, by comparing stretchability, tensile force, and aspect-ratio changes between Mesh and Accordion techniques in a porcine ex vivo model, and by presenting representative clinical cases.

Materials and Methods: Standardized free gingival grafts 7×16 mm were harvested from the mandibular lingual region of porcine jaws. Grafts were prepared using either grid-like incisions, defined as the Mesh group, or parallel incisions for accordion-like expansion, defined as the Accordion group. Tensile force was measured at extensions of 18, 20, 21, 22, and 25 mm, and length, width, and aspect ratio of graft were recorded. Conventional FGG, Mesh-expanded FGG, and Accordion-expanded FGG were also applied clinically in sites with insufficient keratinized gingiva/mucosa.

Results: At 18 mm extension, tensile force was 0.19 ± 0.10 N (mean $\pm$ SD) in the Mesh group and 0.09 ± 0.04 N in the Accordion group, with no significant difference. At 20 mm, the Mesh group showed significantly higher tension than the Accordion group 0.89 ± 0.43 N vs. 0.11 ± 0.09 N. Maximum extension was 21 mm for the Mesh technique and 25 mm for the Accordion technique, suggesting efficient longitudinal expansion with the Accordion design. Clinically, both expanded techniques increased keratinized tissue width.

Conclusion: Expanded FGG may help maximize limited graft tissue. Mesh and Accordion techniques showed distinct expansion characteristics and significantly different tensile behavior.

GB-14

Maintenance-Induced Titanium Surface Alterations Shape Fibroblast Responses and Organization

Natsumi Saito^{*1,2}, Yasamin Mohazeb³, Yusuke Hamada⁴, Denny Chao³, Takahiro Ogawa^{1,5}

¹Weintraub Center for Reconstructive Biotechnology, UCLA School of Dentistry, ²Department of Periodontology, Graduate School of Medical and Dental Sciences, Institute of Science Tokyo, ³Division of Advanced Prosthodontics, UCLA School of Dentistry, ⁴Section of Periodontics, UCLA School of Dentistry, ⁵Division of Regenerative and Reconstructive Sciences, UCLA School of Dentistry

Background and objective: Polished titanium abutments are routinely instrumented during peri-implant maintenance for biofilm removal. However, how maintenance-induced surface alterations affect human gingival fibroblast (hGnF) morphology and orientation remains insufficiently understood. This study evaluated early hGnF responses to instrumented titanium surfaces using cell morphometry and a novel image-based Orientation Quality Index (OQI).

Materials and Methods: Machined titanium specimens were allocated to five groups: non-instrumented machined titanium (MA), air-flow treatment (AF), stainless steel curette treatment (SS), titanium curette treatment (TS), and titanium piezoelectric scaler treatment (TP). Surface characteristics were assessed by SEM, optical profilometry, and EDS. hGnFs were cultured for up to 5 days. Cell morphology, time-dependent cell density, and F-actin-based orientation were evaluated by fluorescence microscopy. Directionality-derived parameters were integrated into OQI to quantify planar cellular organization.

Results: Instrumentation generated distinct surface patterns. AF largely preserved the machined morphology, SS and TS produced directionally coherent linear grooves, and TP caused pronounced disordered topographical disruption. On day 1, hGnFs on SS and TS showed greater elongation, whereas cell-density differences among groups diminished over time. Orientation analysis revealed the most organized early alignment on TS and the broadest, least organized pattern on TP. OQI captured these group- and time-dependent differences, reflecting organized versus disordered fibroblast alignment more comprehensively than single orientation parameters.

Conclusion: Implant maintenance instruments produced instrument-specific alterations on polished titanium surfaces, which were associated with distinct early hGnF morphology, density, and orientation. These findings suggest that instrumented abutment-like surfaces may influence the early fibroblast reattachment process. OQI may provide a practical framework for quantifying fibroblast organization in peri-implant soft tissue research.

General (Clinical Research)

GC-01

Periodontal regeneration using rhFGF-2 and CO₃Ap: a 3-Year RCT

Kentaro Imamura^{*1,2}, Wataru Yoshida¹, Fumi Seshima¹, Hideto Aoki¹, Keiko Yamashita¹,
Tasuku Murakami¹, Saki Nakane-Koyachi¹, Rio Hisanaga-Mokudai¹, Sho Mano¹,
Akihiko Katayama¹, Sachiyo Tomita¹, Atsushi Saito^{1,2}

¹Department of Periodontology, Tokyo Dental College,

²Oral Health Science Center, Tokyo Dental College, Tokyo, Japan

Background and objective: This study aimed to evaluate longitudinal outcomes of recombinant human fibroblast growth factor (rhFGF)-2 plus carbonate apatite (CO₃Ap) therapy in comparison with rhFGF-2 alone for treating periodontal intrabony defects.

Materials and Methods: This study describes 3-year follow-up outcomes of the original randomized controlled trial. Intrabony defects in periodontitis patients were treated with rhFGF-2 (control) or rhFGF-2 + CO₃Ap (test). Clinical, radiographic, and patient-reported outcome (PRO) measures were used to evaluate the outcomes.

Results: Forty-eight sites were able to be followed up. At 3 years, both groups showed a significant improvement in clinical attachment level (CAL) from baseline. CAL gains were 3.4 ± 1.5 mm and 2.9 ± 1.5 mm in the test and control groups. No significant inter-group difference was noted. Both groups showed a progressive increase in radiographic bone fill (RBF). The test treatment yielded greater RBF (68.9%) compared with the control group (47.0%). There was no significant difference in patient-reported outcomes between groups.

Conclusion: At the 3-year follow-up, the test and control treatments were similarly effective in improving CAL, whereas the test treatment achieved a significantly greater RBF. In both treatments, favorable clinical, radiographic, and patient-reported outcomes can be sustained for at least 3 years.

GC-02

PISA and aGVHD Onset after Hematopoietic Stem Cell Transplantation

Yura Iijima^{*1}, Makoto Yoshimitsu², Takatoshi Hiroshimaya¹, Takeshi Nishiyama¹, Kei Fujishima¹,
Kenji Ishitsuka², Naofumi Tamaki¹

¹Department of Preventive Dentistry, Kagoshima University Graduate School of Medical and Dental Sciences,

²Department of Hematology and Rheumatology, Kagoshima University Graduate School of Medical and Dental Sciences

Background and objective: Periodontal inflammation suggests to influence systemic inflammatory responses; however, association with acute graft-versus-host disease (aGVHD) remains unclear. This study investigated the association between periodontal inflammation and aGVHD onset in patients undergoing hematopoietic stem cell transplantation (HSCT).

Materials and Methods: This retrospective observational study included patients who underwent HSCT. Periodontal examinations were performed at admission prior to the initiation of conditioning therapy, and quantified using the periodontal inflamed surface area (PISA). Patients were followed during hospitalization for aGVHD onset. Laboratory parameters, including C-reactive protein (CRP), total bilirubin, γ -glutamyl transferase (γ -GTP), blood urea nitrogen (BUN), and estimated glomerular filtration rate (eGFR), were obtained during hospitalization. Bloodstream infection events were identified based on positive blood culture results. Multivariable logistic regression and inverse probability of treatment weighting analyses were performed to evaluate the association between periodontal inflammation and aGVHD onset after adjustment for established clinical risk factors.

Results: A total of 71 patients were included, of whom 45 developed aGVHD. PISA was significantly higher in patients with aGVHD onset than in whom without. Higher PISA was significantly associated with aGVHD onset in univariate analysis, and this association remained significant after adjustment for clinical risk factors and in inverse probability weighted analyses. Patients with higher periodontal inflammation more frequently experienced bloodstream infection and showed alterations in CRP, total bilirubin, γ -GTP, BUN, and eGFR.

Conclusion: Periodontal inflammation assessed by PISA was associated with aGVHD onset after HSCT. Pre-transplant periodontal assessment may provide clinically relevant information for risk stratification and comprehensive patient management.

GC-03

BMI and the PISA: A New Link via Mouth Breathing

Chia-Huei Chan^{*}, Nanae Dewake, Takato Miura, Shinya Kato, Yuki Ohtani, Tzu-Yang Kuo, Moko Kato, Yangyue Shi, Wen-Ni Hsieh, Nobuo Yoshinari

Department of Cariology, Endodontology and Periodontology, Matsumoto Dental University

Background and objective: Obesity, quantified by body mass index (BMI), has previously been associated with periodontal disease; however, few studies have examined the relationship between BMI and periodontal inflammation, as assessed by the Periodontal Inflamed Surface Area (PISA) in patients without diabetes mellitus. Obesity-induced mouth breathing may also contribute to periodontal deterioration. This study examined the associations between BMI, plaque control record (PCR), mouth breathing, and PISA in adult periodontal patients in Japan.

Methods: A cross-sectional study was conducted using data from new outpatients at Matsumoto Dental University Hospital. After excluding patients with type 2 diabetes mellitus, 120 participants were included in the final analysis. PISA was calculated and log₁₀-transformed (log-PISA). Simple and multiple linear regression analyses were performed. The association between BMI and mouth breathing was assessed using an independent-samples t-test. This study was approved by the Ethics Committee of Matsumoto Dental University (No. 0383).

Results: The PISA ≥ 500 group showed significantly higher BMIs (23.49 ± 3.86 vs. 21.45 ± 2.86 kg/m², $p = 0.002$) and higher PCR values (65.37 ± 19.12 vs. 53.08 ± 19.42 %, $p = 0.001$) than the PISA < 500 group. Mouth-breathing participants had significantly higher BMIs than those without (23.85 ± 3.69 vs. 22.16 ± 3.48 kg/m², $p = 0.020$). BMI ($\beta = 0.229$, $p = 0.016$) and PCR ($\beta = 0.230$, $p = 0.011$) were independent predictors of log-PISA, whereas mouth breathing was not ($p = 0.762$).

Conclusion: BMI and PCR were independent predictors of periodontal severity. The higher BMI in mouth-breathing participants suggests obesity may indirectly influence periodontal severity through mouth breathing. Weight management and mouth breathing assessment should be incorporated into periodontal care.

GC-04

Salivary CRP for monitoring systemic inflammation after periodontal therapy

Satoshi Sekino^{*1,2}, Shunsuke Takeya¹, Yukihiro Numabe¹

¹Department of Periodontology, The Nippon Dental University School of Life Dentistry at Tokyo,

²General Dentistry, The Nippon Dental University Hospital

Background and objective: Full-mouth non-surgical periodontal treatment induces transient and long-term changes in systemic inflammation, commonly assessed using serum C-reactive protein (CRP). However, blood sampling is invasive and not always suitable for repeated measurements in dental practice. Salivary CRP has been proposed as a non-invasive alternative, but its agreement with blood CRP and its ability to reflect longitudinal changes remain unclear. This study aimed to evaluate whether salivary CRP can serve as a non-invasive biomarker for monitoring systemic inflammatory changes following periodontal therapy.

Materials and Methods: Ten patients with stage III or IV periodontitis (aged 24–62 years) were included. At baseline, periodontal examination and collection of resting saliva and fingertip blood samples were performed. Full-mouth subgingival debridement was conducted using an ultrasonic scaler or Er: YAG laser. Saliva and blood samples were collected at 1 day, 1 month, and 3 months after treatment, and CRP levels were measured at each time point.

Results: Salivary CRP showed strong correlations with blood CRP at all time points ($r = 0.79$ – 0.88). Repeated measures correlation demonstrated a moderate within-individual association ($r_m = 0.68$). Interval-specific correlations varied ($r = 0.28$, -0.45 , and 0.58). Bland-Altman analysis revealed poor agreement with proportional bias.

Conclusion: Salivary CRP does not reflect absolute blood CRP levels but may serve as a practical non-invasive biomarker for monitoring systemic inflammatory changes following periodontal therapy.

GC-05

Systemic Effects of Full-Mouth Debridement Using an Er: YAG Laser

Shunsuke Takeya^{*1}, Satoshi Sekino¹, Naoki Mino², Hajime Suzuki², Manami Tukamoto²,
Yukihiro Numabe¹

¹Department of Periodontology, The Nippon Dental University School of Life Dentistry at Tokyo, ²General Dentistry, The Nippon Dental University Hospital

Background and objective: Full-mouth debridement, a non-surgical periodontal treatment performed on the entire dentition at once, triggers a systemic inflammatory response within the first few hours following the procedure. We believed that we could suppress this by using an Er: YAG laser, which is considered less invasive than conventional instruments. The purpose of this study was to investigate whether the Er: YAG laser reduces systemic effects compared to an ultrasonic scaler on full-mouth debridement.

Materials and Methods: This study included patients with periodontitis who visited the Department of General Dentistry at Nippon Dental University Hospital. Following oral hygiene instruction, patients were randomly assigned to receive either ultrasonic scaling (control group) or Er: YAG laser treatment (Erwin Advel 5, Morita) (test group) for full-mouth debridement. CRP levels in saliva were measured preoperatively, on day 1, at 1 month, and at 3 months.

Results: The trial period has concluded for the 10 participants in the control group and the 11 participants in the test group. Between-group and within-group differences were analyzed using a linear mixed-effects model with baseline values as covariates. Day 1, the estimated mean CRP levels rose to 2,213 pg/mL (95% CI: 1,024–4,780) in the control group and 1,883 pg/mL (95% CI: 871–4,068) in the test group; however, the difference between the groups was not statistically significant ($p = 0.47$).

Conclusion: Based on the current results, the systemic inflammatory response following full-mouth debridement with an Er: YAG laser is comparable to that observed with conventional instruments.

GC-06

Development of a Periodontal Disease AI Analysis for Easy Self-Checking

Tomotaka Kato^{*1}, Natsuki Fujiwara², Norio Kotani³, Tomohisa Ogawa¹

¹Department of General Dentistry, The Nippon Dental University Hospital, ²Fujiwara Dental Clinic, ³Digital Solutions Inc.

Background and objective: Periodontal disease can develop as early as the teens and twenties; therefore, early detection and intervention are critical in this demographic. However, because early-stage periodontal disease is often asymptomatic, opportunities for intervention are sometimes missed. To address this, we developed an IT tool utilizing an AI analysis system for simple periodontal self-checking and evaluated its capability.

Materials and Methods: The study included 52 patients aged 15–24 years who visited a dental clinic between 2019 and 2024. Periodontal tissue of the labial marginal gingiva—from the mandibular right lateral incisor to the left lateral incisor—was evaluated using intraoral frontal photographs. The test group was assessed by an AI system using a four-level scale based on the PMA index. In the control group, a single board-certified periodontist evaluated the same sites using the PMA index. A score of 0 or 1 was defined as “negative” and ≥ 2 as “positive” for periodontal disease. Sensitivity, specificity, and kappa coefficient were calculated. This study was approved by the Ethics Committee of The Nippon Dental University (NDU-T2025-18).

Results: Participants included 36 males and 16 females (mean age: 19.8 years). The AI system had a sensitivity of 0.83, specificity of 0.67, positive predictive value (PPV) of 0.93, negative predictive value (NPV) of 0.44, and a kappa coefficient of 0.42.

Conclusion: The AI analysis system developed in this study demonstrated high sensitivity and PPV, suggesting that it possesses sufficient detection accuracy to serve as a self-checking tool for young people.

GC-07

Oral health-related QOL and pain after periodontal regenerative therapy

Yoshimasa Taketani^{*1}, Jun Takenoya², Reina Hongyo¹, Yusuke Yamane¹, Mabuki Uchinuma¹,
Makiko Ishii¹, Kitetsu Shin³, Joichiro Hayashi¹

¹Division of Periodontology, Department of Oral Biology and Tissue Engineering, Meikai University School of Dentistry, ²Meikai University Post-Doctoral Institute Saitama Dental Clinic,
³Meikai University School of Dentistry

Background and objective: In recent years, the incorporation of patient-centered assessments, including oral health-related quality of life (QOL), alongside conventional clinical assessments, such as attachment level, has been recommended in periodontal treatment. This study proposed to evaluate postoperative patient burden by surveying oral health-related QOL and pain before and after periodontal tissue regeneration therapy.

Materials and Methods: The participants were 104 patients with chronic periodontitis who underwent periodontal regenerative therapy using enamel matrix derivative (EMD), fibroblast growth factor-2 (FGF-2), or open flap debridement as the control group. Oral health-related QOL was assessed using the General Oral Health Assessment Index (GOHAI). Pain was evaluated using a visual analog scale (VAS).

Results: The GOHAI total score decreased significantly on days 3 and 7 in all groups compared to preoperative values. The VAS score increased significantly on day 3 in all groups compared to preoperative levels, and the FGF-2 group showed significantly higher VAS scores than the EMD group on day 14.

Conclusion: These results indicate that periodontal regenerative therapy causes a temporary decline in oral health-related QOL after surgery and that postoperative pain may be more prolonged in the FGF-2 group than in the EMD group. This study suggests the necessity of considering patient burden, such as changes in oral health-related QOL and pain, to decide the procedure for periodontal tissue regeneration therapy.

GC-08

Comprehensive analysis of bacterial-fungal interactions across healthy, gingivitis, and periodontitis

Shunsuke Matsumura^{*1}, Takahiko Shiba¹, Ryota Kobayashi¹, Takahiko Nagai¹, Kouki Takada¹,
Kyaw Ye Yint¹, Lee Chen Yi¹, Toshihiro Nakawaka¹, Eduardo H. de Souza Oliveira²,
Magda Feres², Takanori Iwata¹

¹Department of Periodontology, Graduate School of Medical and Dental Sciences, Institute of Science Tokyo,
²Department of Oral Medicine, Infection, and Immunity, Harvard School of Dental Medicine

Background and objective: Bacterial-fungal interactions may contribute to periodontal pathogenesis. *Candida albicans* facilitates the colonization and survival of *Porphyromonas gingivalis*. We hypothesized that such interkingdom interactions influence periodontal treatment outcomes. This study aimed to characterize bacterial-fungal interactions using RNA-based multi-kingdom analysis.

Materials and Methods: 17 patients who visited the Institute of Science Tokyo Hospital with healthy (H), gingivitis (G), and periodontitis (P) sites in each oral cavity were enrolled. Subgingival plaque and clinical parameters (Pocket probing depth (PPD), Bone resorption (BR), Bleeding on probing (BOP)) were collected before and after treatment. Healing was defined as a negative BOP. Bacterial and fungal RNA was extracted and sequenced; taxa were assigned using SqueezeMeta and the Silva database. Network analysis was performed to reveal the interaction between bacteria and fungi. In addition, Spearman's rank correlation was conducted to see the effect of fungi on clinical parameters.

Results: PPD improved significantly at G and P sites (G: $2.76 \pm 0.44\text{mm}$ – $2.24 \pm 0.44\text{mm}$; P: $5.82 \pm 1.91\text{mm}$ – $3.88 \pm 1.76\text{mm}$), and BR significantly reduced at P sites ($6.87 \pm 3.12\text{mm}$ – $5.15 \pm 2.14\text{mm}$). Healing was achieved in 9 patients. A total of 308 bacterial and 12 fungal taxa were detected. Fungal *Aspergillus* and some bacteria were significantly more abundant before than after treatment. Spearman's rank correlation revealed no significant association between fungal abundance and PPD or BR. However, network analysis revealed a negative correlation between *Porphyromonas* and *Aspergillus* in the pre-treatment non-healing group.

Conclusion: Although fungi alone did not affect PPD or BR, a negative correlation between *Porphyromonas* and *Aspergillus* in the pre-treatment non-healing group suggested that interkingdom interactions may influence periodontal treatment outcomes.

GC-09

Impact of Smoking Cessation on Periodontal Regenerative Therapy: A Propensity Score-Matched Study

Yoshito Ochiai*

Department of Periodontology, Nihon University School of Dentistry at Matsudo

Background and objective: Smoking is known to reduce the effectiveness of periodontal therapy. However, the impact of smoking cessation on the efficacy of periodontal regenerative therapy has not been sufficiently investigated. This study aimed to statistically evaluate the effect of smoking cessation on the outcomes of periodontal regenerative therapy using a propensity score-matched retrospective study.

Materials and Methods: Sites that underwent periodontal regenerative therapy at Nihon University School of Dentistry at Matsudo Hospital between February 2017 and June 2024 were included in subjects. Clinical parameters and smoking information were extracted from electronic medical records. After propensity score matching, outcomes were compared between current and former smokers. The primary outcome was radiographic bone fill (RBF, %) at 12 months postoperatively, and the secondaries were clinical attachment level (CAL, mm) gain and probing depth (PD, mm) reduction.

Results: A total of 30 subjects (15 current and 15 former smokers) were matched. RBF was 34.4 ± 20.0 in current smokers and 56.5 ± 27.6 in former smokers. CAL gain and PD reduction were 2.07 ± 1.39 and 2.67 ± 1.76 in current smokers, and 3.07 ± 1.39 and 2.87 ± 1.46 in former smokers, respectively. Multivariable regression analysis showed that RBF was significantly higher in former smokers (regression coefficient: 23.5, 95% confidence interval: 4.15–42.7). In contrast, no significant differences were observed between the groups in CAL gain or PD reduction.

Conclusion: Although there are limitations to the research design, the present findings suggested that smoking cessation increases bone regeneration by 23.5%.

GC-10

Amelotin in Saliva reflected bleeding on probing in SPT

Misaki Matsuzaki^{*1}, Yoshito Ochiai¹, Takumi Morita¹, Kazuma Igarashi¹, Masatomo Wada¹, Yumi Saito^{1,2}, Arisa Yamaguchi^{1,2}, Mizuho Yamazaki-Takai^{1,2}, Hideki Takai^{1,2}, Yorimasa Ogata^{1,2}, Yohei Nakayama^{1,2}

¹Department of Periodontology, Nihon University School of Dentistry at Matsudo, Matsudo, Japan, ²Research Institute of Oral Science, Nihon University School of Dentistry at Matsudo, Matsudo, Japan.

Background and objective: The expression of gingival junctional epithelium (JE)-associated genes, including amelotin (AMTN), odontogenic ameloblast-associated protein (ODAM), and follicular dendritic cell secretory protein (FDC-SP), increases during inflammation. However, their association with clinical parameters remains unclear. This study investigated this association using human saliva.

Materials and Methods: This study included 101 patients with chronic periodontitis undergoing supportive periodontal therapy (SPT) at Nihon University School of Dentistry at Matsudo Hospital. Real-time PCR was performed using RNA from saliva to analyze the mRNA expression levels of JE-related genes. Relation between RNA levels and clinical parameters were analyzed by Spearman's rank correlation, multiple regression, and ROC curves.

Results: After adjusting undetectable values of RNA levels, Spearman's rank correlation analysis revealed a weak positive correlation between AMTN expression and bleeding on probing (BOP) rate, periodontal inflammation surface area, the proportion of probing depth 4–5 mm. No significant correlations were observed between ODA or FDC-SP expression and periodontal clinical parameters. Multiple regression analysis, with these clinical parameters as dependent variables and JE-associated genes as independent variables, revealed a weak positive correlation between AMTN expression levels and the BOP rate. In a multiple regression analysis with the dependent and independent variables reversed, AMTN expression also showed a weak positive correlation with the BOP rate. ROC curve revealed that AMTN expression was a significant predictor of the 9% BOP rate threshold.

Conclusion: The expression of AMTN in saliva has been suggested as a potential adjunctive marker for assessing the activity of periodontitis in patients with SPT.

GC-11

Comparison of wound healing by biochemical evaluation between EMD and rhFGF-2 procedures

Takumi Morita*

Department of Periodontology, Nihon University School of Dentistry at Matsudo

Background: Enamel matrix derivative (EMD) is widely used not only in periodontal tissue regeneration therapy but also promotion of wound healing. Recombinant human basic fibroblast growth factor (rhFGF-2) similarly promotes periodontal tissue regeneration. This prospective study aims to biochemically compare wound healing status by analyzing inflammation, cellular migration, and immune response in gingival crevicular fluid (GCF) between EMD and rhFGF-2.

Materials and Methods: Subjects were treated the application of EMD or rhFGF-2 at Nihon University School of Dentistry at Matsudo Hospital, the sites had probing depths (PD) ≥ 4 mm and bone defect depths ≥ 3 mm after initial periodontal therapies. GCF was collected by inserting a paper point into the target site on four occasions, before surgery (baseline; BL), at disinfection (2 and 7 days after surgery), and at suture removal. Interleukin-1 β (IL-1 β), IL-8, and cluster of differentiation (CD) 68 concentrations in GCF were measured by ELISA.

Results: IL-1 β concentrations decreased significantly in both groups from days 2 to 7, and 7 to 14. IL-8 concentrations increased significantly in both groups from BL to day 2, and decreased significantly from day 2 to 7, and 7 to 14. In intergroup comparisons, the rhFGF-2 group showed significantly higher concentrations than the EMD group at all time points. CD68 concentrations decreased significantly in both groups from BL to day 2 with no significant difference between the groups.

Conclusion: rhFGF-2 induced cellular migration via IL-8, suggesting the possibility that rhFGF-2 had an advantage of gingival wound closure in comparison with EMD.

GC-12

Prognostic assessment of tooth survival after treatment of endodontic-periodontal lesions: A retrospective study

Fumihiko Kimura^{*1}, Risako Mikami², Koji Mizutani³, Daisuke Kido³, Kohei Takeda¹, Keita Nakagawa¹, Shu Takemura³, Hiromi Kominato³, Natsumi Saito¹, Tatsuro Seike¹, Eri Sakaniwa¹, Ayu Sugiyama³, Tomoki Nogami³, Satoshi Watanabe⁴, Jun Aida⁵, Takanori Iwata¹

¹Department of Periodontology, Graduate School of Medical and Dental Sciences, Institute of Science Tokyo,

²Department of Advanced Materials, Graduate School of Medical and Dental Sciences, Institute of Science Tokyo,

³Department of General Dentistry, Graduate School of Medical and Dental Sciences, Institute of Science Tokyo,

⁴Department of Pulp Biology and Endodontics, Graduate School of Medical and Dental Sciences, Institute of Science Tokyo, ⁵Department of Dental Public Health, Graduate School of Medical and Dental Sciences, Institute of Science Tokyo

Background and objective: Prognostic assessment of teeth affected by endodontic-periodontal lesions (EPLs) is clinically challenging. This study aimed to identify prognostic factors for EPL-affected teeth by integrating the 2017 World Workshop classification (EPL grade) with a radiographic subclassification (I-J-U) using survival analysis.

Materials and Methods: This retrospective study included 187 EPL-affected teeth in 157 patients treated at a university hospital. EPLs were categorized by EPL grades (1-3) and a radiographic subclassification: I-shape (apical lesion only), J-shape (unilateral proximal defect), and U-shape (bilateral proximal defects). All teeth received standardized endodontic and periodontal therapy. The primary outcome was tooth survival. Cox proportional hazards models and time-dependent receiver operating characteristic (ROC) curves were used to evaluate prognostic accuracy.

Results: During a mean follow-up of 5.8 years, 77 teeth (41.2%) were extracted. Detailed analysis revealed that 96.1% of extractions were disease-related: 70.1% due to disease progression/natural fallout and 26.0% due to non-response to therapy within 6 months. Multivariable analysis identified age, EPL grade, probing pocket depth, and the I-J-U subclassification as significant prognostic factors. Specifically, U-shape defects exhibited a significantly higher risk of tooth loss (HR: 3.65, 95% CI: 1.05 to 12.63) compared to I-shape. The integrated model (EPL grade + I-J-U subclassification) showed superior predictive accuracy for 5-year survival compared to using either classification alone (AUC: 0.82 vs. 0.73 to 0.78).

Conclusion: Integrating the I-J-U subclassification with the EPL grade significantly improves prognostic accuracy. U-shaped bone defects are a critical indicator of poor treatment response and high risk of tooth loss.

Case Report

R-01

Esthetic and Functional Rehabilitation Using Crown Lengthening and Root Submergence: A Case Report

Kosuke Kashiwagi^{*1,2}, Dumitru Gogarnoiu², Howard Fraiman², Masakazu Nishibori¹

¹Private Practice, Tokyo, Japan, ²Department of Periodontics, University of Pennsylvania School of Dental Medicine, Philadelphia, Pennsylvania, USA

Background: Esthetic and functional rehabilitation in the maxillary anterior region is often challenging due to post-extraction alveolar bone resorption and gingival recession. These dimensional changes are particularly pronounced because the facial bone wall in this area is frequently thin, potentially compromising prosthetic outcomes. The root submergence technique has been reported to preserve alveolar ridge contours by maintaining the periodontal ligament, while crown lengthening surgery is commonly used to reestablish biologic width and improve gingival symmetry.

Case: A 50-year-old Spanish female presented to the Department of Periodontics at the University of Pennsylvania School of Dental Medicine in April 2021 with a chief complaint of esthetic disharmony in the maxillary anterior region. Her medical history included controlled hypercholesterolemia and diabetes mellitus, and she was classified as American Society of Anesthesiologists (ASA) physical status II.

Clinical Procedure and Outcomes: Tooth #9 was diagnosed as non-restorable and extraction was initially planned. Following elevation of the mucoperiosteal flap, alveolar bone dehiscence was identified. To minimize post-extraction ridge collapse and preserve esthetic outcomes, the root submergence technique was performed at the #9 site. Healing was uneventful, with no postoperative complications. Pontic site development was initiated two months after surgery, and the definitive prosthesis was delivered six months postoperatively. At the one-year follow-up examination, stable peri-prosthetic soft tissue conditions were observed without biological or esthetic complications.

Conclusion: The combined use of the root submergence technique and crown lengthening surgery may represent a predictable treatment option for achieving esthetic and functional rehabilitation in maxillary anterior cases with alveolar bone dehiscence.

R-02

Regeneration in a Severe Non-Contained Periodontal Defect

Toru Matsuura^{*}

Yamaguchi Stomatological Clinic, Yamaguchi, Japan

Background: Periodontal regenerative therapy in defects with minimal residual bony walls is clinically challenging because space maintenance and wound stability are difficult to achieve. Predictable surgical strategies for managing such defects remain limited.

Case: A 26-year-old systemically healthy, non-smoking female was diagnosed with Stage III, Grade C periodontitis with localized advanced periodontal breakdown in the maxillary right premolar-molar region. Clinical examination revealed localized advanced periodontal breakdown with gingival recession between the maxillary right second premolar and first molar. Cone-beam computed tomography confirmed a severe non-contained periodontal defect with minimal residual bony support. The initial probing depth was 9 mm and persisted at 6 mm following non-surgical periodontal therapy.

Clinical Procedures and Outcomes: Periodontal regenerative therapy was performed using a tunneling-based approach intentionally designed to establish a regenerative envelope through coronal suspension of the interdental papilla in defects lacking bony containment. The flap was elevated without vertical or papillary incisions to preserve vascular supply. The interdental papilla was coronally suspended to enhance wound stability and support the regenerative envelope spatial architecture. Freeze-dried bone allograft hydrated with fibroblast growth factor-2 was placed as a scaffold and covered with a resorbable collagen membrane (Bio-Gide (r)). At the 6-month reevaluation, the site demonstrated reduced probing depth, clinical attachment level gain of up to 5 mm, improvement in gingival recession, and papillary fill. Radiographic assessment, including CBCT, showed increased radiopacity within the defect.

Conclusion: Within the limitations of a single case, this surgical approach may provide a clinically relevant surgical strategy for severe bone defects with limited residual bony support where maintaining regenerative space is inherently challenging.

R-03

Periodontal Regeneration for Cemental Tear During Long-Term Denosumab: 2-Year Outcomes

Daisuke Kido^{*}, Koji Mizutani, Hiroshi Nitta

Department of General Dentistry, Graduate School of Medical and Dental Sciences, Institute of Science Tokyo

Background: This case describes 2-year outcomes of periodontal regenerative therapy for an intrabony defect caused by a cemental tear in an elderly patient who had been undergoing long-term denosumab therapy for osteoporosis.

Case: First visit: March 2022. An 89-year-old woman had undergone subcutaneous denosumab (60 mg) every 6 months since 2015. Preoperative systemic status suggested adequate surgical tolerance (Clinical Frailty Scale, 1; MNA-SF, 13; T-score, -5.6). At baseline, she had 20 teeth. Sites with probing depth (PD) ≥ 4 mm and ≥ 6 mm accounted for 1.7% and 0.8%, respectively, and bleeding on probing (BOP) was 18.3%. Tooth #9 showed an 8-mm PD with BOP and a 2- to 3-wall intrabony defect on radiographs. The diagnosis was localized Stage III, Grade B periodontitis with a cemental tear at #9.

Clinical Procedures and Outcomes: Following Phase I therapy, regenerative surgery using enamel matrix derivative (EMD) was performed 16 weeks after the last denosumab injection. A single-flap approach was applied, limited from the distal of #9 to the distal of #8. Preoperative antibiotics were administered, and strict postoperative plaque and infection control were maintained. PD improved to 3 mm at 6 months postoperatively. Computed tomography demonstrated new bone formation within the defect, and PD remained stable at ≤ 3 mm throughout the 2-year follow-up.

Conclusion: Successful periodontal regeneration in elderly patients on long-term denosumab may require a comprehensive treatment plan integrating: (1) minimally invasive surgery tailored to defect morphology, (2) rigorous wound infection control, and (3) assessment of surgical fitness using objective systemic indices.

R-04

Esthetic crown lengthening and lip repositioning for excessive gingival display

Tasuku Murakami^{*1,2}, Sho Mano^{1,3}, Rio Hisanaga-Mokudai¹, Saki Nakane-Koyachi^{1,2}, Kentaro Imamura^{1,3}, Akihiko Katayama^{1,2}, Atsushi Saito^{1,3}

¹Department of periodontology, Tokyo Dental College, ²Yurakucho Dental Office, ³Oral Health Science Center, Tokyo Dental College

Background: Excessive gingival display (EGD), defined as gingival exposure exceeding 3 mm during smiling, is generally considered to compromise esthetic perception. This report presents a case of EGD associated with altered passive eruption and a hyperactive upper lip, treated with esthetic crown lengthening and lip repositioning.

Case: A 29-year-old woman presented with short-looking teeth and excessive gingival display during smiling. At baseline, gingival display during a full smile was 7 mm, upper lip mobility was 12 mm, and the clinical crown length of the maxillary central incisors was 9 mm, with partial gingival coverage. Radiographic findings revealed a coronally positioned alveolar bone crest in the maxillary anterior region. Based on clinical and radiographic findings, the patient was diagnosed with EGD associated with altered passive eruption (Coslet classification: Type 1-B) and a hyperactive upper lip. The mean probing depth was 2.4 mm, with bleeding on probing (BOP) of 13.1% and a plaque control record (PCR) of 21.4%, indicating plaque-induced gingivitis.

Clinical Procedures and Outcomes: Initial periodontal therapy, including scaling and oral hygiene instruction, improved BOP to 6.0% and PCR to 9.8%. Osseous resective surgery was performed as part of esthetic crown lengthening, followed by gingivoplasty and lip repositioning after 3 months. Postoperatively, the clinical crown length increased to 11 mm, and gingival display was reduced to 0 mm.

Conclusion: The combined surgical approach achieved substantial aesthetic outcomes and high patient satisfaction. While no relapse has been observed to date, long-term follow-up remains essential to confirm the stability of these results.

R-05

Three-year follow-up of furcation involvement treated with rhFGF-2

Saki Nakane-Koyachi^{*1,2}, Sho Mano^{1,3}, Rio Hisanaga-Mokudai¹, Tasuku Murakami^{1,2},
Kentaro Imamura^{1,3}, Akihiko Katayama^{1,2}, Atsushi Saito^{1,3}

¹Department of Periodontology, Tokyo Dental College, ²Yurakucho Dental Office, ³Oral Health Science Center,
Tokyo Dental College, Tokyo, Japan

Background: Furcation involvement (FI) is a critical factor affecting the long-term prognosis of teeth. This report describes a case of periodontitis with furcation involvement (FI) treated with recombinant human fibroblast growth factor (rhFGF)-2, which has maintained favorable clinical outcomes over a three-year follow-up period.

Case: The patient was a 51-year-old man who presented with the chief complaint of gingival bleeding. An initial examination revealed 62.5% of sites with a probing depth (PD) of ≥ 4 mm, plaque control record (PCR) was 87.5%, and the value for periodontal inflamed surface area (PISA) was 3123.2 mm². Radiographic examination revealed generalized horizontal bone resorption. #16 and #37 had Degree 2 FI. A clinical diagnosis of generalized chronic periodontitis (Stage III, Grade C) was made.

Clinical Procedures and Outcomes: Following initial periodontal therapy, we performed periodontal surgery. #16 was treated with a combination therapy, and #37 was treated with FGF-2 alone. For #16, rhFGF-2 mixed with autogenous bone, harvested from the buccal ridge, was applied. At 3 years postoperatively, PD of #16 improved to 3 mm with a clinical attachment level (CAL) gain of 2 mm, PD of #37 improved to 4 mm with a CAL gain of 6 mm. Furthermore, FI in both #16 and #37 improved to Degree 1, and increased opacity at the furcation was observed on radiographs. The PISA improved to 40.9 mm².

Conclusion: In the present case, periodontal regenerative therapy using rhFGF-2 improved the FI and yielded stable periodontal conditions that facilitated a favorable level of plaque control.

R-06

Orthodontically Assisted Interdental Papilla Reconstruction in Severe Periodontitis

Takahiro Ninagi^{*1}, Jumpei Morita²

¹Yokohama West Gate Dental Clinic, ²Department of Skeletal Development and Regenerative Biology, Nagasaki
University Graduate School of Biomedical Sciences

Background: In recent years, the potential for papilla reconstruction using surgical approaches combined with periodontal regenerative therapy and connective tissue grafting has been reported. However, the predictability of papilla reconstruction remains limited, and its success is greatly influenced by local factors such as tooth position and the width of the interdental papilla. In this report, we present a case of interdental papilla loss caused by severe periodontitis in which papilla reconstruction was performed following pre-orthodontic treatment aimed at improving tooth position and interdental papilla width.

Case: A 58-year-old female patient presented in June 2021 with the chief complaint of gingival swelling and suppuration. Clinical examination revealed redness and swelling at teeth #21 and #22, with probing pocket depths of 9 mm, bleeding on probing, suppuration, and Grade I tooth mobility.

Clinical Procedures and Outcomes: At the re-evaluation following initial periodontal therapy, residual periodontal pockets of 7 mm and pronounced gingival erythema were observed at teeth #21 and #22. Open flap debridement was therefore performed to control inflammation and remove granulation tissue. Subsequently, orthodontic treatment including orthodontic extrusion was undertaken to improve alveolar bone and soft tissue levels, increase interdental papilla width, and correct tooth position. Following completion of orthodontic therapy, papilla reconstruction was performed using basic fibroblast growth factor (FGF-2), deproteinized bovine bone mineral (DBBM), and a connective tissue graft (CTG). At 9 months postoperatively, gingival contour was refined using Er: YAG laser-assisted gingivectomy, followed by placement of the final prosthesis.

Conclusion: Pre-orthodontic treatment incorporating orthodontic extrusion improved alveolar bone and soft tissue levels, increased interdental papilla width, and corrected tooth position. These changes facilitated the establishment of a favorable anatomical environment for papilla reconstruction, thereby enhancing its predictability. Within the limitations of a single case, these findings suggest that pre-orthodontic treatment with orthodontic extrusion may be a viable therapeutic approach for interdental papilla loss associated with severe periodontitis.

R-07

Aesthetic Reconstruction of the Interdental Papilla via Subepithelial Connective Tissue Grafting

Yuki Nagase *

Department of Periodontology, Asahi University,

Background and objective: In aesthetic dentistry, all interventions—including periodontal, orthodontic, and prosthetic treatments—must be integrated to achieve both functional excellence and patient satisfaction. Success hinges on the strategic application of advanced dental technologies. This report focuses on the maxillary anterior region, presenting a case where aesthetic harmony and patient satisfaction were restored through a subepithelial connective tissue graft (SCTG)

Materials and Methods: The patient was a 31-year-old female at her initial presentation, presenting with a chief complaint of improving the appearance of non-vital teeth through prosthetic treatment. Following full-arch orthodontic treatment, scaling and root planing (SRP) was performed on sites with residual pocket depths of 4 mm or more. This resulted in gingival recession and the subsequent loss of the interdental papilla between #8 and #9, which were the primary sites scheduled for prosthodontic treatment. To address this, connective tissue was harvested from the distal aspect of #15 and grafted into the maxillary midline area.

Results: Treatment commenced in 2021. Following the completion of orthodontic therapy, the non-vital teeth scheduled for prosthodontics (#7, #9, and #10) were restored with provisional crowns. As tooth #11 remained vital, the patient strongly wished to avoid its preparation. To create a restoration for #9 that was symmetrical to #8, papillary reconstruction was essential. In January 2024, an SCTG was performed to reconstruct the papilla, followed by the final prosthetic treatment. As of March 2026, the clinical outcome remains stable and favorable.

Conclusion: To resolve aesthetic issues such as the “black triangle” encountered in this case, it is necessary to increase gingival volume rather than simply masking the space with long contact areas or over-contoured prosthetics. Achieving this requires the clinician to perform periodontal plastic surgery, alongside the patient’s diligent maintenance of oral hygiene. Close and careful monitoring through regular recall appointments is crucial for ensuring long-term stability.

R-08

The use of shape-memory aligners to improve the success rate of periodontal regenerative therapy

Taiji Suzuki *

SUZUKI DENTAL CLINIC

Background: Periodontal regenerative therapy has seen improved clinical success rates with the introduction of microsurgical techniques. However, the success of regenerative therapy does not depend solely on flap design; pre-treatment factors such as control of inflammation and occlusion are also crucial. In recent years, advances in digital aligner orthodontics have made it possible to optimize tooth position and the surrounding bone environment, thereby facilitating the establishment of conditions suitable for regenerative therapy. This clinical report describes the impact of pre-treatment using digital orthodontics.

Case: The patient was a 49-year-old female who presented with a chief complaint of periodontal treatment. The anterior teeth exhibited an anterior crossbite, and due to the lack of anterior guidance, excessive occlusal forces were applied to the molars, resulting in bone resorption. The condition was diagnosed as Stage III, Grade B periodontitis.

Clinical Procedures and Outcomes: Initial periodontal therapy and orthodontic treatment were performed to control inflammation and occlusion. Upon re-evaluation, periodontal regenerative therapy was carried out for the residual periodontal pockets. In the anterior region, tooth axis was controlled using aligner orthodontics to establish an optimal environment, allowing simultaneous periodontal regeneration and root coverage procedures. At present, the periodontal tissues are stable, and the patient is under supportive periodontal therapy (SPT).

Conclusion: Pre-treatment combined with digital orthodontics resulted in improvements in tooth axis and occlusion, as well as the creation of adequate space at the bone defect site. Consequently, favorable primary wound closure was achieved. Clinically, a reduction in probing depth and a gain in clinical attachment were observed. These findings suggest that pre-treatment using digital orthodontics is an effective approach to enhance the predictability of periodontal regenerative therapy.

R-09

19-Year Management: Regenerative and Orthodontic Therapy for Stage III Grade C

Riichiro Tamaki*

Tamaki Dental Clinic

Background: Long-term periodontal stability in patients with severe, rapidly progressing periodontitis is clinically challenging. This case report describes the 19-year follow-up of a Stage III Grade C periodontitis patient treated with periodontal regenerative therapy and comprehensive orthodontic treatment.

Case: A 37-year-old female presented in February 2004 complaining of gingival suppuration. Clinical examination revealed a Plaque Control Record (PCR) of 3%, Bleeding on Probing (BOP) of 79%, and probing pocket depths (PPD) of 4–9 mm. Radiographs showed generalized horizontal and vertical bone resorption, particularly in the anterior regions (1/2–2/3 bone loss). Familial aggregation and occlusal interference were confirmed. The diagnosis was Stage III Grade C periodontitis.

Clinical Procedures and Outcomes: Following initial periodontal therapy, periodontal regenerative therapy using enamel matrix derivative was performed. After re-evaluation confirmed all PPD ≤ 3 mm, comprehensive orthodontic treatment was initiated following the extraction of all first premolars. Following the completion of orthodontic treatment in January 2007, the patient transitioned to periodontal maintenance.

Conclusion: This case demonstrates the efficacy of combining regenerative therapy with orthodontic treatment and highlights the importance of eliminating etiologic and risk factors. Radiographs show significant periodontal regeneration and a distinct lamina dura, which have been maintained for 19 years. Key factors for long-term stability include (1) maintenance of arch continuity, (2) avoidance of prosthetic splinting to ensure self-cleansing and prevent secondary caries, and (3) presence of only one non-vital tooth. However, the most critical factor was the consistent plaque control maintained by both the patient and the clinician.

R-10

A Novel 360-degree Reconstructive Approach for Cairo RT3 Gingival Recession: Synergizing a Coronally Advanced Palatal Flap with the modified PFT Technique

Tokihisa Mizokami*

Mizokami Dental Office

Background and Objective: Cairo Recession Type 3 (RT3) defects, especially with horizontal bone loss, represent the convergence of two historic periodontal challenges: root coverage and interproximal regeneration. Therefore, a comprehensive, 3D surgical approach is required to optimize blood supply and tissue stability in these compromised sites. Informed consent was obtained.

Materials and Methods: This report introduces a comprehensive “360-degree” protocol. The core innovation is the coronally advanced palatal flap (CAPF) via a novel full-thickness flap, designed to overcome the anatomical limitations of RT3. The incision begins with a vertical releasing incision at the mesial line angle of the tooth situated more than one position mesial to the target tooth, then curves distally to run horizontally at a safe distance from the greater palatine artery (GPA) until more than one position distal to the target tooth. This is synergized with a buccal modified partial-full-thickness (PFT) tunnel and a specific access incision designed for vascular preservation. Basic fibroblast growth factor (b-FGF) and carbonate apatite (CO3 Ap) were used to induce “supraalveolar attachment gain.”

Results: Significant simultaneous improvement of horizontal bone levels and RT3 recession was achieved, bridging the gap between soft tissue coverage and hard tissue regeneration.

Conclusion: This case demonstrates the efficacy of CAPF, which safely enables palatal coronal displacement by protecting the GPA. This approach holds the potential to serve as a novel paradigm for managing complex periodontal defects, including severe RT3 defects previously considered untreatable.

R-11

Saving Hopeless Teeth via Intentional Replantation with Flapless Approach

HiroYuki Saida *

Kanto Branch, Japanese Academy of Clinical Periodontology, Saida Dental Clinic, Department of General Dentistry, Institute of Science Tokyo

Background: Teeth with severe periodontal destruction extending beyond the root apex are generally considered to have a poor prognosis and are often indicated for extraction. However, some of these teeth present with residual periodontal attachment and limited mobility. This report describes two cases of periodontally compromised teeth successfully preserved long-term, more than 10 years, using intentional replantation with enamel matrix derivative (EMD).

Cases: Case 1: A 60-year-old non-smoking male with Stage IV, Grade C periodontitis presented with a mandibular left canine:#33 exhibiting probing depth (PD) of 15 mm and mobility Grade II.

Case 2: A 49-year-old non-smoking male with Stage IV, Grade C periodontitis presented with a maxillary left central incisor:#21 with PD of 15 mm and mobility Grade II.

Clinical Procedures and Outcomes: In both cases, endodontic therapy failed to resolve periodontal breakdown, leading to a diagnosis of perio-endo lesions of periodontal origin. Intentional replantation was performed to enable extraoral debridement while preserving viable periodontal ligament. EMD was applied to the defect prior to replantation. Case 1 underwent rigid fixation followed by free gingival grafting at 2 years; Case 2 received semi-rigid fixation. Both cases demonstrated marked clinical improvement, with PD reduced to ≤ 3 mm. Favorable outcomes were maintained over 10 and 13 years, respectively.

Conclusion: Intentional replantation with EMD may enable long-term retention of teeth previously considered hopeless, suggesting a paradigm shift in treatment decision-making for advanced periodontal destruction.

R-12

Periodontal Regenerative Therapy for Endodontic-Periodontal Lesion with Furcation Involvement

Yoshimune Iwata*, Masami Ninomiya, Daisuke Nakamura, Hiromichi Yumoto

Department of Periodontology and Endodontology, Tokushima University Graduate School of Biomedical Sciences

Background: Endodontic-periodontal lesions (EPLs) with furcation involvement are difficult to manage and often have an unfavorable prognosis due to the anatomical complexity of the furcation area and the combined effects of periodontal and endodontic infections. This report describes a mandibular molar with an EPL and furcation involvement that was successfully treated with periodontal regenerative therapy using basic fibroblast growth factor (FGF)-2 and carbonate apatite following endodontic treatment.

Case: A 45-year-old man presented with gingival swelling at #46. He had previously undergone incision and received antimicrobial therapy at a local clinic; however, the lesion recurred repeatedly. The initial examination showed gingival redness, swelling, and a sinus tract at #46. The maximum probing pocket depth was 8 mm at the distobuccal site, with bleeding on probing, slight tenderness to percussion, and Miller Class I mobility. Radiographs revealed a radiolucent lesion extending from the furcation to the distal root. The diagnosis was an EPL (Class III) with degree II furcation involvement at #46 and generalized periodontitis (Stage III, Grade B).

Clinical Procedures and Outcomes: After initial periodontal therapy and endodontic treatment of #46, periodontal regenerative surgery using FGF-2 combined with carbonate apatite was performed. Postoperatively, radiographic bone fill was evident, the probing pocket depth improved to within 3 mm, and periodontal stability was maintained with resolution of inflammation.

Conclusion: This case suggests that the combined use of FGF-2 and carbonate apatite following endodontic treatment may provide a favorable regenerative environment and contribute to tooth preservation in EPLs with furcation involvement.

R-13

Treatment of Gingival Recession Using the VISTA Technique with Connective Tissue Graft Harvested from the Maxillary Tuberosity: A Case Report

Takafumi Ueyama *

Ueyama Dental Clinic, Miyazaki, Japan

Background and objective: Gingival recession may result in esthetic concerns, hypersensitivity, and root caries. The VISTA technique (Vestibular Incision Subperiosteal Tunnel Access) is a minimally invasive approach that preserves papillary integrity and enhances soft tissue management.

While connective tissue grafts are typically harvested from the palate, the maxillary tuberosity provides dense and thick tissue, which may improve soft tissue volume and long-term stability.

I hereby report a case of gingival recession treated using the VISTA technique combined with a connective tissue graft harvested from the maxillary tuberosity.

Materials and Methods: A minimally invasive approach using the VISTA technique was performed, involving a vestibular access incision, subperiosteal tunnel preparation beyond the mucogingival junction, root surface debridement, placement of a connective tissue graft harvested from the maxillary tuberosity, and coronal advancement with stabilization of the gingival margin.

Results: The procedure was achieved significant root coverage with increased gingival thickness and keratinized tissue width, resulting in a stable soft tissue contour with favorable esthetic integration and minimal donor site morbidity.

Conclusion: The VISTA technique combined with a connective tissue graft harvested from the maxillary tuberosity provides a minimally invasive and effective approach for the treatment of gingival recession.

The use of tuberosity-derived grafts may enhance soft tissue thickness and support favorable clinical and esthetic outcomes.

R-14

Minimally Invasive Periodontal Regenerative Therapy for Stage III, Grade C Periodontitis: A Case Report

Ryuichi Shirane *

JACP Kanto branch

Background and objective: Flap designs in periodontal regenerative therapy have evolved toward minimally invasive approaches. For patients diagnosed with Stage III, Grade C periodontitis (formerly aggressive periodontitis), advanced surgical intervention by specialists is essential. This report presents a case of generalized vertical bone defects treated with minimally invasive regenerative procedures, achieving favorable clinical outcomes.

Materials and Methods: A 33-year-old male presented with a chief complaint of swelling in the mandibular anterior region. Clinical examination revealed deep probing pocket depths (PPD) and vertical bone defects throughout the dentition. Notably, the distal aspect of #31 exhibited severe inflammation with a 9 mm PPD. Additionally, malocclusion, including crowding and crossbite, was observed in both arches.

Results: Following intensive initial periodontal therapy to resolve severe inflammation, surgical intervention was performed. To prevent gingival recession at #31, the Non-incised Papilla Surgical Approach (NIPSA) was selected. Periodontal regeneration was executed using fibroblast growth factor-2 (FGF-2) and carbonate apatite. At the 2-year follow-up, #31 showed no gingival recession, PPD was reduced to 2 mm, and radiographs confirmed increased radiopacity. MIST-treated molar sites also maintained stable tissue regeneration. Full-mouth orthodontic treatment is currently underway to establish a stable occlusion.

Conclusion: Minimally invasive flap designs are highly effective for treating Stage III, Grade C periodontitis. Specifically, techniques that preserve the interdental papilla, such as NIPSA, minimize post-operative gingival recession in the esthetic zone and significantly contribute to the long-term prognosis of regenerative therapy.

R-15

A case of Stage IV Grade C periodontitis with occlusal reconstruction through periodontal therapy, orthodontic treatment, and periodontal prosthetics: 10-year follow-up

Haru Yoneda *

Tsuchida Dental Clinic

Background: Severe periodontitis may involve pathologic tooth migration, leading to esthetic dissatisfaction and occlusal and masticatory disturbance. Comprehensive dental care is essential for restoring a dentition with significant occlusal collapse. In this case, implants were used to restore occlusal support after periodontal therapy and served as an anchorage for orthodontic treatment. Subsequently, periodontal prosthetics were performed for occlusal reconstruction. We report this case which has been maintained for 10 years through supportive periodontal therapy (SPT).

Case: A 46-year-old male smoker with no significant medical history. The patient was diagnosed with Stage IV Grade C periodontitis. He presented with a chief complaint of esthetic and masticatory dysfunction and requested tooth preservation. Significant occlusal collapse accompanied by pathologic tooth wandering was observed.

Clinical Procedures and Outcomes: Inflammation was controlled through oral hygiene care, scaling and root planing (SRP), and periodontal surgery. While initiating orthodontic treatment, implants for occlusal support were placed in the molar region. These were used for the control of occlusal interference and as an anchorage for orthodontic treatment. After completion of orthodontic treatment, periodontal prosthetics were performed, and SPT has been continued. Not only has esthetics been restored, but masticatory function, periodontal tissue, and occlusion have also stabilized. A radiograph taken 10 years post-treatment shows a clear lamina dura and no evidence of periodontal disease progression.

Conclusion: Restoring occlusal support with implants during orthodontic treatment facilitated the control of occlusal interference and smooth treatment progression. The recovery of esthetics and masticatory function significantly improved the patient's quality of life (QOL). Adherence to SPT every 2 to 3 months over the past 10 years is suggested to have contributed to these favorable long-term results.

Dental Hygiene

H-01

A case report of localized aggressive periodontitis treated with oral hygiene instruction after FOP

Minami Hiramama*, Ryota Kobayashi

Shimizu Dental Clinic, Tokyo, Japan

Background and objective: Aggressive periodontitis often leads to rapid tissue destruction in young patients, making the management of residual pockets after surgical intervention a critical factor for long-term prognosis. This report describes a case of localized aggressive periodontitis (Stage III, Grade B) where a tailored approach to oral hygiene, specifically addressing anatomically challenging areas for self-care after periodontal surgery, led to significant clinical improvement from a dental hygienist's perspective.

Materials and Methods: The patient, a 27-year-old male, presented with spontaneous bleeding in the maxillary anterior region. Initial examination showed generalized marginal gingival redness and edematous papillary swelling, with a 65% bleeding on probing (BOP) rate. Despite flap surgery (FOP) following basic therapy, 6–7 mm pockets and plaque stagnation persisted at the palatal aspect of #16–17. Rather than focusing solely on overall plaque scores, we re-evaluated the patient's specific cleaning techniques. Recognizing the anatomical challenges, we provided targeted instruction on interdental brush size selection and demonstrated a palatal insertion technique to ensure the brush reached the base of the pocket.

Results: The 6 mm pocket with persistent BOP at #16–17 significantly improved to 4 mm, and gingival inflammation was eradicated once the patient understood the localized risks and established a consistent habit of targeted interdental cleaning.

Conclusion: This case highlights that managing residual pockets requires a customized approach addressing specific anatomical risks. For dental hygienists, supporting the habituation of precise self-care during Supportive Periodontal Therapy (SPT) is essential for maintaining periodontal stability.

H-02

Adjunctive equol supplementation for managing painful oral mucous membrane pemphigoid

Aki Kawamoto^{*1}, Naoyuki Sugano^{2,3}, Aki Yamamoto¹, Masako Sakai¹, Takashi Onizawa²,
Jumi Nakata^{4,5}, Noboru Noma⁴, Shuichi Sato^{2,3}

¹Dental Hygienist Section, Nihon University School of Dentistry Dental Hospital, ²Department of Periodontology, Nihon University School of Dentistry, ³Division of Advanced Medical Research, Nihon University School of Dentistry, Research Institute of Oral Science, ⁴Department of Oral Medicine, Nihon University School of Dentistry, ⁵Department of General Medicine and Gastroenterology, Musashino Tokushukai Hospital, Tokyo, Japan

Background: Mucous membrane pemphigoid (MMP) is a chronic autoimmune disorder caused by autoantibodies directed against the epithelial basement membrane zone, most notably BP180. Clinically, MMP is characterized by tense blisters that often rupture to form erosive lesions and may result in scarring. Periodontal management in patients with painful oral MMP remains challenging. Therefore, this report explored whether equol supplementation may support periodontal management by improving gingival tolerance and facilitating oral self-care in painful oral MMP.

Cases: Case 1 was a 72-year-old woman who presented with a primary symptom of gingival and mucosal sensitivity to spicy foods. Case 2 was a 74-year-old woman who presented with daily gingival blister formation accompanied by pain during toothbrushing. Both patients were non-equol producers and were diagnosed with generalized periodontitis (Stage II, Grade A). Due to difficulty with self-care caused by pain, plaque control was poor, and high levels of bleeding on probing (BOP) were observed.

Clinical Procedures and Outcomes: Non-surgical periodontal therapy was initiated, including scaling, root planing, and oral hygiene instruction was provided using the scrubbing technique with a soft-bristle toothbrush and sodium lauryl sulfate-free toothpaste. In addition, equol supplementation (10 mg/day) was initiated and continued for 24 months. As gingival pain gradually improved, the areas that patients were able to brush expanded, resulting in reductions in the O'Leary plaque control record and BOP.

Conclusion: These findings suggest that equol supplementation may be a useful adjunct for improving gingival tolerance and facilitating oral self-care in patients with painful oral MMP.

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