Korean Division of the International Association for Dental Research

PROGRAM and ABSTRACTS

The 41ST Annual Academic Session
The 39th General Meeting

September 22nd, 2022
오스템 임플란트 마곡중앙연구소

국제치과연구학회 한국지부회

IADR 본부 임원 (2022)

▣ 회장인사 ▣

KADR-JADR Joint Meeting 및 제41차 KADR 학술대회에 회원은 물론 평소 치과 임상과 연구에 관심을 가지고 계신 치과의사 여러분들을 진심으로 초대합니다!

국제치과연구학회 (IADR)는 인류의 건강과 복지를 위해 치아, 구강 및 두개악안면에 관한 연구를 선도한다는 미션을 가지고 설립된 학회이며, 임상과 기초를 아우르는 치의학 분야에서 가장 권위 있고 가장 많은 임상가와 치의학 연구자들이 참여하는 학술 단체입니다. 우리 한국지부 (KADR) 또한, 국내의 많은 연구자들과 신진 학자 및 학생들에게 IADR를 소개하고 참여할 수 있는 기회를 제공하고 있는 임상과 기초가 함께하는 학술 단체입니다.

아직도 코로나19의 영향으로 인해 예전과 같은 대면 학술대회는 지양하는 사회적 분위기와 그럼에도 불구하고 학회의 학술 활동은 지속되어야 하고 우리들의 만남 또한 이어져야 한다는 회원들의 열망을 담아서 부득이 하이브리드 학술대회를 준비하게 되었습니다.

On-Line으로 실시되는 KADR-JADR Joint Meeting은 "Understanding and Intervention of Maxillofacial and Dental Disease" 라는 주제하에 한일 양국의 치과 연구분야의 석학과 차세대 Leader들을 모시고 그들의 최신 지견을 통해서, 치과계의 현주소와 미래 방향에 대한 의견을 토론하는 장이 될 것입니다.

그리고, 현장 대면 학술대회로 진행되는 KADR 제41차 학술대회는 치협학술대상을 수상하신 서울치대 민병무 명예교수님의 특강을 포함해서 다양한 주제하의 여러 연자들의 강연이 준비되어 있습니다. 그리고 Hatton Award와 범호신인학술상을 위한 젊은 연구자들의 경연 그리고 E-poster 경연 또한 많은 흥미와 볼거리를 제공해 줄 것입니다.

이틀에 걸쳐 진행되는 금번 학술대회를 통해서 치과의 임상과 연구에 관한 최신 지견을 생동감 있게 느껴보시고, 젊은 치의학도들의 증례 및 연구발표를 통해서 미래 치의학을 예견해볼 수 있는 기회가 될 것으로 기대합니다. 부디 많은 동참을 통해서, 선배로서 동료로서 의미 있는 관심과 격려 부탁드립니다.

우리 KADR은 융합 치의학 심포지엄을 통한 4차산업시대에 걸맞은 인재를 양성함으로써 치과계의 새로운 성장동력을 이끌도록 노력함은 물론, IADR 산하에 있는 다양한 연구그룹 활동에 KADR의 연구자들이 주도적으로 참여하여 우리나라의 치과계 위상에 걸맞는 국제활동을 이어 나가도록 지속적으로 노력하겠습니다.

끝으로 이번 학술대회 준비를 위해 수고해주신 학회 임원과 위원들께 감사의 말씀을 전합니다.

2022. 9. 22.

회장 **권 긍 록**

▣ KADR-JADR Joint Symposium ▣

Sep. 22nd (Thursday)
Venue: Osstem Implant Magok Central Research Institute and Online
Moderator: Prof. Jae-Sung Kwon

Time	Details
08:50 ~ 09:00	Registration
09:00 ~ 09:10	Opening Ceremony and Remarks (President of KADR and JADR)
Special Lectures (Chair: President of KADR, Prof. KR Kwon and Director of JADR, Prof. Kazunori Ikebe)	
09:10 ~ 09:50	Invited JADR President Lecture (JADR President, Prof. Seiji Nakamura)
09:50 ~ 10:40	Special Lecture (Academic Director of KADR, Prof. Ji-Marn Park)
10:40 ~ 10:50	Coffee Break
KADR-JADR Joint Symposium Invited Speech “Understanding and Intervention of Maxillofacial and Dental Disease” (Chair: Academic Director of KADR, Prof. Jin-Soo Ahn and Director of JADR, Prof. Prof. Hiroshi Egusa)	
10:50 ~ 11:20	Speaker 1 from Japan Prof. Takashi Nakamura, Tohoku University Graduate School of Dentistry
11:20 ~ 11:50	Speaker 1 from Korea Prof. Sang-Woo Lee, Seoul National University
11:50 ~ 12:20	Speaker 2 from Japan, Prof. Takuya Ogawa, Tokyo Medical and Dental University
12:20 ~ 12:50	Speaker 2 from Korea Prof. Sung-Hwan Choi, Yonsei University
12:50 ~ 13:00	Closing Ceremony/Remark (President of KADR and Director of JADR)
13:00 ~	Lunch

The Venue

오스템 임플란트 마곡중앙연구소 (강서구 마곡중앙12로 3)

오시는 길

주소 서울 강서구 마곡중앙12로 3

전화 TEL) 02-2016-7000, FAX) 02-2016-7001

주변 지하철

9 마곡나루역 공항 마곡나루역 9 신방화역 5 마곡역

주변 정류장

① 마곡나루역 ② 마곡나루역2번출구 ③ 마곡나루역1번출구 ④ 롯데R&D센터

주변 버스

지선 6642 | 6645 | 6648

간선 N65(심야)

마을 강서05-1

▣ KADR-JADR Joint Meeting & 제41차 KADR 학술대회 ▣
및 제39차 정기총회 일정

일시: 2022년 9월 22일 (목) ~ 23일 (금)
장소: 오스템 임플란트 마곡중앙연구소 강당 및 제4세미나실 (서울 강서구 마곡중앙12로 3)

9월 22일 (목) KADR-JADR Joint Meeting (온라인 중계, 강당)
Sep. 22nd (Thursday)
Moderator: Prof. Jae-Sung Kwon

Time	Details
08:50 ~ 09:00	Registration
09:00 ~ 09:10	Opening Ceremony and Remarks (President of KADR and JADR)
Special Lectures (Chair: President of KADR, Prof. KR Kwon and Director of JADR, Prof. Kazunori Ikebe)	
09:10 ~ 09:50	Invited JADR President Lecture (JADR President, Prof. Seiji Nakamura)
09:50 ~ 10:40	Special Lecture (Academic Director of KADR, Prof. Ji-Marn Park)
10:40 ~ 10:50	Coffee Break
KADR-JADR Joint Symposium Invited Speech "Understanding and Intervention of Maxillofacial and Dental Disease" (Chair: Academic Director of KADR, Prof. Jin-Soo Ahn and Director of JADR, Prof. Prof. Hiroshi Egusa)	
10:50 ~ 11:20	Speaker 1 from Japan Prof. Takashi Nakamura, Tohoku University Graduate School of Dentistry
11:20 ~ 11:50	Speaker 1 from Korea Prof. Sang-Woo Lee, Seoul National University
11:50 ~ 12:20	Speaker 2 from Japan, Prof. Takuya Ogawa, Tokyo Medical and Dental University
12:20 ~ 12:50	Speaker 2 from Korea Prof. Sung-Hwan Choi, Yonsei University
12:50 ~ 13:00	Closing Ceremony/Remark (President of KADR and Director of JADR)
13:00 ~	Lunch

9월 22일 (목) 제41차 KADR 학술대회 및 제39차 총회(1) - 강당 및 제4세미나실

<table>
<tr><th>시간</th><th colspan="2">내용</th></tr>
<tr><td>11:00 ~ 12:50</td><td colspan="2">Johnson and Johnson Competition and Award
(제4세미나실)
좌장/심사위원: KADR 학술이사 박지만 교수, KADR 국제이사 장일호 교수</td></tr>
<tr><td>14:00 ~ 14:30</td><td colspan="2">등록/부스 운영 시작</td></tr>
<tr><td>14:30 ~ 14:40</td><td colspan="2">개회사 (강당) 차기회장님(유용욱 교수님)</td></tr>
<tr><td>14:40 ~ 15:20</td><td colspan="2">Plenary (1) 특강 - 대한치과의사협회 학술상 서울대학교 민병무 명예교수
(강당 혹은 온라인, 좌장: KADR 회장 권긍록 교수)</td></tr>
<tr><td>15:20 ~ 15:30</td><td colspan="2">휴식</td></tr>
<tr><td></td><td>좌장: KADR 국제이사 김규태 교수,
KADR 섭외홍보이사 전상호 교수</td><td>좌장/심사위원: KADR 학술이사 안진수 교수, KADR 학술이사 권재성 교수</td></tr>
<tr><td>15:30 ~ 16:00</td><td>특강 1 (강당) - 전북대학교 민경산 교수</td><td rowspan="3">Hatton Award (범호신인학술상)
(제4세미나실)</td></tr>
<tr><td>16:00 ~ 16:30</td><td>특강 2 (강당) - 경희대학교 홍성진 교수</td></tr>
<tr><td>16:30 ~ 17:40</td><td>범부처의료기기사업단-KADR 공동 학술교류행사 (강당) - 아래 추가 정보</td></tr>
<tr><td>18:00 ~</td><td colspan="2">Banquet (메리어트 호텔) 초청자에 한함</td></tr>
</table>

9월 23일 (금) 제41차 KADR 학술대회 및 제39차 총회(2) – 강당

시간	내용
09:00 ~ 09:30	등록 및 포스터 설치
09:30 ~ 10:10	Plenary (2) 특강 - 연송치의학학술상 치의학수상자 연세대 한상선 교수 (강당, 좌장: KADR 학술이사 박지만 교수)
10:10 ~ 11:10	포스터 발표 (홀) 심사: KADR 공보이사 이동운 교수, KADR 정보통신이사 김진만 교수
11:10 ~ 11:20	휴식
좌장: KADR 부회장 김형룡 교수, KADR 재무이사 김경아 교수	
11:20 ~ 11:50	특강 3(강당) - 연세대학교 미래캠퍼스 한선영 교수
11:50 ~ 12:20	특강 4(강당) - 경북대학교 치과재료 박찬호 교수
12:20 ~ 13:00	시상식 및 총회 (권긍록 회장님)

범부처의료기기사업단–국제치과연구학회(KADR) 공동 학술교류행사 (연자, 토론자 확정)

사회(좌장) : 김법민 단장 (범부처전주기의료기기연구개발사업단), 박지만 교수 (KADR 학술이사, 서울대학교 보철과)

	연자	소속	제목	시간 배정	비고
1 부	전기영	범부처전주기의료기기 연구개발사업단 본부장	치과 의료기기 개발의 범부처전주기의료기기 연구개발사업단 지원 사업 소개 및 향후 추진 방향	10 분	
	장현양	㈜대양덴텍 대표	치과의료기기의 맞춤형 표준개발 및 역량 강화 연구	10 분	사업단 수행 과제
	홍석원	부산대학교 교수	구강질환 조기 진단·치료를 위한 생체분자 인식 소재기반 스마트 구강건강 모니터링 시스템 개발	10 분	사업단 수행 과제
	송주동	㈜오스템임플란트 이사	치아결손으로 심미 및 저작기능 회복을 위해 임플란트 식립이 필요한 자를 대상으로 특수재질 치과용 임플란트 고정체의 유효성 및 안전성을 비교 평가하기 위한 다기관, 단일눈가림, 전향적, 무작위배정, 비교, 확증 임상시험	10 분	사업단 수행 과제
2 부	전기영[a], 윤정호[b], 허중보[c], 김선영[d], 장현양[e], 홍석원[f], 송주동[g]		국산 치과 의료기기 개발과 임상적용의 발전을 위한 토론	30분	

a) 전기영 본부장 (범부처전주기의료기기연구개발사업단 R&D 운영본부),
b) 윤정호 교수 (KADR 총무이사, 전북대학교 치주과)
c) 허중보 교수 (KADR 기획이사, 부산대학교 보철과)
d) 김선영 교수 (KADR 기획이사, 서울대학교 보존과)
e) 장현양 대표 (㈜대양덴텍)
f) 홍석원 교수 (인천대학교)
g) 송주동 이사 (㈜오스템임플란트)

1. 초록 접수 안내

가. KADR 홈페이지 (www.iadr.or.kr)의 공지사항에서 초록 양식 다운로드(아래 첨부)
나. 제출처: 학술이사 권재성 교수 (연세대학교 치과대학), jkwon@yuhs.ac로 제출
다. 마감: 2022년 9월 13일(화요일) 까지
라: **초록발표자는 현장등록 불가입니다. 기한 내에 사전등록을 하시기 바랍니다.**

2. 등록 안내

가. 등록기간 : 9월 13일(화)까지
나. 등록계좌번호: 신한은행 100-031-937149 국제치과연구학회한국지부회

* 송금 시에는 반드시 성명과 소속기관이 명시되도록 하시기 바랍니다. (예, 홍길동(서울대))
* 송금 후에는 확인을 위하여 송금액, 회원 ID, 성명(영문 및 국문), 소속기관, 전화번호, 전자메일주소를 k2aortho@khu.ac.kr (재무이사 김경아 교수)로 보내주시기 바랍니다.

		사전등록 (9월13일까지)	현장등록
2022 & 2023 회원	일반회원	6 만원	8 만원
	학생회원	3 만원	5 만원
비회원	일반, 교수 비회원	8 만원	10 만원
	학생비회원	5 만원	7 만원
치과대학/치의학대학원 학부생		1 만원	1 만원

3. 포스터 발표안내

포스터 발표는 디지털 디스플레이 장치로 진행 될 예정이며 자세한 사항은 포스터 초록 등록자에게 안내될 예정입니다.

4. 범호 신인학술상 경연 (자세한 사항은 지원자들에게 추후 별도 안내)

- 2022 또는 2023 IADR 회원에 한하며, 영어로 진행합니다.

1) Hatton Travel Award:
범호신인학술상 수상자 1위와 2위 - IADR 세계대회에서 IADR/Unilever Hatton Awards Competition에 참가하게 되며, 여행경비(항공료 및 체재비). 1등 수상자는 범호 학술장학금 (80만원)을 제공받게 됩니다. 이번 수상자들은 2023년도 IADR 세계대회에 참가하게 됩니다.

2) 우수 신인 학술상 (JADR Travel Award):
3위에게 주어지며, DDS출신 (만 37세 이하, 박사학위 취득 후 5년 이내)에 한합니다. 2023년 JADR 학술대회에 참가하게 되며, JADR 측으로 부터 70,000엔을 지원받습니다.

3) 우수 학술상
4위 (1명, 50만원) - (재) 대한치주연구소 우수학술상
5위 (5명, 각 20만원)
- 김영수 교수 우수학술상 (2명)
- 양규호 교수 우수학술상 (1명)
- 서울IADR대회기념 우수학술상 (2명)

5. Johnson & Johnson KADR Award (치과대학 및 치의학전문대학원생 학술상 경연)
- 현(2022 또는 2023) 회원등록자에게 한합니다.
치과대학 및 치의학전문대학원생에 한하며, 경연은 영어로 진행합니다. 수상자 1위와 2위는 각 US $600을 지원받습니다. 내년 IADR SEA Division 주최 학술대회에 참석/발표를 권장합니다.

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KADR-JADR Joint Symposium
(Special Lectures)

Sep. 22nd (Thursday)
Venue: Osstem Implant Magok Central Research Institute and Online
Moderator: Prof. Jae-Sung Kwon

S-1

A novel disease entity, IgG4-related disease, involves salivary gland diseases, so-called Mikulicz's disease and Küttner's tumor: its unique clinical, pathological, and immunological features

Seiji Nakamura, D.D.S., Ph.D.
Faculty of Dental Science, Graduate School of Dental Science,
and School of Dentistry, Kyushu University, Japan

S-2

Present and future of digital prosthodontics

Ji-Man Park
Departments of Prosthodontics, School of Dentistry and Dental Research Institute, Seoul National University, Seoul, Korea

S-3

Elucidation of neuronal-epithelial communication in murine submandibular development

Takashi Nakamura and Minoru Wakamori
Division of Molecular Pharmacology and Cell Biophysics, Department of Disease Management Dentistry, Tohoku University Graduate School of Dentistry, Sendai, Japan

S-4

Roles of Soluble Sema4D in Lymphocyte Migration to Salivary Glands Affected by Primary Sjögren's Syndrome

Lele Wang[1], Jin-Seok Byun[2], Do-Yeon Kim[3], Kyungpyo Park[1*], Sang-woo Lee[1*]
1 Department of Physiology, School of Dentistry and Dental Research Institute, Seoul National University, Seoul 110-749, South Korea; 2 Department of Oral Medicine, School of Dentistry, Kyungpook National University, Daegu 41940, Republic of Korea; 3 Department of Pharmacology, School of Dentistry, Kyungpook National University, Daegu 41940, Republic of Korea.

S-5

Abnormal root formation in a rare genetic disorder

Takuya Ogawa
Department of Maxillofacial Orthognathics, Graduate School of Medical and Dental Sciences, Tokyo Medical and Dental University, Tokyo, Japan

S-6

Computer-Aided Orthodontics for Precise Diagnosis: Ready for the future

Sung-Hwan Choi
Department of Orthodontics, Institute of Craniofacial Deformity, Yonsei University College of Dentistry, Seoul, Republic of Korea

제41차 KADR 학술대회(Special lecture Ⅰ)

9월 22일 (목)
제41차 KADR 학술대회 및 제39차 총회(1)
강당 및 제4세미나실

SL-1

Novel therapeutic approach for the prevention and treatment of periodontal disease with a bioactive peptide

Junbeom Lee[1†], Hong Ki Min[2†], Cho Yeon Park[3†], Hyun Ki Kang[3], Sung Youn Jung[3], Byung-Moo Min[3*]
Departments of [1]Periodontology and [3]Oral Biochemistry and Program in Cancer and Developmental Biology, Dental Research Institute, School of Dentistry, Seoul National University, Seoul, Korea
[2]Division of Rheumatology, Department of Internal Medicine, Konkuk University Medical Center, Seoul, Korea

SL-2

Evaluation of machine-assisted irrigation on removal of intracanal biofilm and extrusion of sodium hypochlorite using three-dimensionally printed root canal model

Ji-Yoon Shin[1], Mi-Ah Kim[1], Hee-Jin Kim[2], Prasanna Neelakantan[3], Mi-Kyung Yoo[1,4,5], Kyung-San Min[1,4,5*]
[1]Department of Conservative Dentistry, School of Dentistry, Jeonbuk National University, Jeonju, Korea
[2]Department of Dentistry, Department of Dentistry, College of Medicine, Kosin University, Busan, Korea
[3]Discipline of Endodontology, Department of Restorative Dental Sciences, Faculty of Dentistry, The University of Hong Kong, Hong Kong SAR
[4]Research Institute of Clinical Medicine of Jeonbuk National University, Jeonju, Korea
[5]Biomedical Research Institute of Jeonbuk National University Hospital, Jeonju, Korea

SL -3

Analysis of scanning error in two type intraoral scanner by scanning strategy

Yeong Seok Kwon[1†], Seoung-Jin Hong[2*]
[1]Department of Prosthodontics, Kyung Hee University Dental Hospital, Seoul, Korea
[2]Department of Prosthodontics, School of Dentistry, Kyung Hee University, Seoul, Korea

제41차 KADR 학술대회(Special lecture Ⅱ)

9월 23일 (금)
제41차 KADR 학술대회 및 제39차 총회(2)
강당

SL -4

Development of artificial intelligence model in oral and maxillofacial radiology

Sang-Sun, Han[1]
[1]Departments of Oral and Maxillofacial Radiology, Yonsei University, College of Dentistry, Seoul, South Korea

SL -5

Development of aspiration pneumonia risk assessment technology based on microbial autofluorescence

Sun Young Han
Departments of Dental Hygiene, College of Software and Digital Healthcare Convergence, Yonsei University, Wonju, Korea

SL -6

Topographical Strategies to Control Bone and Ligament Tissue Regenerations

Chan Ho Park [1*]
[1]Departments of Dental Biomaterials, School of Dentistry, Kyungpook National University, Daegu, Korea

범호 신인학술상 경연 (Hatton award)

9월 23일 (금) 11:00-12:50
4층 세미나실

H-1

The development of preformed xenografts

Su-Hyun Hwang[1†], Jung-Bo Huh[1*]
[1]Departments of Prosthodontics and Dental and Life Sciences Institute, Education and Research Team for Life Science on Dentistry, School of Dentistry, Pusan National University, Yangsan, Korea

H-2

Ceria nanozyme activity from modified methacrylate-based polymer imparts a cytoprotective and bio-friendly intaglio surface micro-environment for oro-facial prosthesis

Utkarsh Mangal[1†],Jie Jin[1†], Ji-Young Seo[1], Ji-Yeong Kim[1,3], Young-Hee Lee[2], Sungil Jang[2,*], Jae-Sung Kwon[3,*] and Sung-Hwan Choi[1,*]
[1]Department of Orthodontics, Institute of Craniofacial Deformity, Yonsei University College of Dentistry, 50-1 Yonsei-ro, Seodaemun-gu, Seoul 03722, Republic of Korea.
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[3]Department and Research Institute of Dental Biomaterials and Bioengineering, Yonsei University College of Dentistry, 50-1 Yonsei-ro, Seodaemun-gu, Seoul 03722, Republic of Korea

H-3

Altered Th1/Th17 balance caused by zinc-deficiency and infection with *Escherichia coli* induce increased CD4 T cell infiltration in oral mucosa

Phuc Thi-Duy Vo, Sung-ho Chang, Hyeong-jin Kim, Youngnim Choi*
Departments of Immunology and Molecular Microbiology, School of Dentistry and Dental Research Institute, Seoul National University, Seoul, Korea

H-4

***Porphyromonas gingivalis* produces analgesic effects by the direct action on the nociceptive sensory neurons**

Sena Chung[1], Doyun Kim[2], Yeon Kyeong Ko[3], Hayun Kim[4], Youngnim Choi[3], Seog Bae Oh[2,4]
[1]Department of Brain and Cognitive Sciences, College of Natural Sciences, Seoul National University, Seoul, Korea
[2]Department of Neurobiology and Physiology, School of Dentistry and Dental Research Institute, Seoul National University, Seoul, Korea
[3]Department of Immunology and Molecular Microbiology, School of Dentistry and Dental Research Institute, Seoul National University, Seoul, Korea
[4]Interdisciplinary Program in Neuroscience, College of Natural Sciences, Seoul National University, Seoul, Korea

H-5

Comparative study on accuracy of surgical robot system and surgical template for dental implant placement

Xun Jin[1], Ji-Man Park[1*], Seong-Joo Heo[1], Jai-young KoaK[1], Seong-Kyun Kim[1]
[1]Department of Prosthodontics & Dental Research Institute, School of Dentistry, Seoul National University, Seoul, Korea

H-6

Comparing effectiveness of Alveolar ridge preservation to Guided bone regeneration performed on spontaneously healed extraction sockets with different grade of destroyed defects : a preclinical study in dogs

Jung Yoon Kim*, Hae Jee Shin*, Kyu-Jin Hong, Hsu Kuo Tien, Won-ho Lee, Jung-Seok Lee[#]
Department of Periodontology, Research Institute for Periodontal Regeneration, College of Dentistry, Yonsei University, Seoul, South Korea

 # Corresponding author: *Prof. Jung-Seok Lee*
***** Jung Yoon Kim and Hae Jee Shin contributed equally to this work.

H-7

A Randomized controlled clinical trial of comparison between wedge-shaped collagenated bone substitute versus particle-type bone substitute in guided bone regeneration on horizontal ridge defect around dental implants

Ji Young Jung[1,2], Kyung A Ko[1,2], Jung Seok Lee[1,2]
[1]Department of Periodontology, Research Institute of Periodontal Regeneration, Yonsei University College of Dentistry, Seoul, Korea
[2]Innovation Research and Support Center for Dental Science, Yonsei University Dental Hospital, Seoul, Korea

Johnson & Johnson KADR award

9월 23일 (금) 11:00-12:50
4층 세미나실

J-1

Clinical evaluation of artificial intelligence recognition of dental plaque index

Jae-Hun Lee[1,3], Seok-Mo Heo[2,3]
[1]School of Dentistry, Jeonbuk National University; Jeonju, Republic of Korea.
[2]Department of Periodontology, School of Dentistry, Jeonbuk National University; Jeonju, Republic of Korea
[3]Research Institute of Clinical Medicine of Jeonbuk National University-Biomedical Research Institute of Jeonbuk National University Hospital, Jeonju, Republic of Korea

J-2

Antibiotic resistance genes in orofacial abscesses identified using a metagenomics-based approach

Yeeun Lee[1†], Joo-Young Park[2], Youngnim Choi[3]
[1]Department of Dentistry, School of Dentistry, Seoul National University, Seoul, Korea
[2]Department of Oral and Maxillofacial Surgery, Seoul National University Dental Hospital, Seoul National University, Seoul, Korea
[3]Department of Immunology and Molecular Microbiology, School of Dentistry, Seoul National University, Seoul, Korea

J-3

A radiographic study on root resorption according to orthodontic treatment

Ji-Hae Song[1], Kyoung-A Kim[2]
[1]School of Dentistry, Jeonbuk National University; Jeonju 54896, Republic of Korea.
[2]Department of Oral and Maxillofacial Radiology, School of Dentistry, Jeonbuk National University

Poster Presentations

P-1

3D-printed resorbable PCL/β-TCP membrane for guided bone regeneration in peri-implant dehiscence defect

Subramanian keerthana[1†], Jae-Hong Lee[2], Jeong-Ho Yun[1,*]
[1]Department of Periodontology, College of Dentistry and Institute of Oral Bioscience, Jeonbuk National University, Korea
[2]Department of Periodontology, Daejeon Dental Hospital, Institute of Wonkwang Dental Research, Wonkwang University College of Dentistry, Daejeon, Korea

P-2

Ceria nanozyme activity from modified methacrylate-based polymer imparts a cytoprotective and bio-friendly intaglio surface micro-environment for oro-facial prosthesis

Utkarsh Mangal[1†],Jie Jin[1†], Ji-Young Seo[1], Ji-Yeong Kim[1,3], Young-Hee Lee[2], Sungil Jang[2,*], Jae-Sung Kwon[3,*] and Sung-Hwan Choi[1,*]
[1]Department of Orthodontics, Institute of Craniofacial Deformity, Yonsei University College of Dentistry, 50-1 Yonsei-ro, Seodaemun-gu, Seoul 03722, Republic of Korea.
[2]Department of Oral Biochemistry, Institute of Oral Bioscience, School of Dentistry, Jeonbuk National University, Jeonju-si 54907, Korea.
[3]Department and Research Institute of Dental Biomaterials and Bioengineering, Yonsei University College of Dentistry, 50-1 Yonsei-ro, Seodaemun-gu, Seoul 03722, Republic of Korea

P-3

Diagnostic Value of Bone Scan for the Detection of TMJ Osteoarthritis

Tae Seok Kim and Yeon-Hee Lee
Department of Oralfacial Pain and Oral Medicine, Kyung Hee University Dental Hospital, Seoul, Korea.

P-4

The Anti-inflammatory Properties of Ginseng Derived Exosome-like Nanoparticles in LPS-indued RAW264.7

Youn Kyung Kim and Yeon-Hee Lee
Department of Oralfacial Pain and Oral Medicine, Kyung Hee University Dental Hospital, Seoul, Korea.

P-5

Strategies to Complete Successfully the Clinical Trial during COVID-19

Seo Sol Sol and Yeon-Hee Lee
Department of Oralfacial Pain and Oral Medicine, Kyung Hee University Dental Hospital, Seoul, Korea.

P-6

Investigation of Oral Microorganisms in Saliva and Inner Surfaces of Mask in Patients with Halitosis and Volatile Sulfide Compounds during the COVID-19 Pandemic

Yeon-Hee Lee
Department of Oralfacial Pain and Oral Medicine, Kyung Hee University Dental Hospital, Seoul, Korea.

P-7

Novel tooth bleaching agent containing hydrated calcium silicate

Ji Won Choi[1†], Song Yi Yang[2*], Jae Sung Kwon[1*]
[1]Department and Research Institute of Dental Biomaterials and Bioengineering, BK21 FOUR Project, Yonsei University College of Dentistry, Seoul, Korea
[2]Department of Dental Hygiene, Konyang University, Daejeon, Korea

P-8

Antibacterial activity of organic solvent extracts of *C.tricuspidata* on *S.mutans*

Eun-Sook Kim[1,2], Ji-Eon Jeong[2], Jooyi Kang[2], Yong-Ouk You[2*]
[1]Institute of Biomaterials and Implant, College of Dentistry, Wonkwang Univ.
[2]Dept. of Oral Biochemistry, School of Dentistry, Wonkwang Univ.

P-9

Inhibition of cariogenic activities by pine needle essential oil

Jooyi Kang[1], Eun-Sook Kim[1,2], Yong-Ouk You[1*]
[1]Dept. of Oral Biochemistry, School of Dentistry, Wonkwang Univ.
[2]Institute of Biomaterials and Implant, College of Dentistry, Wonkwang Univ.

P-10

Porphyromonas gingivalis produces analgesic effects by the direct action on the nociceptive sensory neurons

Sena Chung[1], Doyun Kim[2], Yeon Kyeong Ko[3], Hayun Kim[4], Youngnim Choi[3], Seog Bae Oh[2,4]

[1]Department of Brain and Cognitive Sciences, College of Natural Sciences, Seoul National University, Seoul, Korea

[2]Department of Neurobiology and Physiology, School of Dentistry and Dental Research Institute, Seoul National University, Seoul, Korea

[3]Department of Immunology and Molecular Microbiology, School of Dentistry and Dental Research Institute, Seoul National University, Seoul, Korea

[4]Interdisciplinary Program in Neuroscience, College of Natural Sciences, Seoul National University, Seoul, Korea

P-11

Comparative study on accuracy of surgical robot system and surgical template for dental implant placement

Xun Jin[1], Ji-Man Park[1*], Seong-Joo Heo[1], Jai-young KoaK[1], Seong-Kyun Kim[1]

[1]Department of Prosthodontics & Dental Research Institute, School of Dentistry, Seoul National University, Seoul, Korea

P-12

Clinical evaluation of artificial intelligence recognition of dental plaque index

Jae-Hun Lee[1,3], Seok-Mo Heo[2,3]

[1]School of Dentistry, Jeonbuk National University; Jeonju, Republic of Korea.

[2]Department of Periodontology, School of Dentistry, Jeonbuk National University; Jeonju, Republic of Korea

[3]Research Institute of Clinical Medicine of Jeonbuk National University-Biomedical Research Institute of Jeonbuk National University Hospital, Jeonju, Republic of Korea

P-13

Antibiotic resistance genes in orofacial abscesses identified using a metagenomics-based approach

Yeeun Lee[1†], Joo-Young Park[2], Youngnim Choi[3]

[1]Department of Dentistry, School of Dentistry, Seoul National University, Seoul, Korea

[2]Department of Oral and Maxillofacial Surgery, Seoul National University Dental Hospital, Seoul National University, Seoul, Korea

[3]Department of Immunology and Molecular Microbiology, School of Dentistry, Seoul National University, Seoul, Korea

P-14

A radiographic study on root resorption according to orthodontic treatment

Ji-Hae Song[1], Kyoung-A Kim[2]

[1]School of Dentistry, Jeonbuk National University; Jeonju 54896, Republic of Korea.

[2]Department of Oral and Maxillofacial Radiology, School of Dentistry, Jeonbuk National University

P-15

The development of preformed xenografts

Su-Hyun Hwang[1†], Jung-Bo Huh[1*]
[1]Departments of Prosthodontics and Dental and Life Sciences Institute, Education and Research Team for Life Science on Dentistry, School of Dentistry, Pusan National University, Yangsan, Korea

P-16

Altered Th1/Th17 balance caused by zinc-deficiency and infection with *Escherichia coli* induce increased CD4 T cell infiltration in oral mucosa

Phuc Thi-Duy Vo, Sung-ho Chang, Hyeong-jin Kim, Youngnim Choi*
Departments of Immunology and Molecular Microbiology, School of Dentistry and Dental Research Institute, Seoul National University, Seoul, Korea

P-17

Comparing effectiveness of Alveolar ridge preservation to Guided bone regeneration performed on spontaneously healed extraction sockets with different grade of destroyed defects : a preclinical study in dogs

Jung Yoon Kim*, Hae Jee Shin*, Kyu-Jin Hong, Hsu Kuo Tien, Won-ho Lee, Jung-Seok Lee#
Department of Periodontology, Research Institute for Periodontal Regeneration, College of Dentistry, Yonsei University, Seoul, South Korea

 # Corresponding author: *Prof. Jung-Seok Lee*
***** Jung Yoon Kim and Hae Jee Shin contributed equally to this work.

P-18

A Randomized controlled clinical trial of comparison between wedge-shaped collagenated bone substitute versus particle-type bone substitute in guided bone regeneration on horizontal ridge defect around dental implants

Ji Young Jung[1,2],Kyung A Ko[1,2], Jung Seok Lee[1,2]
[1]Department of Periodontology, Research Institute of Periodontal Regeneration, Yonsei University College of Dentistry, Seoul, Korea
[2]Innovation Research and Support Center for Dental Science, Yonsei University Dental Hospital, Seoul, Korea

Korean Division of the International Association for Dental Research

KADR-JADR Joint Symposium (Special Lectures)

Sep. 22nd (Thursday)
Venue: Osstem Implant Magok Central Research Institute and Online
Moderator: Prof. Jae-Sung Kwon

KADR-JADR Joint Symposium

Curriculum Vitae (Academic and occupational backgrounds):

1976-1982	Faculty of Dentistry, Kyushu University, Japan
1982-1986	Graduate School of Dental Science, Kyushu University, Japan
1986	Research Associate, Second Department of Oral and Maxillofacial Surgery, Faculty of Dentistry, Kyushu University, Japan
1986-1988	Postdoctoral Fellow, Department of Immunology, Oklahoma Medical Research Foundation, U.S.A.
1988-1989	Research Associate, Department of Internal Medicine, University of Virginia Medical School, U.S.A.
1989-1994	Research Associate, Second Department of Oral and Maxillofacial Surgery, Faculty of Dentistry, Kyushu University, Japan
1994-2004	Assistant Professor, Second Department of Oral and Maxillofacial Surgery, Kyushu University Dental Hospital, Japan
2004-present	Professor & Chairman, Section of Oral and Maxillofacial Oncology, Division of Maxillofacial Diagnostic and Surgical Sciences, Faculty ofDental Science, Kyushu University, Japan
2009-2012	Vice-Dean, Faculty of Dental Science, Kyushu University, Japan
2012-2019	Vice-Director, Kyushu University Hospital, Japan
2019-present	Dean: Faculty of Dental Science, Graduate School of Dental Science, and School of Dentistry, Kyushu University, Japan

Academic Positions:

President of Japanese Association for Dental Research (JADR) (2021-2022)

Immediate Past President of IADR-APR (2021)

President of Japanese Society of Oral Medicine

Immediate Past President of Japanese Stomatological Society (a member society of Japanese Association of Medical Sciences)

Invited JADR President Lecture

S-1

A novel disease entity, IgG4-related disease, involves salivary gland diseases, so-called Mikulicz's disease and Küttner's tumor: its unique clinical, pathological, and immunological features

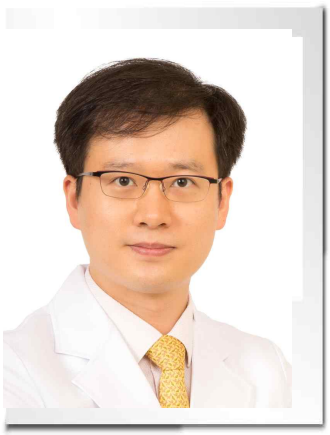
Seiji Nakamura, D.D.S., Ph.D.
Faculty of Dental Science, Graduate School of Dental Science,
and School of Dentistry, Kyushu University, Japan

Dry mouth is commonly induced by various causes and cases with damages of salivary glands especially show severe symptoms and refractory to any symptomatic treatment.

IgG4-related disease (IgG4-RD) has recently been proposed from Japan, as a novel systemic disease entity characterized by elevated levels of serum IgG4 concentration and tumefaction infiltrated with IgG4-positive plasma cells, and includes autoimmune pancreatitis, sclerosing cholangitis, Riedel's thyroiditis, and so on.

So-called Mikuliçz's disease and Küttner's tumor have also been recognized as IgG4-RD.

At this presentation, I will show you the clinical, pathological, and immunological features, in comparison with a well-known autoimmune disease, Sjögren's syndrome, showing severe dry mouth with some similarities to those of IgG4-RD.



Ji-Man Park, has Graduated from Seoul National University in 2002. He trained at the department of prosthodontics, Seoul National University Dental Hospital. He gained Ph. D and Master's degree at Seoul National University. He started working as an assistant professor at Ewha Womans University in 2009 and did his best on dental treatment, research and education until 2015. He was a clinical associate professor at Seoul National University Gwanak Dental Hospital from 2015 to 2017. He was a clinical associate professor at Yonsei University, College of Dentistry from 2017 to 2021. He has been an associate professor at Seoul National University, School of Dentistry since 2021.

He has studied digital dentistry and the clinical application of intraoral scanners and 3D printers. He also has worked on government research projects, "Standardisation of evaluation protocol for the performance comparison of digital intraoral scanners", "Development of 3D printable ceramic material and associated printer", and "Robotic system for implant surgery".

Ji-Man Park is an active member of IADDM (International Academy of Digital Dental Medicine), IADR, AO, AAP, and works as an Editor-in-Chief of the Journal of implantology and applied sciences (JIAS).

S-2

Present and future of digital prosthodontics

Ji-Man Park

Departments of Prosthodontics, School of Dentistry and Dental Research Institute, Seoul National University, Seoul, Korea

In digital dentistry, the workflow to produce prostheses is largely divided into three stages: 'image acquisition,' which takes images of structures in the oral cavity; 'CAD,' which designs desired restorations on the acquired images; 'CAM,' manufactures restoration by digitizing the design data and processing the desired material. With the development of intraoral scanners, digital dentistry is quickly being integrated into the dental field, as the first step in the digital workflow can be applied directly to the patient's mouth with the help of the intraoral scanner.

With the advancement of intraoral scanners, the first step of the digital workflow can be applied directly to the patient's mouth, and digital restorative dentistry is rapidly being grafted into dentistry. Compared with traditional prosthetic procedures, the advantages of intraoral image acquisition and CAD/CAM technique are as follows; the omission of conventional impression materials, reduced workflow step, and increased efficiency by online communication with clinic and laboratory. Facial scans are also being used in diagnostic processes such as digital smile design by combining them with intraoral scan data. The provisional and definitive prostheses are designed along the patient's physiological moving path by recording dynamic movements. As the virtual patient was utilized, the dentist and the patient's interaction was dramatically improved. Full mouth rehabilitation can be achieved by utilizing dynamic mandibular movement in dental CAD software. When jaw movement tracking is actively utilized in the digital workflow, the dentist can help the patient reach the ideal occlusion more easily.

In this lecture, I will present various devices used in digital dentistry, including intraoral scanners, which have recently come close to the dentist with improved cost-effectiveness and easy interface. In addition, I would like to show the changed dental office brought by the intraoral scanner and 3D printer through clinical cases. Also, the methodology to integrate digital information and utilize the patient's mandible movement will be introduced.

Takashi Nakamura is currently working as an Associate Professor at Tohoku University Graduate School of Dentistry. His research focuses on the elucidation of the function of Epiprofin transcription factor in ectodermal organogenesis and carcinoma pathogenesis. He received his Bachelor of Dentistry from Hiroshima University and obtained a DDS in 1994. He received his PhD degree from Osaka University in 1998. He worked as an oral surgent in Kansai Rosai Hospital. He worked as a postdoctoral fellow for 2 years and a JSPS fellow following 2 years at National Institute of Dental and Craniofacial Research, NIH. He was then appointed an NIH federal employee and worked for 3 years in NIDCR. Thereafter he joined the university faculty as an assistant professor of orthopaedic surgery at Thomas Jefferson University School of Medicine. He has been awarded the best presentation in the Japanese Society of Pediatric Dentistry (2010) and Tohoku Society for Bone Metabolism and Osteoporosis (2018).

Speaker 1 from JADR

S－3

Elucidation of neuronal-epithelial communication in murine submandibular development

Takashi Nakamura and Minoru Wakamori
Division of Molecular Pharmacology and Cell Biophysics, Department of Disease Management Dentistry, Tohoku University Graduate School of Dentistry, Sendai, Japan

Saliva containing a variety of enzymes and ions plays important roles in oral lubrication, oral hygiene, digestion, and host defense responses such as immunity and detoxification. Saliva is produced and secreted from salivary glands under neuronal control and is deeply associated with our health by function as a primary gate keeper at the interface of oral mucosa and external particles including foods and uninvited invaders. Therefore, salivary gland dysfunction or loss of function caused by diseases, side effects of medicines, or radiation therapy greatly reduces our quality of life. The aim of this project is to develop a novel approach for salivary gland functional regeneration as a potential treatment of xerostomia. Parasympathetic nerves are an essential vital component for both the fetal development of salivary gland and the regulation of salivary gland function after birth. Recently, we found the dynamic changes of the expression profiles of parasympathetic acetylcholine receptor subtypes during salivary gland development. In addition, we identified a part of the mechanisms of interactions between the epithelium and the parasympathetic nerves in developing submandibular gland. In this presentation, we propose a novel concept for tissue architecture during neurofunctional organogenesis.

Sang-woo Lee was born in 1987 in Daegu, Korea. He obtained his BS degree (Department of Biological Science) in KAIST. He obtained his DDS-PhD degree in School of Dentistry, Seoul National University in 2021. Currently, he is Associate Professor in Department of Oral Physiology, School of Dentistry, Seoul National University. His research focuses are pathophysiology of salivary gland dysfunction, salivary gland development, salivary gland tissue engineering, regeneration, and protection. He won the first place in 2018 IADR Hatton Competition as a Senior Basic Researcher, and he has been awarded Young Scientist Award from Korea Dental Association 2022.

Speaker 1 from KADR

S-4

Roles of Soluble Sema4D in Lymphocyte Migration to Salivary Glands Affected by Primary Sjögren's Syndrome

Lele Wang[1], Jin-Seok Byun[2], Do-Yeon Kim[3], Kyungpyo Park[1*], Sang-woo Lee[1*]

1 Department of Physiology, School of Dentistry and Dental Research Institute, Seoul National University, Seoul 110-749, South Korea; 2 Department of Oral Medicine, School of Dentistry, Kyungpook National University, Daegu 41940, Republic of Korea; 3 Department of Pharmacology, School of Dentistry, Kyungpook National University, Daegu 41940, Republic of Korea.

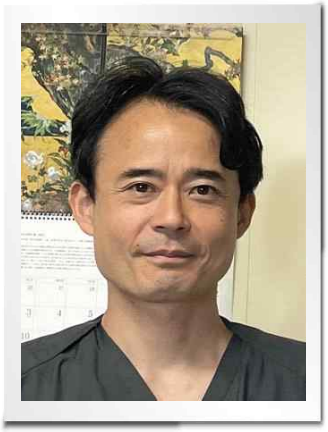
Objectives: Primary Sjögren's syndrome (pSS) is a chronic and systemic autoimmune disease exhibiting salivary gland dysfunction. Activation of immune-competent molecules expressed by salivary gland epithelial cells (SGECs) induces focal lymphocytic infiltration and apoptosis of SGECs. In this study, we have investigated putative roles of soluble Sema4D, which had been known to be increased in pSS patient serum, in salivary gland damage and inflammation found in pSS patients.

Methods: We examined minor salivary glands of healthy and pSS subjects. To examine roles of soluble Sema4D in T cell chemokinesis, we performed live cell imaging of Jurkat cell treated with recombinant Sema4D. To specify the key receptor for soluble Sema4D-mediated enhancement of Jurkat cell chemokinesis/chemoattraction, we selectively blocked each of CD72, Plexin B1, and B2 with blocking antibodies.

Results: We found that the expression level of membrane-bound Sema4D was significantly decreased in the salivary glands from pSS subjects, while soluble form of Sema4D was significantly increased compared to that of healthy subjects. In vitro migration assay revealed that soluble Sema4D has both chemokinetic and chemoattraction effects to Jurkat cells. These enhanced chemokinesis and chemoattraction were due to the increased expression of CXCR4, phosphorylated Rho, and phosphorylated myosin light chain. By using siRNA and blocking antibody selectively inhibiting function of Sema4D receptors including CD72, Plexin B1, and Plexin B2, we found that CD72 is mainly responsible for the soluble Sema4D-mediated enhancement of chemokinesis and chemoattraction of Jurkat cells.

Conclusions: In conclusion, increased local concentration of soluble Sema4D can enhance attraction, mobilization, and retention of T-lymphocytes, which may explain the mechanism of salivary gland lymphocytic infiltration found in pSS patients.

Acknowledgements: This work was supported by a National Research Foundation of Korea grant, NRF-2021R1A2B5B03002719 and 2022R1I1A206878611 at Seoul National University.



Dr. Takuya Ogawa is currently Associate Professor, Department of Maxillofacial Orthognathics, Tokyo Medical and Dental University (TMDU), Japan. He graduated from School of Dentistry, TMDU in 1998, and completed PhD degree at TMDU in 2002. He pursued his research in The University of Texas Health Science Center at Houston, U.S.A. from 2002-2005. His research focuses on basic and clinical studies of cleft lip and/or palate and other congenital craniofacial anomalies. He is an active member of Japanese Association for Dental Research, International Association for Dental Research, Japanese Orthodontic Society, Japanese Cleft Palate Association, the Japanese Society for Jaw Deformities, Japan Society of Cranio-Maxillo-Facial Surgery, and the Japanese Society of Human Genetics.

Speaker 2 from JADR

S－5

Abnormal root formation in a rare genetic disorder

Takuya Ogawa
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Clinical data obtained from a patient with a hereditary disease can be very useful. The bioresources acquired from the diseased patient include an extracted tooth for orthodontic treatment, which can help ascertain the function of causal genes.

Oculo-facio-cardio-dental (OFCD) syndrome is a rare X-linked dominant disorder characterized by microphthalmia, congenital cataracts, facial dysmorphic features, congenital heart defects, and dental anomalies. A majority of patients with OFCD have remarkable dental anomalies, including radiculomegaly with prolonged dental roots and wide-open apices, occurring predominantly in the canine roots. Mutations in the BCL-6 corepressor (*BCOR*) gene, which encodes a transcriptional corepressor, have been described in OFCD syndrome. To function as a transcriptional corepressor, BCOR needs to enter the nucleus. However, the molecular pathway for its nuclear translocation during dental root formation remains unclear. In addition, the function of BCOR, which is a transcription inhibitor, is yet to be elucidated. Elucidation of the role of BCOR in OFCD syndrome may aid in understanding the mechanism of root formation, especially the factors involved in controlling the final root length.

This symposium will introduce examples in an attempt to elucidate the role of the responsible gene, based on information obtained from patients with OFCD syndrome.

Sung-Hwan Choi was born in 1981 in Seoul, South Korea. He obtained his DDS degree from Yonsei University College of Dentistry in 2008. He has been trained in the Department of Orthodontics, Yonsei University Dental Hospital, and obtained a Ph.D. degree in Yonsei University College of Dentistry. He is now an Associate Professor at Yonsei University College of Dentistry, teaching and researching clinical orthodontics and orthodontic materials. His reach focuses on biomaterials, biofilms, and digital orthodontics. He has been awarded the Young Researcher Award, Korean Dental Association (2017), the Young Researcher Award, Ministry of Health and Welfare, Republic of Korea (2019), and the Gold Prize of the 17th Yeonsong Dental Award, Korean Academy of Dental Science (2021).

Speaker 2 from KADR

S-6

Computer-Aided Orthodontics for Precise Diagnosis: Ready for the future

Sung-Hwan Choi
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To establish a treatment plan for orthodontic treatment and orthognathic surgery, it is necessary to analyze cephalometric radiographs. Although bilateral landmarks such as porion or orbitale were very important reference points setting the FH plane, they overlapped each other, so accurate detection could not be achieved. This was one of the causes of the difference in the analysis results for each investigator. In addition, when analyzing facial asymmetry through posteroanterior cephalometric radiographs, we mainly depended only on the direction of menton deviation and the distance away from the midsagittal plane. In this way, it is difficult to diagnose the three-dimensional stereoscopic asymmetry of the mandible.

Recently, cone-beam computed tomography (CBCT) has been popularized and analysis using three-dimensional (3D) reconstructed images is possible. However, without anatomical expertise, the measurement itself is very difficult, and it takes more time and effort compared to the analysis of two-dimensional radiographs, so it is difficult to use in a private clinic.

In this presentation, I would like to introduce CBCT automatic landmark detection technology. Also, I would like to introduce a new concept using a similarity index (SI) and tomographic similarity scan (ToSS) curves that can maximize facial symmetry during orthognathic surgery by mirroring both structures based on the newly proposed computed modified absolute midsagittal plane of the mandible.

This presentation demonstrates the potential of 3D automatic tracing, SI, and ToSS curves in orthodontic and surgical simulation software to improve the precision in the clinical decision-making process.

Acknowledgements: This study was supported by a grant from the Korea Health Technology R&D Project through the Korea Health Industry Development Institute (KHIDI), funded by the Ministry of Health & Welfare, Republic of Korea (grant number: HI20C0611).

Korean Division of the International Association for Dental Research

제41차 KADR 학술대회
(Special lecture Ⅰ)

9월 22일 (목)
제41차 KADR 학술대회 및 제39차 총회(1)
강당 및 제4세미나실

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Special lecture

SL-1

Novel therapeutic approach for the prevention and treatment of periodontal disease with a bioactive peptide

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Objectives: This study investigated whether a vitronectin-derived peptide (VnP-16) prevents and/or reverses alveolar bone resorption induced by ligature-induced periodontitis in rodents and identified the underlying mechanism.

Methods: We evaluated the effects of VnP-16 on osteogenic differentiation in hPDLCs, lipopolysaccharide-induced inflammatory responses in gingival fibroblasts, and immune response in T lymphocytes. Ligature-induced periodontitis was induced by ligating the bilateral mandibular first molars for 14 days in rats and for 7 days in mice (n = 10/group). VnP-16 (100 μg/10 μl) was applied topically into the gingival sulcus of rats via intrasulcular injection, whereas the peptide (50 μg/5 μl) was administered directly into the gingiva of mice via intragingival injection. To evaluate the preventive and therapeutic effects of VnP-16, micro-CT analysis and histological staining were then performed.

Results: VnP-16 promoted osteogenic differentiation of periodontal ligament cells and inhibited the production of lipopolysaccharide-induced inflammatory mediators in gingival fibroblasts. Concomitantly, VnP-16 modulated the host immune response by reducing the number of RANKL-expressing lipopolysaccharide-stimulated $CD4^+$ and $CD8^+$ T cells, and by suppressing RANKL and IL-17A production. Furthermore, local administration of VnP-16 in rats and mice significantly prevented and reversed alveolar bone loss induced by ligature-induced periodontitis. VnP-16 enhanced osteoblastogenesis and simultaneously inhibited osteoclastogenesis and suppressed RANKL and IL-17A expression in vivo.

Conclusions: Our findings suggest that VnP-16 acts as a potent therapeutic agent for preventing and treating periodontitis by regulating bone remodeling and immune and inflammatory responses.

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Special lecture

SL-2

Evaluation of machine-assisted irrigation on removal of intracanal biofilm and extrusion of sodium hypochlorite using three-dimensionally printed root canal model

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Objectives: This study aimed to compare the biofilm removal and apical extrusion of sodium hypochlorite (NaOCl) following machine-assisted irrigation using three-dimensionally (3D) printed dentin-insert model.
Methods: Multispecies biofilms were formed in a 3D-printed curved root canal model with dentin insert. The model was then placed in a container that was filled with 0.2% agarose gel containing 0.1% m-Cresol purple. Root canals were irrigated with 1% NaOCl using syringe irrigation, sonically agitated (EndoActivator or EDDY) or ultrasonically activated (Endosonic Blue) irrigation. Samples were photographed and the color-changed area was measured. Biofilm removal was assessed using colony-forming unit counting, confocal laser scanning microscopic analysis and scanning electron microscopic observations. The data were analyzed using one-way ANOVA, followed by Tukey test ($p < 0.05$).
Results: EDDY and Endosonic Blue demonstrated significantly greater reduction of biofilms compared to other groups ($p < 0.05$). No significant differences were observed in the remaining biofilm volume in the untreated control, syringe-and-needle irrigation and EndoActivator groups. EDDY and Endosonic Blue groups presented with numerous exposed dentinal tubules. EDDY showed significantly greater NaOCl extrusion compared to other groups ($p < 0.05$).
Conclusions: The ultrasonic activation system Endosonic Blue demonstrated superior biofilm removal with minimal extrusion of irrigant in this standardized 3D-printed dentin-insert model. While the sonic agitation system EDDY showed comparable biofilm removal to ultrasonic, it also showed increased irrigant extrusion.

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SL -3

Analysis of scanning error in two type intraoral scanner by scanning strategy

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Intraoral scanner (IOS) is an optical device used to digitize the intraoral conditions to three-dimensional (3D) object file format. IOSs can be classified by the principles for data acquisition including confocal microscopy and triangulation type. Regardless of the data acquisition principle that each IOS employed, the most important factor of IOS is accuracy. Previous studies comparing the accuracy of IOSs based on various type have reported that confocal microscopy type showed higher accuracy than other types. IOS employing dual-camera triangulation that improves the limitations of traditional triangulation have been reported and assessed the accuracy. The clinician places the center of the viewfinder at the scanned object and moves the head of the IOS along a specific path, it is called scanning strategy, and for accurate scanning, the scanning strategy is also crucial apart from the data acquisition type of IOS. Most manufacturers recommend specific scanning strategies to obtain the accurate scanning data with IOS. All IOSs and dedicated software create the 3D object by merging (stitching) several images taken under different viewpoints. The scanning strategy is closely related to the software which stitches the images. Accuracy of scanned data is particularly important in dental restorative treatments, because it affects the marginal and internal fits and functionality of dental restorations. Accordingly, most of the previous studies were focused on the clinical parameter, for example, marginal and internal fits or angulation of implant. However, more detailed analysis of the cause of the error is required to improve these clinical parameters. This study aims to analyze the error of shape recognition and stitching procedure by scanning the various shape objects using confocal microscopy and triangulation type IOSs.

Korean Division of the International Association for Dental Research

제41차 KADR 학술대회
(Special lecture Ⅱ)

9월 23일 (금)
제41차 KADR 학술대회 및 제39차 총회(2)
강당

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SL -4

Development of artificial intelligence model in oral and maxillofacial radiology

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Artificial intelligence (AI) technology in oral and maxillofacial radiology is being studied in various fields such as diagnosis, automatic segmentation, and registration, and products based on it are being introduced, and the number is increasing.

Image quality evaluation and reading of X ray require professional training, and the accuracy of image interpretation may vary depending on according to the qualifications of the performer. Accordingly, X-ray image-based quantification and automation research were attempted, and various studies such as automatic segmentation, detection, and classification were conducted while applying AI technologies including deep learning.

In currently, there are few technologies that are used in clinical dental practice. If a basis for clinical effectiveness and ethical responsibility is established and more clear profitability model can be developed, the use of dental image-based AI technology products is expected to gradually increase.

Thus, in this lecture, I would like to introduce research of AI technology development and share experiences based on various dental X-ray images including periapical, panoramic radiographic images, and dental cone beam computed tomographic images.

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Special lecture

SL-5

Development of aspiration pneumonia risk assessment technology based on microbial autofluorescence

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Objectives: Aspiration pneumonia is caused by aspiration of respiratory pathogens colonizing the oropharynx and upper gastrointestinal tract. Therefore, early detection of aspiration pneumonia pathogens is an important factor in the treatment and prevention of nosocomial pneumonia. The aim of this study was to investigate the differences in autofluorescence properties of aspiration pneumonia pathogens using a Quantitative Light-induced Fluorescence-Digital (QLF-D) and to establish evidence for clinical guidelines.
Methods: The experimental microorganisms were selected from commonly found in aspiration pneumonia patients: *Staphylococcus aureus* (*S.aureus*), *Acinetobacter baumannii* (*A.baumannii*), *Escherichia coli* (*E.coli*), *Enterococcus faecalis* (*E.faecalis*), *Klebsielaa pneumoniae* (*K.pneumoniae*), *Candida albicans* (*C.albicans*). And *Streptococcus mutans* (*S.mutans*) was selected as a control. Tryptic soy agar (TSA) was used as the culture medium for all strains to exclude bias due to color of the medium for image analysis. Each sample was plated on TSA medium and incubated for 7 days in an aerobic chamber at 37℃. Microorganisms were photographed using QLF-D, and changes in red/green values (R/G ratio) were analyzed when each microorganism was single-cultured and cross-cultured.
Results: In the single cultured, *K.pneumoniae* and *S.aureus* showed strong red fluorescence, and *A.baumannii*, *E.coli*, and *C.albicans* showed weak red fluorescence with an R/G ratio of around 1.0. *E.faecalis* and *S.mutans* did not express red fluorescence throughout 168 h of incubation, and the R/G ratio was less than 1.0. However, when the two types of microorganisms were cross-cultured, the red fluorescence gradually increased with the incubation time in some microorganisms, resulting in advantageous clinical identification.
Conclusions: Aspiration pneumonia pathogens could be identified and classified through bacterial autofluorescence emission, and the difference in autofluorescence emission according to the interaction of the causative bacteria of nosocomial pneumonia could be confirmed. Through this, it was possible to confirm the clinical applicability of a fast and easy-to-use identification technology based on bacterial autofluorescence.

Acknowledgements: This study was supported by the National Research Foundation of Korea (NRF) grant funded by the Korea government (MSIT) (No. 2017R1C1B5018016). I would like to thank Eun-Ha Jung, Ji-Hye Yang, Jiyeon Roh, and Yun-Seon Lee for their assistance in deriving the results of this study.

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Special lecture

SL -6

Topographical Strategies to Control Bone and Ligament Tissue Regenerations

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Objectives: Various tissue engineering techniques have been developed for multiple tissue regeneration and integrative structure formations. However, the regenerations of dental tissues or tooth-supportive structures still have limitations due to the micro-interfacial compartmentalization of multiple tissues and their integrations for systematic responses. Of the periodontal complex, periodontal ligaments (PDLs) generate systematical force-responses with specific orientations and tissue integrations to both mineralized tissues; alveolar bone and cementum on tooth-root surface. Here, we investigated two different 3D micro-topographical approaches to spatiotemporally organize PDLs and limitedly promote mineralized tissue formations.

Methods: Based on previous *in-vitro* study and *in-vivo* study, perio-complex scaffold was computer-designed and manufactured using 3D printing system to spatiotemporally compartmentalize and organize periodontal complex in the canine pilot study with two parts; microgroove-patterned PDL architectures and bone region with open-structures. Micro-CT and histology were analyzed for mineralized tissue formation, PDL fiber orientations, and PDL functioning restoration.

Results: Bone ingrowth were limitedly controlled into the bone regions of perio-complex scaffolds but there was statistically significant difference in bone parameters using micro-CT. In histological analyses with H&E staining, PDL architecture surfaces in perio-complex scaffolds can regulate orientations of fibrous tissues in 4 weeks. Interestingly, microgroove patterns could significantly guide fibrous connective tissue orientations to tooth-root surfaces in canine model as well as regulate specific angulations of PDL bundles in rat calvaria.

Conclusions: Although there was the critical time limitation for the canine tissue formation in this pilot study (time point: 4 weeks), 3D-printed PDL architectures could regulate fibrous tissue orientations and bone formation with predictability and controllability of tissue formations. Therefore, the single perio-complex scaffolds can provide spatial compartmentalization for oriented PDL regeneration in PDL regions and bone formation.

Acknowledgements: This study was supported by the Osteology Foundation in Switzerland (#16-173).

Korean Division of the International Association for Dental Research

범호 신인학술상 경연
(Hatton award)

Hatton Award

H-1

The development of preformed xenografts

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Most xenografts are in the form of particles, when the defect shape is irregular or wide, it is difficult to expect the grafted particle to maintain stability during the reconstruction period. Particle types have poor handling due to a lack of bond strength, which can result in graft substitutes filling in the wrong position and poorly maintained space. In order to solve these problems, we have studied various types of bone graft materials such as xenograft block-type scaffolds and the addition of organic materials to the particle-type xenografts. The purpose of this study was to investigate the effect of two-layer porcine-derived bone blocks are composed of cortical and cancellous bones in order to manufacture a customized bone graft material for a wide range of bone defects. Four circular defects were created on the cranium of a rabbit. Each defect was filled with block bone scaffolds: cortical bone block (Cortical group, *n* = 6), cancellous bone block (Cancellous group, *n* = 6), and two-layer bone block (2layer group, *n* = 6). No graft material was applied to the defect for the negative control group (Control group, *n* = 6). All rabbits were sacrificed at 8 weeks after bone grafting, and bone formation was evaluated by micro-computed tomography (micro-CT), histological, and histomorphometric assessments. New bones were primarily observed in cancellous parts of the Cancellous and the 2layer group, while the Cortical exhibited few new bones and Control filled with fibrotic tissue without new bone formation. In the results of new bone volume and area analyses, the Cancellous showed the highest value followed by the 2layer and were significantly higher than the Cortical. Within the limitation of this study, the 2layer scaffold may demonstrate its sufficient efficiency in repairing a bony defect, producing enough spaces for regenerated bones.

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H-2

Ceria nanozyme activity from modified methacrylate-based polymer imparts a cytoprotective and bio-friendly intaglio surface micro-environment for oro-facial prosthesis

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Objectives: Orofacial deformities are increasingly prevalent due to congenital defects and sequelae to surgical resection of oral cavity cancer. Oral rehabilitation is often needed after surgical intervention for optimal restoration of aesthetics and function. Poly(methyl methacrylate) (PMMA) based resin is a common biomaterial of choice for oral prosthetics. However, the interaction of the intaglio surface with underlying post-operative frail mucosa often leads to localized stress resulting in an inflammatory erythematous lesion, most often associated with microbial adhesion. This study aimed to investigate the bacterial and inflammatory resistance effects of ceria nanozyme delivered via mesoporous particles in PMMA to improve the biological effects of long-term appliances.
Methods: SBA-15 impregnated with cerium oxide were pre-treated with sulfo-polybetaine and incorporated into the auto-polymerizing PMMA (SC+ group) while PMMA without modification was the Control group. The effect of ceria nanozyme biological activity was investigated progressively through *in vitro*, *ex vivo* and *in vivo* experiments. Periodic release of cerium ions was evaluated along with superoxide dismutase (SOD) and catalase (CAT) mimetic catalytic activities. Biological interactions were characterized in two modalities: (i) fungal and multispecies microbial adhesive resistance, and (ii) response towards cellular homeostasis. Surface microbiota was also analyzed by 16S rRNA with metagenomic shotgun sequencing. Response of HGF-1 cells was investigated for protein expression associated with inflammatory stimuli, and wound healing assays was evaluated with scratch test and western blot assays. Lastly, the improvement in bio-favorability with SC+ was verified via extra-and intra-oral *in vivo* models.
Results: In contrast to the Control group, the SC+ group showed significantly increased release of cerium ions. Significant resistance to candidal and multispecies bacterial biofilm was also observed in SC+ group. Similary, SC+ also showed better dysbiosis resistance with down-regulation of pathogenic c-di-GMP, sRNA and quorum sensing associated gene ontological pathways. The levels of reactive oxygen species and inflammatory markers (MMP-9, MMP2 and HIF-1-alpha) were reduced in the HGF-1 assay with the SC+ group. Moreover, improved wound healing response was observed with increased cell migration and increased expression of MAPK pathway-associated proteins. The *in vivo* analyses showed the absence of both local and systemic adverse biological reaction with SC+ extracts in both the skin and oral mucosa models.
Conclusions: These findings suggest that SC+ type resin-based appliance can improve cytoprotective effect by multispecies dysbiosis resistance and effectively reducing pro-inflammatory markers while imparting improved healing response.

Acknowledgements: This study was supported by the Korea Medical Device Development Fund grant funded by the Korea government (the Ministry of Science and ICT, the Ministry of Trade, Industry and Energy, the Ministry of Health and Welfare, the Ministry of Food and Drug Safety) (Project Number: KMDF_PR_20200901_0067-01), by the National Research Foundation of Korea(NRF) grant funded by the Korea government (MSIT) (No. 2021R1A2C2091260).

Hatton Award

H-3

Altered Th1/Th17 balance caused by zinc-deficiency and infection with *Escherichia coli* induce increased CD4 T cell infiltration in oral mucosa

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Objectives: Oral lichen planus (OLP) is a chronic T cell-mediated inflammatory disease of unknown etiology. Bacterial infection of the epithelium and lamina propria has been proposed as a triggering factor to activate T cells. Several studies reported low zinc levles in the serum or saliva of OLP patients and the therapeutic effect of zinc supplementation. This study aimed to investigate the interplay of bacterial infection and zinc-deficiency in the pathogenesis of OLP.
Methods: Intracellular survival of *Escherichia coli* 7.2, a strain isolated from OLP tissue, in human oral keratinocytes (HOK) and transcriptomic data were examined under normal or zinc-depleted condition. C57BL/6 mice of 8-week-old were put on either standard (SD) or zinc-deficient diet (ZDD) for 4-8 weeks. The labial mucosae of mice were micro-damaged using a dental stone, and then mice received oral administration of *E. coli* 7.2 every other day for 3 weeks. Leukocyte population in the cervical lymph nodes (CLN) were analyzed by flow cytometry. Hematoxylin and eosin staining, in situ hybridization, and immunofluorescence of labial tissues were performed to investigate immune response against oral infection of *E. coli.*
Results: Zinc-depleted condition increased the intracellular survival of *E. coli* in HOK cells with reduced expression of genes involved in nitric oxide synthesis or response to oxidative stress. ZDD alone induced an increase in the number of T cells and a reduced Th1/Th17 ratio specifically in the cervical lymph nodes (CLN) of mice, accompanied with oral dysbiosis. While *E. coli* infection induced a Th1-dominant response in mice with SD, a Th17-dominant response was induced in mice with ZDD. In addition, *E. coli* infection under ZDD increased total bacterial load in the oral cavity, the invasion of bacteria into the labial epithelium and lamina propria, and infiltration of CD4 T cells in the labial mucosa, presenting a few apoptotic keratinocytes.
Conclusions: *E. coli* infection and a Th17-skewed immune response increased bacterial invasion and CD4 T cell infiltration in oral mucosa. Host environment factors such as mechanical damage, a specific bacterial species (*E. coli*), and zinc-deficiency could impair the immune homeostasis with oral microbiota, which may contribute to the pathogenesis of OLP.

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Hatton Award

H−4

***Porphyromonas gingivalis* produces analgesic effects by the direct action on the nociceptive sensory neurons**

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Objectives: Periodontitis is a chronic inflammatory disease of the periodontium that leads to tissue destruction, bleeding, and bone resorption. However, pain, one of the cardinal signs of inflammation, is not commonly accompanied in periodontitis, which is unlike other inflammatory conditions. Although a lack of pain symptoms may contribute to delayed detection and treatment of periodontitis in patients, the cause and mechanism of decreased pain hypersensitivity in periodontitis remain elusive. Given that *Porphyromonas gingivalis* (Pg) is known as one of the keystone pathogens of periodontitis, Pg could be associated with decreased pain hypersensitivity in chronic periodontitis. Thus, this study was aimed to determine whether Pg produces analgesic effects in inflammatory conditions and to examine the underlying mechanisms in nociceptive sensory neurons.

Methods: Pain-like behavior tests in adult mice were conducted in naïve or complete Freund's adjuvant (CFA) chronic inflammatory pain model after intraplantar injection of Pg in the hind paw. Spontaneous pain-like behaviors were analyzed by measuring licking/biting time. Thermal and mechanical sensitivities were measured by Hargreaves' test and von Frey assay, respectively. Inflammation and intraepidermal nerve fibers (IENF) density were quantified by H&E- and βIII-tubulin-staining, respectively, of Pg-infected plantar hind paw skin sections. Heat-killed Pg (hkPg), gingipain-null mutant Pg (KDP136), or outer membrane vesicles (OMV) isolated from wildtype (WT) or KDP136 was intraplantarly injected in the CFA model and subjected to pain-like behavior tests to find the analgesic molecule. Calcium imaging was performed to examine whether Pg can directly activate dorsal root ganglia (DRG) neurons. Direct interaction of Pg with sensory neurons was visualized under fluorescent microscopy after the co-culture of Pg and DRG neurons, and the level of pain-related neuropeptide, calcitonin gene-related peptide (CGRP), was measured by ELISA in the supernatant from co-culture of DRG neurons with Pg.

Results: Pg infection in naïve mice did not produce spontaneous pain-like behaviors, thermal and mechanical hypersensitivity whereas Pg infection significantly increased the number of inflammatory cells in the hind paw. However, Pg infection significantly reversed thermal and mechanical pain hypersensitivities in the CFA model with no loss of IENF density, indicating a negative correlation between analgesic effects by Pg infection and alteration of nerve innervation. The analgesic effects by live Pg were not recapitulated by hkPg, KDP136, or WT-/KDP136-OMV in the CFA model. Immunocytochemical analysis revealed co-localization of Pg and DRG neurons, suggesting direct physical interaction between Pg and DRG neurons. However, live Pg application did not induce calcium response in DRG neurons, but CGRP level was significantly decreased by live Pg in the supernatant from the co-culture with DRG neurons.

Conclusions: Our results demonstrate that the infection by live Pg with gingipain activity produces analgesic effects in inflammatory conditions, and the decrease in CGRP release from DRG neurons by live Pg suggests the potential contribution of reduced neurogenic inflammation to the Pg-induced analgesic effects. The detailed underlying molecular mechanism for the regulation of neurogenic inflammation by Pg is currently under investigation.

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Hatton Award

H-5

Comparative study on accuracy of surgical robot system and surgical template for dental implant placement

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Purpose: This study aimed to evaluate the tracking accuracy of a robot-assisted implant surgery system and compare the spatial accuracy of robot-assisted implant surgery with that of static stent-guided implant surgery for implant placement.
Materials and Methods: The tracking accuracy of the robot-assisted system was evaluated by measuring the linear discrepancy between the robot-assisted implant placement position and the actual programmed placement position. Dental implants were placed on 3D printed human phantom models using static stent-guided and robot-assisted surgeries. The top, apex, angular, and depth deviations of the placed implant positions were measured relative to the planned position, and the values were compared between the robot and surgical guide groups. The results were analyzed using the Mann-Whitney U test (α =.05).
Results: The robotic system tended to show fewer deviations at the implant apex and guide system at the implant top. The tracking accuracy of the robot-assisted system showed a linear deviation of 0.13±0.04mm and an angular deviation of 0.77±0.02°at the drill tip. Deviations at the top and apex of the implants were 0.61±0.29mm and 0.50±0.14mm in the robot-assisted group and 0.49±0.39mm and 0.72±0.39mm in the stent-guided group, respectively. Angular and depth deviations were 2.38±0.62°and 0.17±0.12mm in the robot group, and 3.16±2.36°and 0.15±0.11mm in the stent-guided group, respectively. The difference in none of the top, apex, angular, or depth deviations was statistically significant between the robot and surgical guide groups (p>.05).
Conclusion: The accuracy in implant placement using robot-assisted implant surgery was comparable to that of static stent-guided surgery. Robot-assisted implant surgery and static-guided surgery tended to result in minor deviations at the apex and top of the implants, respectively.

Acknowledgements: This work was supported by the Technology Innovation Program (20007888, Development of dental surgery and treatment assistant robot and navigation system technology for high-precision implant surgery) funded by the Ministry of Trade, Industry & Energy (MOTIE, Korea).

H−6

Comparing effectiveness of Alveolar ridge preservation to Guided bone regeneration performed on spontaneously healed extraction sockets with different grade of destroyed defects : a preclinical study in dogs

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***** Jung Yoon Kim and Hae Jee Shin contributed equally to this work.

Background: The aim of this study is to compare alveolar ridge preservation (ARP) followed by early implant placement to guided bone regeneration (GBR) performed on spontaneously healed extraction socket also followed by early implant placement, in following aspects: (1) dimensional change, (2) new bone regeneration, and (3) implant osseointegration, on different defect types.

Materials and methods: In six beagle dogs, the distal roots of three premolars (P2, P3, P4) were extracted. The mesial roots were remained as pristine bone. Extraction sockets in unilateral mandible were randomly allocated to different defect models as following: the intact socket, 1-wall damaged socket with buccal bone plate removed, and 2-wall damaged socket with buccal and lingual bone plate removed. Each side of mandible is allocated as following surgical interventions:

-Right side: ARP with early implantation

-Left side: Spontaneous healing followed by early implantation with GBR

ARP was performed at the time of tooth extraction and defect preparation. Eight weeks after tooth extraction, the surgical guided implant was placed in each socket, and simultaneous GBR was performed. Eight weeks after the implantation, all dogs were sacrificed for intraoral scanning, radiographic and histologic analyses.

Results: The gain of alveolar ridge volume was significantly higher in GBR group. No significant difference was shown among socket types nor the correlation between socket types and groups.

The proportion of mineralized tissue within regenerated ridge area was significantly largest at intact socket, and larger in ARP group in every type of socket. The proportion of residual bone material, however, was significantly largest at 2-wall damaged socket. There is no significant difference between ARP and GBR group.

2-wall damaged socket showed significantly lowest Buccal fBIC (first bone-to-implant contact) and the highest BIC, as fBIC was lowest in GBR group.

Conclusion: The volume of ridge contour was more stably maintained in GBR group, while no significant difference was found between socket types. New bone regeneration can be facilitated in more intact type of socket as well as in ARP group, and the correlation between socket types and surgical interventions was found. The implant osseointegration was highly obtained in 2-wall damaged socket and GBR group in terms of fBIC.

Hatton Award

H-7

A Randomized controlled clinical trial of comparison between wedge-shaped collagenated bone substitute versus particle-type bone substitute in guided bone regeneration on horizontal ridge defect around dental implants

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Objectives: The wedge-shaped collagenated bone substitute showed great width enhancement around implant defect during Guided Bone Regeneration (GBR). However, the research for long-term enhancement and stability of wedge-shaped collagenated bone substitute has not been thoroughly studied. The aim of this study was to investigate the change of dimension and the stability of wedge-shaped collagenated compared to particle-type bone substitute during GBR.
Methods: To investigate the change of dimension and stability, wedge-shaped collagenated bone substitute (Test) or particle-type bone substitute (Control) was randomly applied to horizontal ridge defects around dental implants with the same membrane (Bio-Gide). CBCT was taken three times; before the surgery, after the surgery, and 4months after the surgery to examine the difference between the two materials. For the measurement of linear (mm), area (mm^2), and volume (mm^3), the OnDmand3D program was used.
Results: Both wedge-shaped collagenated and particle-type bone substitute induced great stability on the defect. The natural shrinkage was observed 4 months after the surgery CBCT from both groups without the effect inside the alveolar bone envelope. Interestingly, the results of linear, area, and volume showed a higher average in both shrinkage and augmentation with wedge-shaped collagenated bone substitute.
Conclusions: These findings suggest that wedge-shaped collagenated bone substitute similarly enhanced the width of alveolar bone compared to particle-type bone substitute with stability after 4 months.

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Korean Division of the International Association for Dental Research

Johnson & Johnson KADR award

Johnson & Johnson KADR award

J-1

Clinical evaluation of artificial intelligence recognition of dental plaque index

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Objectives: Dental plaque is one of major etiologies of dental disease. Artificial intelligence (AI) algorithm has been developed to recognize dental plaque using quantitative analysis. Accordingly, it is helpful to use a AI-based recognition of dental plaque index for evaluating clinical data in contemporary dentistry.
Methods: Under Institutional Review Board (IRB No. 2022-07-049), intra-oral photos of forty two subjects were collected before and after application of disclosing agent. A mask R-CNN(regional convolutional neural network) algorithm based on the weight map was adopted. This algorithm visualized the area of teeth and dental plaque respectively. The proportion of dental plaque in teeth from each picture was calculated. The AI Index was developed utilizing a modified Quigley & Hein (mQH) index.
The three clinicians evaluated the quantitative amount of dental plaque based on mQH index in oral photography. Clinical evaluation was conducted by comparing AI index and mQH index.
Results: Before and after disclosing the dental plaque, the recognition rates based on R-CNN algorithm were 98% and 80% respectively. The recognition rate of upper teeth was higher than that of mandible. The recognition rate of canines was slightly lower than other incisors. The AI Index and the clinician's mQH score were clinically different. The coincidence rate between AI Index and clinician's mQH index was higher in the pre-disclosing agent picture than in the post-disclosing agent picture. Overall, the range of the coincidence rate was from 21% to 55% between the AI Index and the mQH index. Given the plaque index of 3 or higher, the coincidence rate between the AI Index and the mQH index was more than 80% for the central and lateral incisors. In the cases of central incisors, the coincidence rate was up to 96%.
Conclusions: The AI model can be used for oral hygiene management and education by demonstrating the location and the rate of plaque. Clinical applications may be available effectively when sufficient data is accumulated in the future.

Acknowledgements: This study was supported by the Jeonbuk National University, School of Dentistry and by the Biomedical Research Institute of Jeonbuk National University Hospital.

J-2

Antibiotic resistance genes in orofacial abscesses identified using a metagenomics-based approach

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Objectives: Current culture-based methods for microbiological diagnosis and antibiotic susceptibility tests have limitations in the management of oral and maxillofacial infections. In this pilot study, we aimed to profile pus microbiota and identify antibiotic resistance genes (ARGs) in oral and maxillofacial infections using a culture-independent approach.

Methods: Taxonomic profiling and prediction of ARGs were performed directly from the metagenomic raw reads generated by shotgun sequencing of genomic DNA samples extracted from the pus specimens of two patients with orofacial abscesses.

Results: Taxonomic profiling revealed obligate anaerobic polymicrobial communities associated with infections of odontogenic origins: the microbial community of Patient 1 consisted of one predominant species (*Prevotella oris* 74.6%) with 27 minor species, while the sample from Patient 2 contained 3 abundant species (*Porphyromonas endodontalis* 33.0%; *P. oris* 31.6%; and *Prevotella koreensis* 13.4%) with five minor species. A total of 150 and 136 putative ARGs were predicted in the metagenome of each pus sample. The coverage of most predicted ARGs was less than 10%, and only the CfxA2 gene identified in Patient 1 was 100%. ARG analysis of assembled genomes available in a public database suggested that P. oris may carry CfxA2 gene.

Conclusions: a metagenomics-based approach is useful to profile predominantly anaerobic polymicrobial communities, and this pilot study implies the possibility of ARG analysis using clinical metagenomic samples.

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Johnson & Johnson KADR award

J-3

A radiographic study on root resorption according to orthodontic treatment

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Objectives: Root resorption in orthodontic treatment is a common problem that has not yet been completely resolved. In this study, radiographic analysis before and after orthodontic treatment was conducted to determine whether age, treatment period, and Angle's classification act as risk factors for root resorption.
Methods: This study included periapical radiographs of forty-five subjects treated with fixed appliances from 2004 to 2020. The patient's age ranged from 11 to 56 years, and the mean age was 22.89 years. The radiographic images of the maxillary central incisors and mandibular incisors were taken at the beginning and end of orthodontic treatment. The root resorption rate was calculated by measuring the distance from the cemento-enamel junction to the root apex and the incisal edge to the root apex. Measuring of root length was conducted by one dental student and one oral and maxillofacial radiology specialist (Cronbach's Alpha = .795). The correlation was analyzed by comparing the root resorption rate with age, treatment period, and Angle's classification. The statistical analysis was conducted by paired t-test, ANOVA test, the correlation test utilizing IBM SPSS Statistics version 27.0.
Results: Root resorption was observed in 73% of the study subjects. The root resorption rate increased by 1.11% after orthodontic treatment. The correlation between age, treatment period, Angle's classification and root resorption was not statistically significant ($P > 0.05$). But when the patients were classified into three groups by treatment period which is 1 to 2 years, 2 to 3 years, and 3 years or longer, the root resorption was 0.93%, 1.1%, and 1.4% respectively. According to the Angle's classification, the root resorption was highest in Angle Class Ⅲ with 1.52%, followed by Angle Class Ⅱ with 1.18% and Angle Class Ⅰ with 0.59%.
Conclusions: Although there is no correlation between age, treatment period, Angle's classification and root resorption, Root resorption was occurred in 73% of the study subjects. Measures are essentially required to prevent root resorption during orthodontic treatment.

Acknowledgments: This study was supported by School of Dentistry, Jeonbuk National University.

Korean Division of the International Association for Dental Research

Poster Presentations

Poster Presentation

P-1

3D-printed resorbable PCL/β-TCP membrane for guided bone regeneration in peri-implant dehiscence defect

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Objectives: The aim of this study was to evaluate the membrane feasibility and changes in alveolar ridge dimensions following the clinical application of a resorbable 3D printed polycaprolactone/β-tricalcium phosphate (PCL/β-TCP) membrane in comparison with a collagen membrane on peri-implant dehiscence defects.
Methods: For a total of 15 patients, alveolar bone augmentation was accomplished with either pre-shaped 3D-printed PCL/β-TCP membrane as a test group or collagen membrane as a control group in conjunction with bovine-derived xenograft. The changes in horizontal bone thickness, HW0 at the level of the implant shoulder, HW2 and HW4 at respective depths of 2mm and 4mm apical to the implant shoulder and vertical thickness (VT), and VT at 45° angle were measured upward from the implant shoulder using cone beam computed tomography(CBCT)scan data, at immediately after implant placement(baseline) and at re-entry surgery.
Results: Throughout the healing period, surgical sites showed the absence of soft-tissue dehiscence and membrane exposure, and there were no signs and symptoms of severe post-operative complications. The intergroup CBCT comparison between the test and control group showed a statistically significant difference ($p < 0.05$) in mean horizontal and vertical bone dimensions observed at HW0, VT, and 45-VT. A significantly higher amount of bone regeneration was observed in the 3D-printed PCL/β-TCP membrane group. However, in comparison between the first and second surgeries for the control and test group, no statistically significant differences ($p > 0.05$) were found.
Conclusions: Within the limitations of the present study, peri-implant dehiscence defects could be effectively treated with a pre-shaped 3D-printed resorbable PCL/β-TCP membrane in terms of stability, degradation rate, and improved bone regeneration at both horizontal and vertical augmented regions.

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P-2

Ceria nanozyme activity from modified methacrylate-based polymer imparts a cytoprotective and bio-friendly intaglio surface micro-environment for oro-facial prosthesis

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Objectives: Orofacial deformities are increasingly prevalent due to congenital defects and sequelae to surgical resection of oral cavity cancer. Oral rehabilitation is often needed after surgical intervention for optimal restoration of aesthetics and function. Poly(methyl methacrylate) (PMMA) based resin is a common biomaterial of choice for oral prosthetics. However, the interaction of the intaglio surface with underlying post-operative frail mucosa often leads to localized stress resulting in an inflammatory erythematous lesion, most often associated with microbial adhesion. This study aimed to investigate the bacterial and inflammatory resistance effects of ceria nanozyme delivered via mesoporous particles in PMMA to improve the biological effects of long-term appliances.
Methods: SBA-15 impregnated with cerium oxide were pre-treated with sulfo-polybetaine and incorporated into the auto-polymerizing PMMA (SC+ group) while PMMA without modification was the Control group. The effect of ceria nanozyme biological activity was investigated progressively through *in vitro*, *ex vivo* and *in vivo* experiments. Periodic release of cerium ions was evaluated along with superoxide dismutase (SOD) and catalase (CAT) mimetic catalytic activities. Biological interactions were characterized in two modalities: (i) fungal and multispecies microbial adhesive resistance, and (ii) response towards cellular homeostasis. Surface microbiota was also analyzed by 16S rRNA with metagenomic shotgun sequencing. Response of HGF-1 cells was investigated for protein expression associated with inflammatory stimuli, and wound healing assays was evaluated with scratch test and western blot assays. Lastly, the improvement in bio-favorability with SC+ was verified via extra-and intra-oral *in vivo* models.
Results: In contrast to the Control group, the SC+ group showed significantly increased release of cerium ions. Significant resistance to candidal and multispecies bacterial biofilm was also observed in SC+ group. Similary, SC+ also showed better dysbiosis resistance with down-regulation of pathogenic c-di-GMP, sRNA and quorum sensing associated gene ontological pathways. The levels of reactive oxygen species and inflammatory markers (MMP-9, MMP2 and HIF-1-alpha) were reduced in the HGF-1 assay with the SC+ group. Moreover, improved wound healing response was observed with increased cell migration and increased expression of MAPK pathway-associated proteins. The *in vivo* analyses showed the absence of both local and systemic adverse biological reaction with SC+ extracts in both the skin and oral mucosa models.
Conclusions: These findings suggest that SC+ type resin-based appliance can improve cytoprotective effect by multispecies dysbiosis resistance and effectively reducing pro-inflammatory markers while imparting improved healing response.

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Poster Presentation

P-3

Diagnostic Value of Bone Scan for the Detection of TMJ Osteoarthritis

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Objectives: Bone scan can help to diagnose pathologic state of bone due to bone inflammation and degenerative changes. Bone scan can be powerful to detect the abnormal bony changes that could not be found in the clinical examination or X-ray imaging such as panoramic radiographs and cone-beam computed tomography (CBCT). The aim of this study was to report a case in which temporomandibular joint (TMJ) had no pathologic findings on CBCT, but it was finally proven to have osteoarthritis by bone scan.
Methods: A 44-year-old female patient visited the Department of Oral and Facial Pain, Kyung Hee University Dental Hospital, who complained of pain and sound in her right TMJ when she opened her mouth. On clinical examination, uncorrected s-deviation of mouth opening pathway to right side was observed, with pain and crepitus sound of right TMJ. We made a tentative diagnosis of degenerative joint disorder according to the diagnostic criteria for temporomandibular disorders (DC/TMD). For further evaluation of degenerative disease of TMJ, we decided to take CBCT and bone scan.
Results: On the CBCT images, obvious sclerosis and erosion were observed on the right condyle. Thus, degenerative joint disease of the right TMJ was confirmed based on DC/TMD. CBCT images of the left condyle showed no significant morphologic changes and were within normal range. In bone scan, however, increased radiotracer uptake was observed in both condyle at a similar level of activity, which presents osteoarthritis in both TMJ.
Conclusions: This case suggests that osteoarthritis of TMJ can be detected by bone scan even without significant radiographic findings or clinical symptoms. Early diagnosis of arthritis can prevent bone resorption of TMJ and its further progression to degenerative disease. Therefore, when performing CBCT to confirm degenerative diseases of TMJ, additional bone scan is recommended to detect inconspicuous arthritis.

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Key words: Bone scan, temporomandibular disorder, temporoamandibular joint, osteoarthritis, diagnosis, detection

P-4

The Anti-inflammatory Properties of Ginseng Derived Exosome-like Nanoparticles in LPS-indued RAW264.7

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Objectives : Exosomes are extracellular nano-sized vesicles which transport proteins, lipids, nucleic acids and polysaccharides. Exosomes facilitate cell-to-cell communication in various organisms raging from microbiomes and plant to human. The root extract of *Panax ginseng C.A. Meyer* (Araliaceae) is known to have pharmacological activities including anticancer, anti-inflammatory, anti-oxidant and anti-aging effects. Furthermore, ginseng derived exosome-like nanoparticles (GDEs) have been isolated and studied their biological roles, possibly suggesting that the GDEs may contribute to inflammation mechanisms. But there is not still a strong evidence for its regulatory linkage. So, the main aim of this study elucidated that GDEs exert anti-inflammatory activities, which can act as an immunomodulator related to an inflammation mechanism in mammalian cells.

Methods : GDEs were isolated by sucrose cushioning ultracentrifugation and the morphology of GDEs was shown through transmission electron microscope (TEM). The number of particles and size distribution of the GDEs were evaluated using nanoparticle tracking analysis (NTA). To investigate the anti-inflammatory activity of the GDEs, the expression levels of inflammatory mediators, cytokines and chemokines were analyzed in lipopolysaccarides (LPS)-induced RAW 264.7, murine macrophages. ELISA, qPCR, western blot and nitric oxide assay were carried out for analyzing anti-inflammatory effects of the GDEs in murine macrophage, RAW264.7.

Results : Ginseng derived exosome-like nanoparticles showed a spherical shape with an average diameter of 176.2 nm and a substantial number of GDEs was counted as 1.09 $x10^9$ particles/ml. Pretreated GDEs in LPS-induced RAW264.7 suppressed the protein expression levels of pro-inflammatory cytokines including interlukin-1beta (IL-1β), interlukin-6 (IL-6) and tumor necrosis factor-alpha (TNF-α). In addition, protein expression levels of inflammation-related enzymes, cyclooxygenase-2 (COX2) and inducible nitric oxide synthase (iNOS) as well as production of nitric oxide (NO) were dramatically decreased by the GDEs in LPS-indused RAW264.7. Correspondingly, the GDEs treatment clearly reduced LPS-stimulated mRNA expression levels of the iNOS and COX2. In addition, expression patterns of the IL-1β, IL-6, TNF-a and monocyte chemoattractant protein-1(MCP1) were gradually down-regulated by the GDEs in a dosage dependent manner.

Conclusion : These results demonstrated that Ginseng derived exosome-like nanoparticles inhibited the expression of the inflammation mediators, suggesting that the GDEs possess anti-inflammatory activities and molecularly regulate the inflammatory mechanism in mammalian cells. Collectively, the GDEs has high potential as a novel therapeutic agent to treat chronic inflammatory diseases.

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Keywords: Ginseng · Exosome · Ginseng-derived exosome-like nanoparticles· Inflammation · Anti-inflammation

Poster Presentation

P-5

Strategies to Complete Successfully the Clinical Trial during COVID-19

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Objectives : The purpose of this study was to summarize and announce the points to be taken into account when conducting a 125-person saliva clinical trial in the context of COVID-19. In addition, we tried to find a way to reduce the dropout rate of participants.
Methods : From September 2020 to August 2022, a saliva-based clinical trial was conducted for diagnosing periodontitis in a total of 125 patients (58 females, 67 males average age 45 years old) compared to normal people. Data were obtained by measuring salivary flow rate, salivary pH, and salivary buffer capacity, and their halitosis from all participants. At this time, oral microorganisms from saliva were obtained and analyzed by next generation sequencing and RT-PCR.
Results : Nine of 133 patients (6.76%) were dropped out. Five participants (3.7%) postponed clinical trial appointments at least once. None of the participants postponed their appointment more than twice. The main reasons for their dropout were the fear of COVID-19 infection within the hospital, the sudden increase of the prevalence of COVID-19, the disapproval of family members with personal concerns, and the physical distance from their residence. Sometimes personal vacation or travel schedule, and personal factors such as worsening of the patient's physical condition were also mentioned as a factor in dropout. Most of these factors were directly or indirectly correlated with the COVID-19 pandemic situation and social factors. In order to reduce the dropout rate, we waited until the time for participants to come safely, repeatedly explained that the hospital environment and clinical trial conditions are optimal to prevent SARS-COV2 viral infection, reassuring participants, and promised clinical trials from the patient's point of view as much as possible. This ensures that no participant postponed an appointment more than twice. It took 23 months for a total of 133 patients to this rather complicated clinical trial.
Conclusion : The COVID-19 pandemic situation is absolutely challenging and must be difficult to conduct clinical trials. However, in the course of clinical trials, mutual understanding and rapport formation between participants and facilitators, a sufficient explanation of the situation, and the allocation of a participant-centered appointment date and time are important for a successful clinical trial completion even in a pandemic situation.
Acknowledgements: This research was supported by a Korea Medical Device Development Fund grant funded by the Korean government (Ministry of Science and ICT, Ministry of Trade, Industry and Energy, Ministry of Health & Welfare, Republic of Korea, Ministry of Food and Drug Safety) (Project Number: KMDF_PR_20200901_0023, 9991006696)

Keywords: COVID-19, saliva, participant, clinical trial, strategy, dropout

P-6

Investigation of Oral Microorganisms in Saliva and Inner Surfaces of Mask in Patients with Halitosis and Volatile Sulfide Compounds during the COVID-19 Pandemic

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Objectives : Wearing a mask is still strongly recommended due to the long tail of the COVID-19 pandemic. Within the chamber of the mask, people become more aware of their oral malodor. This study aimed to measure volatile sulfide compound (VSC) levels in patients with halitosis and to investigate the oral microorganism profile on the inner surface of their mask. It was also investigated which oral bacteria increases VSC levels and whether the oral bacteria of saliva from the oral cavity and mask has a correlation with each other.

Methods : A total of 50 (41 females, average age 38.12 ± 12.58 years old) were included in the study, 25 normal healthy subjects and 25 patients with halitosis who wore masks for more than 3 hours. Dominant bacterial species, bacterial profile, and Shannon diversity index of whole unstimulated saliva and the inner surface of the mask were investigated. Bacterial 16S ribosomal-RNA genes of major oral bacterial species were analyzed by real-time PCR. Hydrogen sulfide (H_2S) and methyl mercaptan (CH_3SH), which are representative VSCs, were measured using gas chromatography.

Results : The total bacterial DNA copy number was significantly larger in the saliva than in the mask sample ($p<0.001$), and the average value of saliva was 276 times greater. Shannon diversity index also significantly higher in saliva than in the inner surface of the mask (2.62 ± 0.81 vs. 1.15 ± 1.52, $p<0.001$). The most common gram-negative and gram-positive species in mask were *Porphyromonas gingivalis* (*Pg*) and *Lactobacillus casei* (*Lc*), respectively. The bacterial species with a significant positive correlation between saliva and mask were *Prevotella intermedia* (*Pi*) ($r=0.324$, $p<0.05$), *Lc* ($r=0.293$, $p<0.05$), and *Parvimonas micra* ($r=0.366$, $p<0.01$). The mean value of CH_3SH was significantly higher in the Halitosis group than in the non-Halitosis group (17.84 ± 29.00 vs. 3.84 ± 10.57 ppb, $p=0.031$). In the Halitosis group, in the order of *Pg*, *Treponema denticola (Td)*, *Tannerella forsythia*, *Pi*, and *Prevotella nigrescens* of saliva, their DNA copy numbers and VSC levels had a larger positive correlation coefficient (all $p<0.05$). Regarding bacterial profiles of the mask, only *Td* had positive correlations with CH_3SH ($r=0.414$, $p=0.040$) and total VSCs ($r=0.374$, $p=0.033$) in Halitosis group.

Conclusion : Oral bacteria, whose association with halitosis has been identified, increased VSC levels in mask-wearing subjects during the COVID-19 pandemic, particularly gram-negative anaerobes such as *Pg* and *Td*. The bacteria of saliva and mask had a significant correlation with each other within and between samples. Therefore, it may be beneficial for people with halitosis to control these gram-negative species through oral hygiene management and to change masks regularly.

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Keywords: halitosis, COVID-19, mask, saliva, oral microorganism**,** volatile sulfide compound

Poster Presentation

P-7

Novel tooth bleaching agent containing hydrated calcium silicate

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Objectives: Hydrogen peroxide (HP) are the most commonly used chemical materials for tooth bleaching. However, tooth bleaching products containing HP of high percentages are still a concern due to negative side effects such as decreased mirohardness, and increased surface roughness. The purpose of this study was to assess the bleaching efficacy, microhardness, and surface morphology of a newly developed tooth bleaching material containing hydrated calcium silicate (hCS) on the enamel surface.
Methods: White Portland cement was mixed with distilled water and ground into particles before being mixed with 35% HP in the following manner: only HP (HP); 2.0 wt.% hCS + HP (hCS 2.0), 1.0 wt.% hCS + HP (hCS 1.0), 0.50 wt.% hCS + HP (hCS 0.50), and 0.25 wt.% hCS + HP (hCS 0.25). As a commercial control (CC), teeth whitening gel (Teeth whitening gel, SenAllis Cosmetics, NY, USA) was used. The pH and calcium ion release were measured for 15 min. To measure the effect of tooth bleaching, the color change value (ΔE^*) was measured using a spectrophotometer before and after the tooth bleaching treatment. Microhardness and morphology were also evaluated before and after the application.
Results: The pH and calcium ion concentration from the experimental agents containing hCS were significantly higher than those from HP and CC at the end point ($p<0.05$). There were no appreciable differences between the experimental agents with various hCS contents and the specimen treated with experimental agents containing hCS, but the ΔE^* of the specimen treated with experimental solutions containing hCS was significantly higher than that of the CC. The percentage of microhardness loss (PML) was generally decreased by the experimental solutions containing hCS, and this reduction became more pronounced as the hCS content rose ($p<0.05$). On HP and CC, the erosion pattern was seen, and on hCS 2.0, aggregated hCS was found.
Conclusions: A novel bleaching agent containing hCS was developed. The pH and calcium ion concentration of the new bleaching agent when combined with hCS and HP were significantly higher than those of the CC. In addition, compared to the CC, the new bleaching agent shows bleaching efficacy and possesses a potent capability to reduce enamel demineralization. Therefore, the novel tooth bleaching agent containing hCS would be a promising bleaching agent because of its wide applicability in minimizing the adverse effects on the enamel surface during treatment in dental clinics.

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P-8

Antibacterial activity of organic solvent extracts of *C.tricuspidata* on *S.mutans*

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Objectives: *Streptococcus mutans*(*S. mutans*) plays the most decisive role in the formation of plaque and is well known as a major causative agent of dental caries caused by calcium release due to the production of organic acids. In this study, the growth inhibitory effect of *S. mutans* by solvent-specific extraction of *C. tricuspidata* root was investigated.

Methods: After immersing in a ratio of 150 g of *C.ricuspidata* root and 500 ml of EtOH, the pharmacological components are extracted and concentrated under reduced pressure, and then Distilled water is added and suspended (EtoH 20% concentration). Then, solvent fractionation was carried out for each $CHCl_3$, EtoAC, n-butanol and Distilled water and then concentrated under reduced pressure to analyze the effect on the growth of *S. mutans*.

Results: *S. mutans* antibacterial activity of organic solvent extracts (concentrations 0, 0.25, 0.5, 1, 2 mg/ml) was shown to be higher than 0.5 mg/ml in the solvent extracts of EtoH and EtoAC. $CHCl_3$, n-Butanol and Aqueous solvent extract showed antibacterial activity at 2 mg/ml or higher.

As for the antibacterial activity of the extract obtained by performing the fractionation for each solvent ($CHCl_3$, EtoAC, n-butanol) on the ethanol extract, the $CHCl_3$ fraction showed antibacterial activity at 15 μg/ml or more, and the remaining solvent fractions showed no antibacterial activity.

From the above results, the highest antibacterial activity was observed in the $CHCl_3$ solvent fraction.

Conclusions: These results suggest that C. tricuspidataroot was able to detect the presence of antibacterial components by chloroform extraction, and inhibit the growth of S. mutans to suppress the induction of caries.

Poster Presentation

P-9

Inhibition of cariogenic activities by pine needle essential oil

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Objectives: *Streptococcus mutans* (*S. mutans*) decomposes sucrose and induces dental caries due to the production of biofilms and organic acids. For the prevention of dental caries, the search for natural products that inhibit the proliferation and glucosyltransferase(GTase) activity of *S. mutans* is being attempted. In this study, the caries inhibitory effect of *S. mutans* on essential oil of *Pinus densiflora* leaves was analyzed, and the components of essential oil were analyzed by GC/MS.
Methods: In order to analyze the dental caries prevention effect of *S. mutans* by P. densiflora leaf essential oil, the effects on growth, organic acid production, and biofilm formation of *S. mutans* were observed, and major components of essential oil were analyzed by GC/MS.
Results: The effect of each concentration of *P. densiflora* leaf essential oil (0.25 - 2mg/mL) on the growth of *S. mutans* was inhibited at 0.5mg/mL or higher. The pH change due to organic acid production was 6.17±0.03 at 0.25 mg/mL, which was higher than the caries critical pH of 5.5, indicating a dental caries preventive effect. The effect of inhibiting biofilm formation by bacteria was observed to be visually reduced at 0.5 mg/mL or more. The main components of the extract were analyzed for α-pinen, β-phellandrene, and β-caryophllene.
Conclusions: These results showed the possibility of a caries-inducing inhibitor by reducing the caries characteristics of the growth, acid production and biofilm formation of *S. mutans* by *P. densiflora* leaf essential oil.

P-10

Porphyromonas gingivalis produces analgesic effects by the direct action on the nociceptive sensory neurons

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Objectives: Periodontitis is a chronic inflammatory disease of the periodontium that leads to tissue destruction, bleeding, and bone resorption. However, pain, one of the cardinal signs of inflammation, is not commonly accompanied in periodontitis, which is unlike other inflammatory conditions. Although a lack of pain symptoms may contribute to delayed detection and treatment of periodontitis in patients, the cause and mechanism of decreased pain hypersensitivity in periodontitis remain elusive. Given that *Porphyromonas gingivalis* (Pg) is known as one of the keystone pathogens of periodontitis, Pg could be associated with decreased pain hypersensitivity in chronic periodontitis. Thus, this study was aimed to determine whether Pg produces analgesic effects in inflammatory conditions and to examine the underlying mechanisms in nociceptive sensory neurons.

Methods: Pain-like behavior tests in adult mice were conducted in naïve or complete Freund's adjuvant (CFA) chronic inflammatory pain model after intraplantar injection of Pg in the hind paw. Spontaneous pain-like behaviors were analyzed by measuring licking/biting time. Thermal and mechanical sensitivities were measured by Hargreaves' test and von Frey assay, respectively. Inflammation and intraepidermal nerve fibers (IENF) density were quantified by H&E- and βIII-tubulin-staining, respectively, of Pg-infected plantar hind paw skin sections. Heat-killed Pg (hkPg), gingipain-null mutant Pg (KDP136), or outer membrane vesicles (OMV) isolated from wildtype (WT) or KDP136 was intraplantarly injected in the CFA model and subjected to pain-like behavior tests to find the analgesic molecule. Calcium imaging was performed to examine whether Pg can directly activate dorsal root ganglia (DRG) neurons. Direct interaction of Pg with sensory neurons was visualized under fluorescent microscopy after the co-culture of Pg and DRG neurons, and the level of pain-related neuropeptide, calcitonin gene-related peptide (CGRP), was measured by ELISA in the supernatant from co-culture of DRG neurons with Pg.

Results: Pg infection in naïve mice did not produce spontaneous pain-like behaviors, thermal and mechanical hypersensitivity whereas Pg infection significantly increased the number of inflammatory cells in the hind paw. However, Pg infection significantly reversed thermal and mechanical pain hypersensitivities in the CFA model with no loss of IENF density, indicating a negative correlation between analgesic effects by Pg infection and alteration of nerve innervation. The analgesic effects by live Pg were not recapitulated by hkPg, KDP136, or WT-/KDP136-OMV in the CFA model. Immunocytochemical analysis revealed co-localization of Pg and DRG neurons, suggesting direct physical interaction between Pg and DRG neurons. However, live Pg application did not induce calcium response in DRG neurons, but CGRP level was significantly decreased by live Pg in the supernatant from the co-culture with DRG neurons.

Conclusions: Our results demonstrate that the infection by live Pg with gingipain activity produces analgesic effects in inflammatory conditions, and the decrease in CGRP release from DRG neurons by live Pg suggests the potential contribution of reduced neurogenic inflammation to the Pg-induced analgesic effects. The detailed underlying molecular mechanism for the regulation of neurogenic inflammation by Pg is currently under investigation.

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Poster Presentation

P-11

Comparative study on accuracy of surgical robot system and surgical template for dental implant placement

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Purpose: This study aimed to evaluate the tracking accuracy of a robot-assisted implant surgery system and compare the spatial accuracy of robot-assisted implant surgery with that of static stent-guided implant surgery for implant placement.
Materials and Methods: The tracking accuracy of the robot-assisted system was evaluated by measuring the linear discrepancy between the robot-assisted implant placement position and the actual programmed placement position. Dental implants were placed on 3D printed human phantom models using static stent-guided and robot-assisted surgeries. The top, apex, angular, and depth deviations of the placed implant positions were measured relative to the planned position, and the values were compared between the robot and surgical guide groups. The results were analyzed using the Mann-Whitney U test (α =.05).
Results: The robotic system tended to show fewer deviations at the implant apex and guide system at the implant top. The tracking accuracy of the robot-assisted system showed a linear deviation of 0.13±0.04mm and an angular deviation of 0.77±0.02°at the drill tip. Deviations at the top and apex of the implants were 0.61±0.29mm and 0.50±0.14mm in the robot-assisted group and 0.49±0.39mm and 0.72±0.39mm in the stent-guided group, respectively. Angular and depth deviations were 2.38±0.62°and 0.17±0.12mm in the robot group, and 3.16±2.36°and 0.15±0.11mm in the stent-guided group, respectively. The difference in none of the top, apex, angular, or depth deviations was statistically significant between the robot and surgical guide groups (p>.05).
Conclusion: The accuracy in implant placement using robot-assisted implant surgery was comparable to that of static stent-guided surgery. Robot-assisted implant surgery and static-guided surgery tended to result in minor deviations at the apex and top of the implants, respectively.

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P-12

Clinical evaluation of artificial intelligence recognition of dental plaque index

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Objectives: Dental plaque is one of major etiologies of dental disease. Artificial intelligence (AI) algorithm has been developed to recognize dental plaque using quantitative analysis. Accordingly, it is helpful to use a AI-based recognition of dental plaque index for evaluating clinical data in contemporary dentistry.
Methods: Under Institutional Review Board (IRB No. 2022-07-049), intra-oral photos of forty two subjects were collected before and after application of disclosing agent. A mask R-CNN(regional convolutional neural network) algorithm based on the weight map was adopted. This algorithm visualized the area of teeth and dental plaque respectively. The proportion of dental plaque in teeth from each picture was calculated. The AI Index was developed utilizing a modified Quigley & Hein (mQH) index.
The three clinicians evaluated the quantitative amount of dental plaque based on mQH index in oral photography. Clinical evaluation was conducted by comparing AI index and mQH index.
Results: Before and after disclosing the dental plaque, the recognition rates based on R-CNN algorithm were 98% and 80% respectively. The recognition rate of upper teeth was higher than that of mandible. The recognition rate of canines was slightly lower than other incisors. The AI Index and the clinician's mQH score were clinically different. The coincidence rate between AI Index and clinician's mQH index was higher in the pre-disclosing agent picture than in the post-disclosing agent picture. Overall, the range of the coincidence rate was from 21% to 55% between the AI Index and the mQH index. Given the plaque index of 3 or higher, the coincidence rate between the AI Index and the mQH index was more than 80% for the central and lateral incisors. In the cases of central incisors, the coincidence rate was up to 96%.
Conclusions: The AI model can be used for oral hygiene management and education by demonstrating the location and the rate of plaque. Clinical applications may be available effectively when sufficient data is accumulated in the future.

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Poster Presentation

P-13

Antibiotic resistance genes in orofacial abscesses identified using a metagenomics-based approach

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Objectives: Current culture-based methods for microbiological diagnosis and antibiotic susceptibility tests have limitations in the management of oral and maxillofacial infections. In this pilot study, we aimed to profile pus microbiota and identify antibiotic resistance genes (ARGs) in oral and maxillofacial infections using a culture-independent approach.

Methods: Taxonomic profiling and prediction of ARGs were performed directly from the metagenomic raw reads generated by shotgun sequencing of genomic DNA samples extracted from the pus specimens of two patients with orofacial abscesses.

Results: Taxonomic profiling revealed obligate anaerobic polymicrobial communities associated with infections of odontogenic origins: the microbial community of Patient 1 consisted of one predominant species (*Prevotella oris* 74.6%) with 27 minor species, while the sample from Patient 2 contained 3 abundant species (*Porphyromonas endodontalis* 33.0%; *P. oris* 31.6%; and *Prevotella koreensis* 13.4%) with five minor species. A total of 150 and 136 putative ARGs were predicted in the metagenome of each pus sample. The coverage of most predicted ARGs was less than 10%, and only the CfxA2 gene identified in Patient 1 was 100%. ARG analysis of assembled genomes available in a public database suggested that P. oris may carry CfxA2 gene.

Conclusions: a metagenomics-based approach is useful to profile predominantly anaerobic polymicrobial communities, and this pilot study implies the possibility of ARG analysis using clinical metagenomic samples.

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P-14

A radiographic study on root resorption according to orthodontic treatment

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Objectives: Root resorption in orthodontic treatment is a common problem that has not yet been completely resolved. In this study, radiographic analysis before and after orthodontic treatment was conducted to determine whether age, treatment period, and Angle's classification act as risk factors for root resorption.

Methods: This study included periapical radiographs of forty-five subjects treated with fixed appliances from 2004 to 2020. The patient's age ranged from 11 to 56 years, and the mean age was 22.89 years. The radiographic images of the maxillary central incisors and mandibular incisors were taken at the beginning and end of orthodontic treatment. The root resorption rate was calculated by measuring the distance from the cemento-enamel junction to the root apex and the incisal edge to the root apex. Measuring of root length was conducted by one dental student and one oral and maxillofacial radiology specialist (Cronbach's Alpha = .795). The correlation was analyzed by comparing the root resorption rate with age, treatment period, and Angle's classification. The statistical analysis was conducted by paired t-test, ANOVA test, the correlation test utilizing IBM SPSS Statistics version 27.0.

Results: Root resorption was observed in 73% of the study subjects. The root resorption rate increased by 1.11% after orthodontic treatment. The correlation between age, treatment period, Angle's classification and root resorption was not statistically significant ($P > 0.05$). But when the patients were classified into three groups by treatment period which is 1 to 2 years, 2 to 3 years, and 3 years or longer, the root resorption was 0.93%, 1.1%, and 1.4% respectively. According to the Angle's classification, the root resorption was highest in Angle Class Ⅲ with 1.52%, followed by Angle Class Ⅱ with 1.18% and Angle Class Ⅰ with 0.59%.

Conclusions: Although there is no correlation between age, treatment period, Angle's classification and root resorption, Root resorption was occurred in 73% of the study subjects. Measures are essentially required to prevent root resorption during orthodontic treatment.

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Poster Presentation

P-15

The development of preformed xenografts

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Most xenografts are in the form of particles, when the defect shape is irregular or wide, it is difficult to expect the grafted particle to maintain stability during the reconstruction period. Particle types have poor handling due to a lack of bond strength, which can result in graft substitutes filling in the wrong position and poorly maintained space. In order to solve these problems, we have studied various types of bone graft materials such as xenograft block-type scaffolds and the addition of organic materials to the particle-type xenografts. The purpose of this study was to investigate the effect of two-layer porcine-derived bone blocks are composed of cortical and cancellous bones in order to manufacture a customized bone graft material for a wide range of bone defects. Four circular defects were created on the cranium of a rabbit. Each defect was filled with block bone scaffolds: cortical bone block (Cortical group, *n* = 6), cancellous bone block (Cancellous group, *n* = 6), and two-layer bone block (2layer group, *n* = 6). No graft material was applied to the defect for the negative control group (Control group, *n* = 6). All rabbits were sacrificed at 8 weeks after bone grafting, and bone formation was evaluated by micro-computed tomography (micro-CT), histological, and histomorphometric assessments. New bones were primarily observed in cancellous parts of the Cancellous and the 2layer group, while the Cortical exhibited few new bones and Control filled with fibrotic tissue without new bone formation. In the results of new bone volume and area analyses, the Cancellous showed the highest value followed by the 2layer and were significantly higher than the Cortical. Within the limitation of this study, the 2layer scaffold may demonstrate its sufficient efficiency in repairing a bony defect, producing enough spaces for regenerated bones.

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P-16

Altered Th1/Th17 balance caused by zinc-deficiency and infection with *Escherichia coli* induce increased CD4 T cell infiltration in oral mucosa

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Objectives: Oral lichen planus (OLP) is a chronic T cell-mediated inflammatory disease of unknown etiology. Bacterial infection of the epithelium and lamina propria has been proposed as a triggering factor to activate T cells. Several studies reported low zinc levles in the serum or saliva of OLP patients and the therapeutic effect of zinc supplementation. This study aimed to investigate the interplay of bacterial infection and zinc-deficiency in the pathogenesis of OLP.

Methods: Intracellular survival of *Escherichia coli* 7.2, a strain isolated from OLP tissue, in human oral keratinocytes (HOK) and transcriptomic data were examined under normal or zinc-depleted condition. C57BL/6 mice of 8-week-old were put on either standard (SD) or zinc-deficient diet (ZDD) for 4-8 weeks. The labial mucosae of mice were micro-damaged using a dental stone, and then mice received oral administration of *E. coli* 7.2 every other day for 3 weeks. Leukocyte population in the cervical lymph nodes (CLN) were analyzed by flow cytometry. Hematoxylin and eosin staining, in situ hybridization, and immunofluorescence of labial tissues were performed to investigate immune response against oral infection of *E. coli.*

Results: Zinc-depleted condition increased the intracellular survival of *E. coli* in HOK cells with reduced expression of genes involved in nitric oxide synthesis or response to oxidative stress. ZDD alone induced an increase in the number of T cells and a reduced Th1/Th17 ratio specifically in the cervical lymph nodes (CLN) of mice, accompanied with oral dysbiosis. While *E. coli* infection induced a Th1-dominant response in mice with SD, a Th17-dominant response was induced in mice with ZDD. In addition, *E. coli* infection under ZDD increased total bacterial load in the oral cavity, the invasion of bacteria into the labial epithelium and lamina propria, and infiltration of CD4 T cells in the labial mucosa, presenting a few apoptotic keratinocytes.

Conclusions: *E. coli* infection and a Th17-skewed immune response increased bacterial invasion and CD4 T cell infiltration in oral mucosa. Host environment factors such as mechanical damage, a specific bacterial species (*E. coli*), and zinc-deficiency could impair the immune homeostasis with oral microbiota, which may contribute to the pathogenesis of OLP.

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Poster Presentation

P-17

Comparing effectiveness of Alveolar ridge preservation to Guided bone regeneration performed on spontaneously healed extraction sockets with different grade of destroyed defects : a preclinical study in dogs

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***** Jung Yoon Kim and Hae Jee Shin contributed equally to this work.

Background: The aim of this study is to compare alveolar ridge preservation (ARP) followed by early implant placement to guided bone regeneration (GBR) performed on spontaneously healed extraction socket also followed by early implant placement, in following aspects: (1) dimensional change, (2) new bone regeneration, and (3) implant osseointegration, on different defect types.

Materials and methods: In six beagle dogs, the distal roots of three premolars (P2, P3, P4) were extracted. The mesial roots were remained as pristine bone. Extraction sockets in unilateral mandible were randomly allocated to different defect models as following: the intact socket, 1-wall damaged socket with buccal bone plate removed, and 2-wall damaged socket with buccal and lingual bone plate removed. Each side of mandible is allocated as following surgical interventions:

-Right side: ARP with early implantation

-Left side: Spontaneous healing followed by early implantation with GBR

ARP was performed at the time of tooth extraction and defect preparation. Eight weeks after tooth extraction, the surgical guided implant was placed in each socket, and simultaneous GBR was performed. Eight weeks after the implantation, all dogs were sacrificed for intraoral scanning, radiographic and histologic analyses.

Results: The gain of alveolar ridge volume was significantly higher in GBR group. No significant difference was shown among socket types nor the correlation between socket types and groups.

The proportion of mineralized tissue within regenerated ridge area was significantly largest at intact socket, and larger in ARP group in every type of socket. The proportion of residual bone material, however, was significantly largest at 2-wall damaged socket. There is no significant difference between ARP and GBR group.

2-wall damaged socket showed significantly lowest Buccal fBIC (first bone-to-implant contact) and the highest BIC, as fBIC was lowest in GBR group.

Conclusion: The volume of ridge contour was more stably maintained in GBR group, while no significant difference was found between socket types. New bone regeneration can be facilitated in more intact type of socket as well as in ARP group, and the correlation between socket types and surgical interventions was found. The implant osseointegration was highly obtained in 2-wall damaged socket and GBR group in terms of fBIC.

P-18

A Randomized controlled clinical trial of comparison between wedge-shaped collagenated bone substitute versus particle-type bone substitute in guided bone regeneration on horizontal ridge defect around dental implants

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Objectives: The wedge-shaped collagenated bone substitute showed great width enhancement around implant defect during Guided Bone Regeneration (GBR). However, the research for long-term enhancement and stability of wedge-shaped collagenated bone substitute has not been thoroughly studied. The aim of this study was to investigate the change of dimension and the stability of wedge-shaped collagenated compared to particle-type bone substitute during GBR.

Methods: To investigate the change of dimension and stability, wedge-shaped collagenated bone substitute (Test) or particle-type bone substitute (Control) was randomly applied to horizontal ridge defects around dental implants with the same membrane (Bio-Gide). CBCT was taken three times; before the surgery, after the surgery, and 4months after the surgery to examine the difference between the two materials. For the measurement of linear (mm), area (mm^2), and volume (mm^3), the OnDmand3D program was used.

Results: Both wedge-shaped collagenated and particle-type bone substitute induced great stability on the defect. The natural shrinkage was observed 4 months after the surgery CBCT from both groups without the effect inside the alveolar bone envelope. Interestingly, the results of linear, area, and volume showed a higher average in both shrinkage and augmentation with wedge-shaped collagenated bone substitute.

Conclusions: These findings suggest that wedge-shaped collagenated bone substitute similarly enhanced the width of alveolar bone compared to particle-type bone substitute with stability after 4 months.

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PROGRAM and ABSTRACTS

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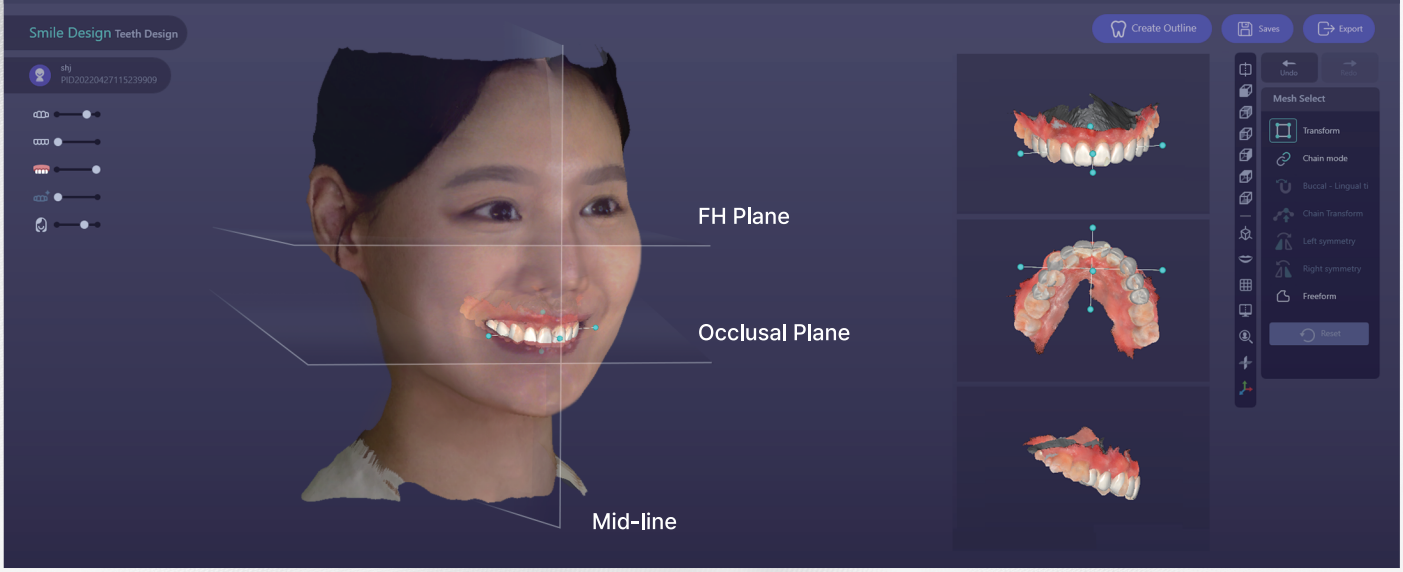

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