Asian Network of Dental Materials Societies (ANDeMS)
Kickoff Meeting

1. Date January 30-31, 2024

2. Venue Auditorium, 9th Floor, Building No. 1, Tokyo Medical and Dental University

3. Program

January 30th

(14:00-15:30 Business meeting, delegates only, 7th Floor, Building No. 1)

16:00 Opening remarks
Satoshi Imazato, Osaka Univ., President ANDeMS

Introductory talk by delegates from five countries

16:20 Education system and dental material curriculum in Indonesia
Angela Evelyna, Univ. Kristen Maranatha, Indonesia
Veni Takarini, Univ. Padjadjaran, Indonesia

16:40 Dentistry and dental materials science in South Korea
Hyeong-Cheol, Yang, Seoul National Univ., President, Korean Society for Dental Materials

Break

17:20 Dentistry and dental material science in Malaysia
Noor Azlin Yahya, Univ. Malaya, President, IADR Malaysia region

17:40 The current state of dental material research and education in Thailand
Pasutha Thunyakitpisal, Suranaree Univ. of Technology, Thailand

18:00 The Japanese Society of Dental Materials and Devices (JSDMD)
Our history and activity
Motohiro Uo, Tokyo Medical and Dental Univ., President, Japanese Society for Dental Materials and Devices

18:20 Group photographing

19:00 Social gathering at Tokyo Garden Palace Hotel, Room "Tenku"

January 31st

Academic talk session

10:00 Improving dental materials research through natural resources utilization
Veni Takarini, Univ. Padjadjaran, Indonesia

10:20 Current status and future perspectives of dental zirconia ceramics
Masanao Inokoshi, Tokyo Medical and Dental Univ., Japan

10:40 Angular organization of periodontal ligaments using 3D printed scaffolding system
Chan Ho Park, Kyungpook National Univ., Korea

11:00 Development of nanosilica from rice husk for dental restorative materials fabrication
Dasmawati Mohamad, Univ. Sains Malaysia, Malaysia

11:20 Monitoring the development of a tissue-engineered oral mucosa on a micropatterned collagen scaffold: Using optical coherence tomography
Orakarn Suebsamarn, Suranaree Univ. of Technology, Thailand

11:40 Substrate stiffness regulates cellular responses in oral tissue: A focus on inflammation and cell viability
Watcharaphol Tiskratok, Suranaree Univ. of Technology, Thailand

12:00-13:00 Lunch Break

13:00 **Rapid fire talk (5 min each for max 20 person)**

Evaluation and comparison of flexural strength and microhardness of lithium disilicate-based CAD/CAM blocks **(Video talk)**
Sofya Zulkiffli, Univ. of Malaya, Malaysia

Development of monetite as a potential bone graft
Sunarso Sunarso, Univ. Indonesia, Indonesia

Development of a laboratory GFRP block for dental CAD/CAM system
Shunsuke Nagata, Nihon Univ. School of Dentistry at Matsudo, Japan

Natural polymer-based hydrophilic hydrogels for bone tissue regeneration
Il Keun Kwon, Kyung Hee Univ., Korea

The potential of curcuma plant extract as root canal irrigation
Martha Mozartha, Univ. Sriwijaya, Indonesia

Application of electron beam melting technology in fabricating titanium prostheses
Yoshiki Ishida, The Nippon Dental Univ., Japan

Visible light triggered antibacterial effect of titania nanotubes with aminated reduced graphene oxide
Seunghan Oh, Wonkwang Univ., Korea

Self-synthesis calcium-sillicate based dental bioactive materials: The effect of testing time to mechanical properties
Angela Evelyna, Univ. Kristen Maranatha, Indonesia

Denture fabrication technique using CAD/CAM technology
Anna Miyayasu, Tokyo Medical and Dental Univ., Japan

History of dental zirconia
Jinsoo Ahn, Seoul National Univ., Korea

A closer looking at cellular mechanotransduction
Hae-Won Kim, Dankook Univ., Korea

Effect of cadmium on the physicochemical properties of mouse femur
Ahmad Bikhardin, Okayama Univ., Japan

Damage and defects of dental CAD/CAM monolith zirconia
Hae-Hyung Lee, Dankook Univ., Korea

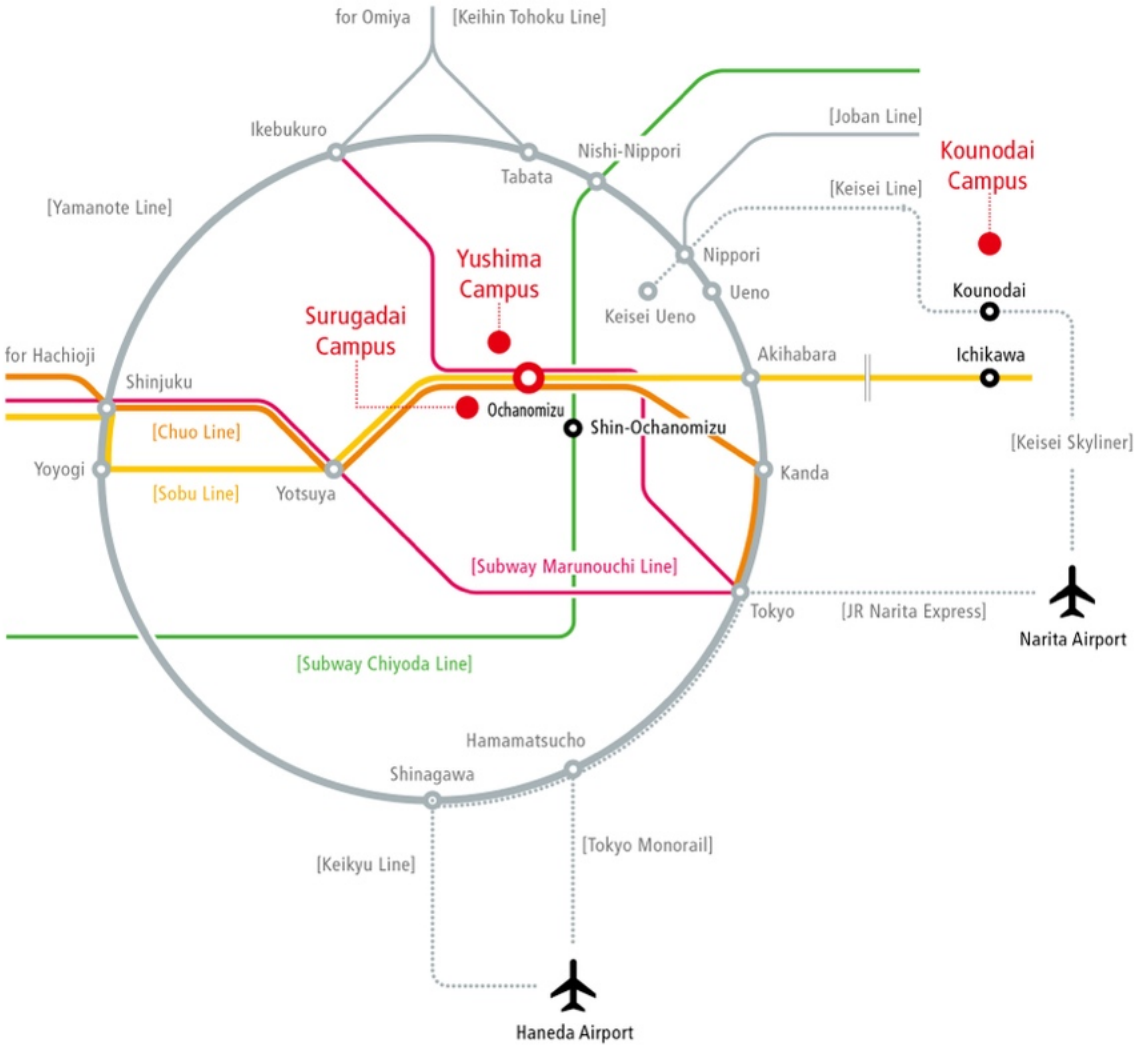
15:00 **Closing remarks**
Motohiro Uo, Tokyo Medical and Dental Univ., President, JSDMD

Yushima and Surugadai Campuses

- JR Line Ochanomizu Sta.
- Subway Marunouchi Line Ochanomizu Sta.
- Subway Chiyoda Line Shin-Ochanomizu Sta.

Kounodai Campus

- Keisei Line Kounodai Sta.
- Sobu Line Ichikawa Sta.
- Bus for Matsudo Sta. from No.1 Keisei Bus Stop to Kokuritsu Byoin



From Haneda Airport

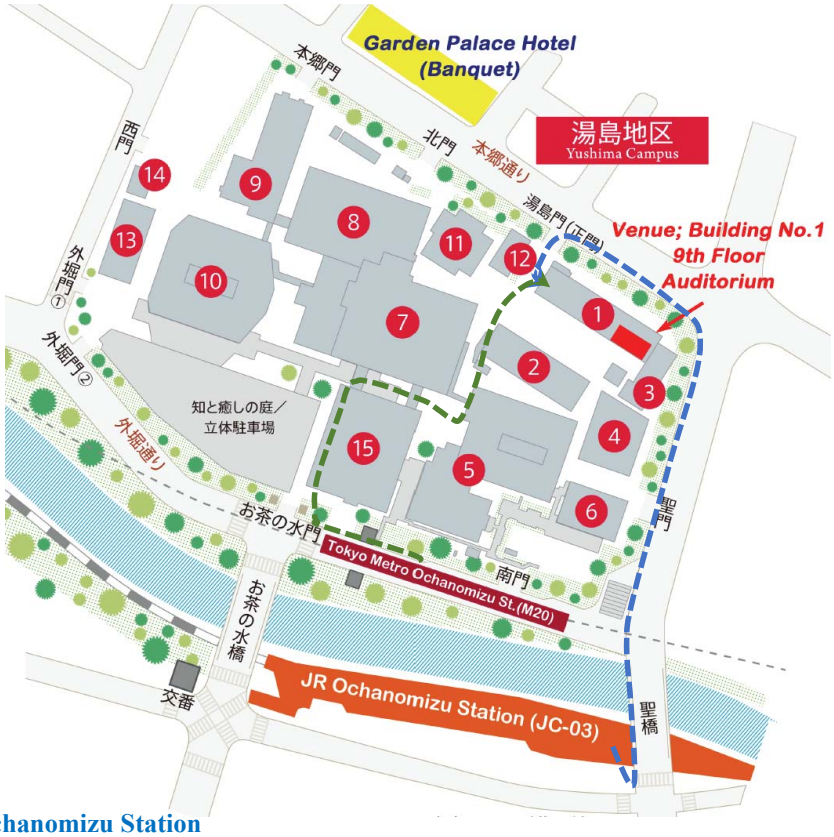
Tokyo Monorail	Keikyu Line
↓	↓
JR Hamamatsucho Sta.	JR Shinagawa Sta.
JR Yamanote Line	JR Yamanote Line
↓	↓
JR Kanda Sta.	JR Kanda Sta.
JR Chuo Line	JR Chuo Line
↓	↓
JR Ochanomizu Sta.	JR Ochanomizu Sta.

From Narita Airport

JR Narita Express	Keisei Skyliner
↓	↓
JR Tokyo Sta.	JR Nippori Sta.
JR Chuo Line	JR Yamanote Line
↓	↓
JR Ochanomizu Sta.	JR Akihabara Sta.
	JR Sobu Line
	↓
	JR Ochanomizu Sta.

Campus Map (TMDU Yushima campus)

Access to the campus from airports is shown in the following site : https://www.tmd.ac.jp/english/outline/access/



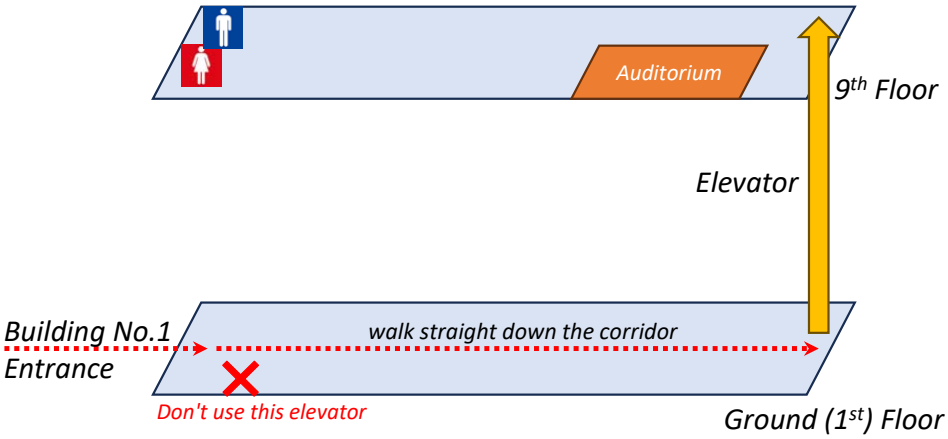
From JR Ochanomizu Station

Please exit from "Hijiribashi exit (聖橋口)" and walk across the bridge (Hijiribashi bridge)
→Walk along the campus and enter the building No.1

From Tokyo Metro Ochanomizu Station

Please exit from "No.1 exit" and enter the campus beside the new building (partly under-construction)
→Walk across the campus and enter the building No.1

Venue (Auditorium) in Building No.1, 9th Floor



https://www.tmd.ac.jp/english/outline/access/

ABSTRACT

Introductory talk by delegates from five countries

Education System and Dental Material Curriculum in Indonesia

[1] Dept. of Dental Biomaterials, Faculty of Dentistry, Maranatha Christian University.,
[2] Dept. of Dental Materials and Technology, Faculty of Dentistry, Universitas Padjadjaran
Angela, Evelyna[1], Veni Takarini[2]

Abstract

Dental education system in Indonesia has experienced various changes over the past decades. Dental education in Indonesia consists of two levels of education programs which is pre-clinical and clinical study program. Pre-clinical program is taken in eight semesters while clinical program is taken in four semesters. Education curriculum in Indonesia is managed by the Ministry of Education, the same as dental education. Nowadays dental curriculum in Indonesia was developed using Outcome-based Education (OBE) system, where education is centered on outcomes not just the theory or cognitive perspective that must be accomplished but the students also must be ready to work as dentist at global level. This curriculum system development is carried out based on the Indonesia Dental Competency Standards (Standar Kompetensi Dokter Gigi Indonesia-SKDGI) and the Indonesian Dental Professional Education Guidelines (Pedoman Pendidikan Profesi Dokter Gigi Indonesia). Dental material curriculum in Indonesia consists of several competency domains which are cognitive, psychomotor, and affective. The Indonesian dental materials association plays roles in determining education system direction in Indonesia. Ikatan Peminatan Material Kedokteran Gigi Indonesia (IPAMAGI) under the Asosiasi Fakultas Kedokteran Gigi (AFDOKGI) forum holds regular meetings to discuss the latest materials and development in dental materials education. Before the final exam (UKMP2DG) is held, a meeting is held in each field of dentistry, including dental materials. The objective of these meetings is to equalize perceptions and discuss the evaluation question for the final exam.

Keywords: Education System, Dental Material Curriculum, Indonesia

Dentistry and Dental Materials Science in South Korea

Dept. of Dental Biomaterials Science and Dental Research Institute, Seoul National Univ.
◯Hyeong-Cheol, Yang

[Abstract]
South Korea's dental device sector has continued to grow in size and quality, a result of the growth of dental device companies coupled with university research and education on new medical technologies. Currently, there are six public and five private dental schools in Korea. The number of dentists and dental hospitals is constantly increasing, with about 750-800 new dentists graduating from these universities and dental school graduates coming from overseas every year. At the same time, the dental device industry is steadily growing, and the value of medical device production is also increasing.
In 2021, the top 10 products of the domestic medical device industry include dental implant fixtures, dental implant abutment, biomaterials for tissue repair, and dental implant procedure instruments. The production value of dental implant fixtures accounts for 11.2% of the total medical device production and is increasing every year. As a company, implant manufacturers have the highest output of any medical device company.
Dental research in Korea is mainly conducted by universities and companies, with universities accounting for 70-80% of research funding. The research areas can be broadly categorized into the following five areas: Diagnosis and cause identification of oral diseases, treatment of oral diseases using genes and stem cells, development of new drugs and utilization of big data for treatment of oral diseases, development of new and customized materials, and digital and software-based research in dental science. The field of new and customized material development, and digital and software-based research in dentistry has been increasing rapidly. In particular, digital and software-based research is focused on developmental research, and clinical applications are expected in a short time.

[Keywords]
Dental Education, Dental Industry, Dental Research, Dental Materials, South Korea

Dentistry and Dental Material Science in Malaysia

Dept. of Restorative Dentistry, Universiti Malaya, Kuala Lumpur, Malaysia
Noor Azlin, Yahya

Universiti Malaya, established in 1971, was the first dental school in Malaysia. The number increased to 13 schools to serve the demand of rising population. The Malaysian dental programs are undergraduate entries and delivered in English. They are organized into preclinical and clinical phases. Dental students learn basic medical and dental sciences during the preclinical phase for two years, and subsequently, they progress to provide patient care in clinics under supervision in the clinical phase for three years. Dental materials science is an important core course in Malaysian dental programs which integrates foundational concepts of chemical engineering and materials science into clinical dentistry. The course aims to provide a thorough understanding of the compositions, characteristics, properties, and manipulation of materials frequently used in dental clinics and laboratories. Dental schools need to regularly evaluate dental materials science curricula to keep abreast with the rapid evolution of knowledge in the field and to equip future dentists with the desired knowledge and skills. Lin et al (2023) aimed to identify relevant dental materials science topics for Malaysian undergraduate dental curricula and to determine their appropriate competency levels in terms of cognitive and psychomotor taxonomies. Dental materials science topics were selected in alignment with the revised national competency statement. 33 topics were identified as important topics and their competency levels were determined. "Endodontic materials" was ranked as the most significant topic with majority of the topics were deemed adequate at the cognitive level of "Apply" and psychomotor level of "Guided response". Based on mean scores, "Impression materials" was rated as the most cognitively demanding topic, whilst "Temporary restorative materials" was the most demanding topic for psychomotor taxonomy. The findings of this study form the basis for future studies to develop measurable learning outcomes, design corresponding innovative pedagogy and propose assessment criteria for each topic.

Keywords: Curriculum development, Dental education, Dental materials, Undergraduate

The current state of dental material research and education in Thailand.

Institute of Dentistry, Suranaree University of Technology, Nakhon Ratchasima 30000, Thailand

Pasutha Thunyakitpisal.

[Abstact]

The first dental school of Thailand has been found in 1940 which was overlapped with the world war II (1939-1945). Due to the shortage of material in that time, the school had to produce the local dental materials such as local anesthesia, amalgam, and zinc oxide-eugenol cement. In the other word, the dental material research and dental education of our country had nearly initiated in the same time. The importance of dental material for dental education has been acknowledged. In 1994, Dental Council of Thailand has been established to ensure minimum quality standards of dental education institutions and programs. The traditional dental school program is six years long (general study in the first year, basic medical science 1.5 years, basic dental science 1.5 years, dental clinical practice 2 years). Recently, the new track: 5 years study program for candidate who received bachelor degree student has been launched. All dental students have enrolled for compulsory national examination for dental graduates in order to ensure minimum competence standards for dentists in Thailand. Up to now, Institute of Dentistry, Suranaree University of Technology has added fundamental dental material and technology courses in undergraduate program to educate dental student understand and use new advance interdisciplinary technological data to solve clinical problems.

Dental material research in Thailand can be classified into 6 groups: I. Comparative study between commercial dental materials in laboratory and clinic, II. Enhancing/Improving physical and/or biological properties of commercial dental materials via directly incorporating interesting substance, III. Innovative development dental material, biomaterial, and oral cosmetic products based on clinical problem, IV. Development digital dental technology and equipment via interdisciplinary collaborations (Intra-oral scanners, CAD/CAM technology and 3D printing), V. Development low-cost basic dental materials. Most research funds come from government which primarily carried out through universities and specialized government agencies. Unpredictable events such as COVID-19 pandemic, government policy, mercury-free restorative material, rapidly advance of digital technology, world geopolitical risk have tremendously affected the direction of dental material research.

[Keywords]

dental education, dental material, Thailand

The Japanese Society of Dental Materials and Devices (JSDMD) Our Hystory and Activities

[1] President, The Japanese Society of Dental Materials and Devices
[2] Dept. of Advanced Biomaterials, Tokyo Medical and Dental University
◯Motohiro Uo[1,2]

[Abstract]

The Japanese Society of Dental Materials and Devices (JSDMD) was established by merging the former "The Japan Research Society of Dental Materials and Appliances (estd. 1951)" and "The Japan Society for Dental Apparatus & Materials (estd. 1960)" on April 3rd, 1982. JSDMD is the specialized academic society in "Japanese Association for Dental Sciences". In the 72 years since the establishment of the former society, the members have contributed to the development of dental materials and devices through research in their respective fields of expertise. JSDMD is composed of the researchers from the universities and colleges, dental clinicians, technicians, hygienists, and dental related companies. We have 1539 members as the Sept, 2023.

We published the following two journals since the establishment of JSDMD. "Dental Materials Journal (DMJ)" is the open access international journal and it has been published only as an online journal from Vol.42, No.1 in 2023. The latest impact factor of DMJ is 2.5 (2022). "The Journal of the Japanese Society for Dental Materials and Devices" is published as the domestic journal (in Japanese).

Annual meeting of JSDMD is held in every spring. Five regional branches have distinctive symposium from summer to autumn. Through those events, the interaction and exchange of information among members are promoted. International Dental Materials Congress (IDMC) was started in 2007 (Bangkok), followed by Seoul (IDMC2011), Bali (IDMC2016), and Taipei (IDMC2022). Every congress had been held with great success by the strong collaboration with each dental materials society of hosting country.

Asian Network of Dental Materials Society (ANDeMS) was initiated in order to establish the close interaction and collaboration among the asian dental materials societies and their researchers in 2022. We hope that international joint researches among the researchers, especially the young researchers, would arise then those contribute to the development of dental science and engineering in Asia.

[Keywords]
JSDMD, Dental Materials Journal

Improving dental materials research through natural resources utilization

[1] Dept. of Dental Materials and Technology, Faculty of Dentistry, Universitas Padjadjaran, [2] Oral Biomaterials Research Centre, Faculty of Dentistry, Universitas Padjadjaran.
◯Veni, Takarini[1,2], Zulia, Hasratiningsih[1,2], Nina, Djustiana[1,2]

[Abstract]

Natural resources can be used in dental materials because they are relatively biocompatible, which means they present fewer risks. They can also be used to supplement national resources. Consequently, the purpose of this review is to shed light on some recent advances in the field of dental materials using natural resources. Indonesian researchers developed dental materials, such as fluoride varnish made from the shellac of Lacifer bugs found in East Nusa Tenggara, ceramics made from Sumatera and Java sand, and impression materials made from glutinous rice flour.

The addition of sodium fluoride to varnish fluoride derived from de-waxed Indonesian shellac exhibited the lowest average in the calcium solubility test and possesses antibacterial properties against Streptococcus mutans to avert demineralization of enamel with the confirmation of non-toxicity and did not impede the healing of damaged tissues. Investigating dental ceramics such as Pangaribuan feldspar, Belitung silica, and Sukabumi kaolinite show promise for supporting the hardness and strength of crown restorations while achieving the desired translucency to resemble natural teeth. Glutinous rice is a natural resource in Indonesia, the world's third-largest rice producer, and it can be an advantage in the manufacturing of organic fillers for dental impression application. A 20 μm continuous line was produced as a satisfactory detail reproduction to support the creation of a working and diagnostic model as an auxiliary dental material.

The excellent physicochemical properties of the natural resources used in dental materials make them suitable for use in various dental fields due to their strengths in sealing, regeneration, and antibacterial capabilities. Furthermore, it has been demonstrated that numerous dental materials made from natural products can overcome important drawbacks of previous sources. Working with a manufacturer to produce dental materials in large quantities using Indonesian natural resources still presents challenges.

[Keywords]
Indonesian natural resources, dental materials research, improvement

Current status and future perspectives of dental zirconia ceramics

[1] Dept. of Gerodontology and Oral Rehabilitation, Tokyo Medical and Dental Univ.
◯Masanao, Inokoshi[1]

[Abstract]
Zirconia-based restorations have gained increasing popularity in dentistry due to their superior strength, aesthetics, and biocompatibility compared to traditional porcelain-fused-to-metal (PFM) restorations. Recently, full-contour zirconia restorations have become the gold standard for posterior tooth restoration. Today, a variety of new types of dental zirconia are available, such as highly translucent zirconia, shade-gradient zirconia, and strength-gradient zirconia. Moreover, various fabrication strategies, such as additive manufacturing and high-speed sintering for zirconia ceramics, have also been introduced.

Our department has conducted several studies on dental zirconia ceramics to achieve long-term clinical success. These studies have focused on surface treatments of zirconia ceramics to improve bonding to zirconia and on optimizing sintering conditions to enhance the aesthetics of zirconia-based restorations. Regarding surface treatments, alumina sandblasting followed by MDP-primer application has been found to be essential for achieving durable bonding to zirconia ceramics. We have also elucidated the impact of different surface treatments on the material properties of dental zirconia ceramics. With regard to sintering conditions, we have reported on the influence of different sintering temperatures and sintering times on the optical and mechanical properties of dental zirconia ceramics.

This presentation will introduce the zirconia research conducted in our department and will outline future perspectives for dental zirconia ceramics research.

[Keywords]
zirconia, surface treatments, sintering

Angular Organization of Periodontal Ligaments using 3D Printed Scaffolding System

[1] Dept. of Dental Biomaterials, College of Dentistry, Kyungpook National Univ.
◯ Chan Ho Park[1]

[Abstract]

Tissue engineering strategies have been developed for multiple tissue regeneration and their functioning restoration using stem cells, scaffolding systems, or signaling molecule approaches. However, the tooth-supporting tissue complexes with structural significance are still challenging due to the micro-interfacial compartmentalization of multiple tissues, their integrations for systematic responses, and spatiotemporal organizations of engineered fibrous tissues. Moreover, systemic disease or diabetes could influence the progression and severity of periodontal disease by changing tissue metabolism, collagen formation or impairment of immunological responses. Here, the studies demonstrated that surface characterization on implantable scaffolds was recently investigated to promote regenerate periodontal ligaments (PDLs) as well as angular orientations of fibrous connective tissues. In the studies, spatial microarchitectures promote PDL orientations with limited mineral tissue formations.

3D-printing technique could create and manufacture compartmentalized constructs for bone and PDLs to hierarchically organize periodontal complexes. Engineered microgroove-patterns could spatiotemporally control fibrous tissue bundle orientations in micron-scaled interfaces with significant predictability in *in-vitro* and *in-vivo*. In particular, bone infiltration could contribute to regenerate mineralized tissues in the defect sites as alveolar bone and angular orientations of PDLs can be patterned with the specific topographies. The strategy can facilitate spatiotemporal tissue organization and tissue-complex compartmentalization with significant predictability.

[Keywords]

Periodontal Ligament, 3D printing, Biomaterials

Development of Nanosilica from Rice Husk for Dental Restorative Materials Fabrication

Dasmawati Mohamad[1], Yanti Johari[1], Syed M Yassin[1,2]

[1]Biomaterials and Craniofacial Aesthetics Research Cluster, School of Dental Sciences, Universiti Sains Malaysia, Kubang Kerian, Kelantan, Malaysia

[2]Department of Pediatric Dentistry and Orthodontic Sciences, College of Dentistry, King Khalid University, Abha, 62529, Kingdom of Saudi Arabia.

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Rice husk (RH) is abundantly available in Malaysia, and it contains about 15% silica. Currently, rice husk is primarily burned to obtain valuable silica which caused air pollution. As an alternative, a simple, effective and environmentally friendly method has been introduced. This patented method produced solid hybrid spherical of silica in which the mean diameter ranges from 50 to 253 nm. The hybrid nanosilica from RH was used as a filler in resin composite and flowable composite.

An experimental resin composite fabricated with RH nanosilica has shown adequate physical and mechanical properties as required by ISO standards. Different resin and filler compositions have been evaluated to improve their properties. The hybrid nanosilica RH also was used in fabrication of experimental flowable composite.

To date, the utilisation of RH nanosilica has been explored further. RH nanosilica has been incorporated as fillers in pits and fissure sealant. With the incorporation of hybrid silica RH, experimental fissure sealant (EFS) has showed the highest flexural strength among the studied sealants and was comparable to commercial controls.

The high flexural strength of EFS could be due to the filler morphology as well as the resin matrix employed. The smaller the filler size, the higher the surface area, thus leading to increased surface energy at the filler matrix contact and enhanced flexural strength of the sealant. Moreover, spherical-shaped nanosilica would allow for more dense packing of fillers, increasing the filler volume of the resin-based sealant.

Hence, the new synthesis route of hybrid nanosilica from RH which is eco-friendly, low cost and sustainable has a promising use in dental restorative materials research and development.

Monitoring the development of a tissue-engineered oral mucosa on a micropatterned collagen scaffold: using optical coherence tomography

O. Suebsamarn[1], Y. Kamimura[2], Y. Kodama[3], K. Haga[4], K. Izumi[4]*.

[1]Children's Oral Health Department, Institute of Dentistry, Suranaree University of Technology, Nakhonratchasima, THAILAND,

[2]SCREEN Holdings Co., Ltd., Kyoto, JAPAN,

[3]Taki Chemical Co., Ltd., Kakogawa, Hyogo, JAPAN,

[4]Division of Biomimetics, Faculty of Dentistry & Graduate School of Medical and Dental Sciences, Niigata University, Niigata, JAPAN

[Abstract]
Objective: We were successful in establishing an ex vivo-produced oral mucosa equivalent (EVPOME) for clinical use, and it is critical to build a specialized quality control tool to analyze the EVPOMEs during production. Optical coherence tomography (OCT) is a non-invasive imaging method that has been widely used in ophthalmology for diagnosis. However, few studies have used OCT to examine human cell- or tissue-based products like the EVPOME. OCT was used to assess the development of the epithelial layer in the EVPOMEs non-invasively. The overall epithelial thickness of the EVPOME was determined as part of in-process monitoring to determine whether OCT is a good and useful technique for EVPOME quality control.
Methods: The EVPOME, composed of oral keratinocytes and a micropatterned scaffold made from fish collagen, was produced following our standard protocol. The OCT pictures were acquired by performing a scan of the EVPOME after choosing the specific area of interest, measuring 1000 μm x 1000 μm, on two separate occasions, specifically on days 8 and 11 of the manufacturing process. This was achieved by applying deep learning methods, specifically a convolutional Neural Network (CNN). The application of this CNN facilitated the extraction of the epithelial layer. There was an analysis done to find out the average thickness and distribution of the epithelium after a 3D model of the epithelial layer was made. These findings were subsequently calculated and demonstrated.
Results: The OCT image closely resembled the conventional EVPOME histologic feature. The progressive increase in average epithelial thickness indicates that stratification of the epithelial layer persisted. Furthermore, the histogram displayed a rightward shift in the distribution of epithelial thickness, suggesting that epithelial formation was uniform.
Conclusion: Utilizing OCT imaging for in-process monitoring to assess the EVPOME graft as a non-invasive and quantitative quality control measurement could be practical and applicable.

[Keywords]
picosecond laser machining, biomimetics, micropattern, optical coherence tomography, quality control, tissue-engineered oral mucosa

Substrate Stiffness Regulates Cellular Responses in Oral Tissue: A Focus on Inflammation and Cell Viability

[1] School of Geriatric Oral Health, Institute of Dentistry, Suranaree University of Technology, Nakhon Ratchasima 30000, Thailand
[2] Division of Molecular and Regenerative Prosthodontics, Tohoku University Graduate School of Dentistry, 4-1 Seiryo-cho, Aoba-ku, Sendai, Miyagi 980-8575, Japan

Watcharaphol Tiskratok [1], Masahiro Yamada[2], Hiroshi Egusa[2]

The interaction between cells and extracellular matrix (ECM) plays an essential role in tissue responses. Microenvironmental stiffness influences these interactions via the regulation of cell functions and responses, including inflammatory responses, progression of malignancies. However, the underlying biological mechanism remains unclear. This study investigated the cellular responses of oral fibroblasts and oral squamous cell carcinoma that were mediated by substrate stiffness. Herein, we aimed to 1) determine the effects of substrate stiffness on inflammatory responses in human gingival fibroblasts (hGFs); 2) assess the influences of substrate stiffness on the osteoclastogenesis-inducing potential of mouse fibrosarcoma L929 cells 3) investigate the effects of substrate stiffness on cell viability and proliferation of human oral squamous cell carcinoma (OSCC) HSC-4 cells. The cells were cultured on type I collagen-coated polydimethylsiloxane (PDMS) substrates with different stiffnesses, representing soft (4.4 kPa) or hard (26.2 kPa) ECM. The results showed that the expression levels of proinflammatory mediators, prostaglandin E2 or interleukin-1β, in hGFs were significantly higher with the soft substrate than with the hard substrate, even without and with lipopolysaccharide (LPS) to induce inflammation. The soft substrate suppressed the expression of mechanotransduction-related transcriptional factors and activated the expression of inflammation-related factors, whereas the hard substrate demonstrated the opposite effects. Furthermore, supernatants of L929 cells cultured on soft PDMS substrates promoted osteoclast differentiation of the osteoclast precursor by stimulating the expression of osteoclastogenesis-related gene markers and tartrate-resistant acid phosphatase activity. The soft substrate inhibited the nuclear translocation of YES-associated proteins in L929 cells. Additionally, the hard substrate induced cell viability and proliferation in OSCC cell line by changing cytomorphometry. Our results indicated that PDMS substrate stiffness controlled the cell viability and inflammatory responses in oral fibroblasts and squamous cells via cellular mechanotransduction. This research sheds light on the significance of ECM stiffness in soft tissue in oral cavity.

[Keywords]
cellular mechanotransduction; extracellular matrix; proinflammatory response, osteoclastogenesis; cell viability

Rapid fire talk

EVALUATION AND COMPARISON OF FLEXURAL STREGNTH AND MICROHARDNESS OF LITHIUM DISIICATE-BASED CAD/CAM BLOCKS

Zulkiffli S[1], Yeoh OT[1], Yahya NA[1], and Kutty MG[1]

[1]Restorative Department, Faculty of Dentistry, University of Malaya

Background: The variations of IPS emax CAD were utilised for construction of dental prosthesis ever since its patent expired in 2015. However, data and studies concerning mechanical properties of these recent lithium disilicate-based CAD/CAM are scarce and it warrants for an investigation to provide scientific evidence to support its routine use.
Objectives: (1) To compare the flexural strength and microhardness of the tested materials (2) To analyse and compare the microstructure, elemental composition and distribution of the tested materials before and after heat-treatment.
Methods: Four CAD/CAM lithium disilicate brands were investigated; IPS emax, Mazic Claro, Cameo, and Tessera. Specimens (n = 10) were cut and final crystallization was performed following manufacturer's instructions. Specimens were polished until the final dimensions for flexural strength (16 x 4 x 1.2 mm) and microhardness test (15 x 13 x 2 mm) were achieved. One specimen from each brand was analysed for the microstructure, elemental composition and distribution before and after heat treatment using scanning electron microscope and energy dispersive x-ray spectroscopy. The three-point flexural strength test (n=10) was performed using universal testing machine and microhardness test (n=10) was performed using Vickers microhardness testing machine. Data were analysed using one-way ANOVA and Dunnett's T3 test.
Results: The highest mean flexural strength was from Group 4 Tessera (540.52 ± 143.33 MPa). For microhardness, the highest mean was from Group 1 Mazic Claro (667.70 ± 9.41 HV). Within the four groups, statistically significant difference is noted for flexural strength ($p=0.001$) and microhardness ($p<0.001$).
Conclusion: Tessera demonstrated significantly higher flexural strength than IPS emax and Cameo. Mazic and Tessera demonstrated significantly higher microhardness than IPS emax and Cameo. There was a difference in the crystal size after the heat treatment of all four lithium disilicate CAD/CAM blocks.

Keywords: CAD/CAM; Lithium disilicate; Flexural strength; Microhardness; Microstructure

Development of Monetite As a Potential Bone Graft

[1] Dept. of Dental Materials Science, Universitas Indonesia
◯Sunarso Sunarso[1]

[Abstract]
Calcium phosphates have been used as a bone graft for years due to their osteoconductivity and biocompatibility. Among them, hydroxyapatite and beta-tricalcium phosphate are considered popular. However, the main drawback of hydroxyapatite and beta-tricalcium phosphate is their resorption. Hydroxyapatite is known for its slow resorption during implantation. Hydroxyapatite, especially sintered ones, is barely resorbed after several years of implantation. Meanwhile, beta-tricalcium phosphate is resorbed faster. Monetite has been reported to balance resorption and new bone formation during implantation, making it an ideal candidate for bone graft material. However, there are only a few reports on the preparation of monetite-based bone grafts. It may be due to its limited method of producing monetite bone grafts. Conventionally, monetite can be obtained via the dehydration of brushite cement. In fact, to the best of our knowledge, this is the only known method available to produce monetite bone grafts. Recently, we have developed a novel method to produce monetite bone grafts. Monetite could be obtained via the phase transformation of calcium sulfate dihydrate through a dissolution-precipitation reaction. This newly developed method could be used to produce porous, dense, and granular monetite. Currently, research on the characteristics, toxicity, and osteogenic potential of novel monetite is ongoing.

[Keywords]
Monetite, bone graft, phase transformation, calcium sulfate dihydrate

Development of a laboratory GFRP block for dental CAD/CAM system

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[Abstract]

In 2014, a computer-aided design and computer-aided manufacturing (CAD/CAM) crown made from a resin composite block has been approved by the Japanese health insurance. However, it is known that the mechanical property of such resin composite for CAD/CAM system inferior to that of other CAD/CAM materials such as ceramic and alloy. In recent years, glass fiber-reinforced plastics (GFRPs) which are mainly used in the industrial field, have been increasingly applied in dentistry. Therefore, we developed a laboratory GFRP block as CAD/CAM material and investigated its mechanical properties. In this study, glass-fiber woven cloth was used as reinforcement for the acrylic matrix resin, that is, a GFRP block composed of glass fiber and acrylic resin was fabricated by hot press method. The glass fiber content of GFRP block obtained using the ashing technique was ~53 mass%. The laboratory-fabricated GFRP exhibited higher flexural strength than commercially available resin composite blocks for CAD/CAM crowns. As well, the flexural strength of GFRP was equivalent to that of lithium disilicate-based glass ceramic though it was lower than zirconia. These indicate that the laboratory GFRP composed of glass fiber and acrylic resin has superior mechanical properties than resin composite for CAD/CAM, and may be clinically adaptable to CAD/CAM crowns. In the future, we will develop more clinically appropriate GFRP blocks for CAD/CAM crowns by optimizing the glass fiber content and matrix resin composition of GFRP.

[Keywords]
glass fiber-reinforced plastic (GFRP), CAD/CAM, mechanical property

Natural polymer-based hydrophilic hydrogels for bone tissue regeneration

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[Abstract]

Tissue engineering with scaffold-based regeneration has been widely used to accelerate recovery by mimicking the extracellular matrix. Natural polymers, such as collagen, have good biocompatibility and can seamlessly integrate with the human body. However, natural polymers have limited potential in biomaterials due to their intrinsic poor water solubility. To overcome this solubility issue, succinylation can be used to modify proteins, increasing the net negative charge at physiological pH, which enhances biocompatibility.
We also developed coagulation-inspired collagen hydrogels to mimic the natural tissue recovery mechanism for bone regeneration. Engineered 3D scaffolds must be biomechanically capable of substituting injured tissues and have typically been made of tissue-mimicking stiffness. However, this paradigm is shifting towards the understanding that the stiffness of scaffolds can be directly responded to by cells. Herein, we have designed a soft hydrogel to meet two criteria that can shift from a soft to progressively hard tissue, similar to tissue development in nature. First, inspired by clotting of blood at the wound site, the goal is to achieve strong bonding with adjacent tissues through physical crosslinking of fibrinogen (FBG). Second, the hydrogel is needed to act as a mattress to dissipate energy, similar to existing collagen (COL) in the body. This scaffold promotes energy dissipation by strengthening the elastic and soft fibers of the FBG through COL to form a dense structure. As a crucial fundamental substrate, soft hydrogels initially induce rapid cell adhesion due to their soft surface. Sequentially, the cells increase penetration into the inner part and make themselves rigid, leading to bone formation. Furthermore, this hydrogel was composed of extracellular matrix (ECM)-like tissue, which could reduce inflammation in the early stage. Therefore, our dual-function system provides a promising strategy for natural tissue-mimicking bone regeneration by reducing inflammation and concurrently bridging the defect area through harmonizing the newly assembled cells and ECMs.

[Keywords]
Natural based polymers, hydrogel, succinylation, tissue engineering

The Potential of Curcuma Plant Extract as Root Canal Irrigation

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One of the factors influencing the success of root canal treatment is the removal of bacteria contaminating the canal and cleaning the smear layer. This can be achieved through a combination of instrumentation and the use of irrigation solutions.The commonly used chemical solutions as endodontic irrigants have antibacterial properties but are highly toxic and can cause tissue irritation. Research using natural sources is increasing due to the demand for alternatives to the use of synthetic chemicals because of their unfavorable side effects. Curcuma rhizomes, widely utilized as traditional herbal medicine in Indonesia, are recognized for their antibacterial activity against oral bacteria and hold potential for utilization as an irrigation solution in root canal therapy

Keywords: antibacterial; curcuma extract; root canal irrigation

Application of electron beam melting technology in fabricating titanium prostheses

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[Abstract]
Developing additive manufacturing technologies is remarkable. The number of application chances for 3D printing in dentistry has been increasing day by day since the patents were expiring. Fabricating final prostheses with additive manufacturing is still challenging; however, the selective laser melting (SLM) process can produce prostheses with titanium, which is well known for having excellent biocompatibility. On the other hand, electron beam melting (EBM) is considered to be another option for additive manufacturing for fabricating titanium prostheses. EBM uses a giant power beam compared to SLM, so it is possible to complete 3D printing. If the process is applied to produce prostheses, time efficiency would significantly improve compared to SLM. However, few reports are applying EBM to fabricating them. Thus, the properties of specimens fabricated with EBM were investigated in my recent research for the purpose of applying the process to the fabrication of prostheses by comparing them with those fabricated with SLM. In particular, the dimensional accuracy of the crown fabricated with EBM was evaluated by comparing it with that fabricated by SLM and the possibility in my recent work. The effects of printing orientation on accuracy were also examined in both EBM and SLM techniques. As a result, the dimensional accuracy of EBM was not as good as that of SLM. However, there should be room to improve the properties and advantages of EBM; thus, these will be investigated in my future study. Today, I am going to talk about my research on EBM technology.

[Keywords]
Additive manufacturing, Titan, SLM, EBM, CAD/CAM

Visible light triggered antibacterial effect of titania nanotubes with aminated reduced graphene oxide.

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[Abstract]
This study aims to optimize the coating process of reduced graphene oxide (rGO) with amine group terminals onto titania nanotubes and to evaluate the plasmon photocatalysis-based antibacterial properties of reduced graphene oxide-coated titania nanotubes (rGO-TiO_2 NTs) by visible light irradiation. rGO powder dispersed in distilled water (0.5 mg/mL) was electrochemically coated (50 V, 1 min) onto the surface of anodized TiO_2 nanotubes (Φ=100 nm). Surface characterization of the rGO-TiO_2 NTs was performed using field emission scanning electron microscope (FE-SEM) and diffuse reflectance UV-Vis-NIR spectrophotometer (DSR), and the optimal coating conditions were identified. The antibacterial properties of rGO-TiO_2 NTs coated with the optimal conditions were evaluated by colony forming unit (CFU) test, catalase (CAT) activity assay, and superoxide dismutase (SOD) activity assay of Pseudomonas aeruginosa and Staphylococcus aureus. The plasmonic photocatalysis-based antibacterial activity was evaluated under 470 nm LED visible light irradiation (light density: 60 mW/cm^2, duration: 15 min). The biocompatibility of rGO-TiO_2 NTs was evaluated by MTT assay (Statistical analysis: one-way analysis of variance, Games-Howell post hoc test, $P<0.05$). FE-SEM observation and DSR analysis showed that all rGO powders were uniformly coated on TiO_2 nanotubes, and all groups exhibited the highest light absorption values around the 470 nm region. The antimicrobial evaluation showed that the CFU, CAT, and SOD results of rGO-TiO_2 NTs irradiated with 470 nm visible light were statistically significantly lower than those of other groups ($P<0.05$). MTT assay showed good biocompatibility of rGO-TiO_2 NTs. Within the limitations of this study, the aminated rGO coated titania nanotubes (rGO-TiO_2 NTs) with plasmonic photocatalytic effect in the visible light region exhibited excellent antibacterial properties and biocompatibility. Therefore, it is expected to be utilized in the development of new fusion technologies for surface treatment of implant materials without the need for antibacterial agents.

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[Keywords]
Reduced graphene oxide, Titania nanotubes, plasmonic photocatalysis, antibacterial activity.

Self-Synthesis Calcium-Silicate Based Dental Bioactive Materials: The Effect of Testing Time to Mechanical Properties

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Abstract

Background: Bioactive materials are widely used in the field of dentistry as restorative and endodontic treatment materials. The term bioactive refer on materials ability to form apatite layer on its surface. Mineral Trioxide Aggregate (MTA) is one of calcium-silicate based cement use in root canal treatment or as pulp capping agent. Despite of its bioactivity, bioactive material also requires good mechanical properties to withstand certain masticatory force for long period of time. **Objective**: This study aimed to assess mechanical properties (compressive strength) of self-synthesis calcium-silicate dental bioactive materials with different testing time (24 hours, 7 days, and 30 days). **Methods**: Tricalcium-silicate (Ca3SiO5) nano particle synthesized using sol-gel method mixed with calcium carbonate (CaCO3), Zirconium Dioxide (ZrO2) powder and Calcium chloride (CaCl2) using mechanical mixer machine to form 20 pieces tube specimens (d= 4mm; h: 6mm) later tested using universal testing machine to measure its compressive strength after 24 hours, 7 days, and 30 days. **Results**: Compressive strength mean of 24 hours specimens is 20.874 MPa, 30.050 MPa for 7 days specimens and 37.117 MPa for 30 days specimens. Data was subjected to parametrical statistical analysis (ANOVA) at significant level of P= 0.05. There were significant differences between the 24 hours, 7 days, and 30 days bioactive cements compressive strength testing. **Conclusion**: Compressive strength of self-synthesis calcium-silicate dental bioactive materials increased over time.

Keywords: Dental bioactive materials, Calcium-silicate, Mechanical Properties

Denture fabrication technique using CAD/CAM technology

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[Abstract]
Digital dentistry has been popular in the world because of introduction of the scanners, dental CAD software, milling machine and 3D printers. Recently digital work flows are rapidly increasing, especially in the field of prosthodontics, and a lot of new methods using a CAD/CAM technology have been applied into clinical and laboratorial situation. According to previous study, CAD/CAM dentures could be alternative treatment to conventional dentures. CAD/CAM denture have potentials to help us to provide cost-effective and constantly high-quality treatment for fully or partially edentate patients. However, there are some problems still remained in the prostheses fabricated by CAD/CAM technology, such as mechanical properties of materials, accuracy of prostheses, limitation of material, technical sensitivity to manipulation of CAD software, etc. Furthermore, in the dental education for undergraduate student, it is not enough curriculum composed to teach those new technology, and the students are falling behind in leaning and practicing CAD/CAM denture.

Our department conducted some research about CAD/CAM denture, topic of mechanical properties and accuracy of 3D printed denture, partial denture framework fabricated by 3D printed resin pattern and educational trial of denture designing by CAD software for 4th grade under graduates. I would like to talk about the present evidence of CAD/CAM denture and introduce these our research to reach future prospect of CAD/CAM dentures.

[Keywords]
Digital dentistry, CAD/CAM technology, 3D printed denture

History of Dental Zirconia

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[Abstract]

Zirconia is one of the most popular restorative materials used in dentistry today. In this presentation, we will discuss the basics of zirconia and how it has evolved from its initial discovery to its medical and dental applications. In addition, we will introduce how dental zirconia has changed with the advancement of technology based on various products, how the development direction of zirconia has progressed according to clinical requirements, and the recent research trends in dental zirconia and predict how zirconia research will progress in the future.

[Keywords]
Dental Zirconia, Dental Restoration, Dental Materials, History of Dental Zirconia

A closer looking at cellular mechanotransduction

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○ Hae-Won Kim

[Abstract]

Cells sense extracellular forces, transmit the mechano-signals and determine their subsequent fate. The mechanotransduction processes occurring within the intracellular domain provide pivotal insights into a spectrum of cellular behaviors and pathophysiological phenomena. In this brief communication, I elaborate on these mechanotransduction events, with a particular emphasis on the underlying molecular intricacies and consequential cellular processes.

[Keywords]

Extracellular forces, mechanotransduction, molecular events, cell behaviors

Effect of cadmium on the physicochemical properties of mouse femur

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[Abstract]

This study evaluated the physicochemical properties of the femur bones of mice exposed to Cd for a short period. Six-week-old male ICR obtained from Japan SLC, Inc. (Shizuoka, Japan) were acclimated for one week before Cd treatment for four weeks. Then, the seven-week-old male ICR mice were divided into control (n = 4) and Cd-treated (n = 4). The mice were given free access to drinking water containing 0 or 100 mg/kg $CdCl_2$ and exposed to a rodent diet (AIN-93G, Oriental Yeast; Tokyo, Japan). At the end of the treatment, the femur bones were collected and characterized using an Scanning electron microscopy-energy dispersive X-ray spectroscopy (SEM-EDS), X-ray diffraction, attenuated total reflectance-Fourier transform infrared ray spectrophotometer (ATR-FTIR), and mechanical tests.

The weight of femur exposed to Cd was higher than the control due to the subchronic exposure to Cd, indicating that Cd has a stimulating effect on bone weight. Instead, there were no significant difference in body weight or femur length between the two groups of mice. Similarly, no discernible changes in body weight. According to the EDS results, the Ca/P ratio was lower in the Cd-treated group (1.13) than in the control group (1.58) due to the high Cd intake, resulting in higher Ca metabolism likely derived from the bone supply.

The XRD patterns of the femur for the control and Cd-treated groups were identical. The primary peaks of the mineral hydroxyapatite (HAp) are 25.91, 31.82, and 32.91°. The control and Cd-treated ATR-FTIR spectra were found to be identical. The primary IR spectrum of the femur includes PO_4^{3-} (1450–1550 cm^{-1}), carbonate ions (CO_3^{2-}), from its substitution by hydroxyl and phosphate groups in biological apatite at 1650-1300 cm^{-1} and 2359 cm^{-1}.

In summary, Cd poisoning in short periods to the mice has been found to impact the physicochemical properties of femur mice due to Cd intake disrupting Ca metabolism.

[Keywords]
Heavy metal, Mechanical properties, Bone

Damage and defects of dental CAD/CAM monolith zirconia

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[Abstract]

Dental zirconia CAD/CAM prosthesis system prevails world widely and became a regular option in daily dental treatment. However, dental clinicians are often encountering unexpected failures of zirconia restorations in daily dental treatment. Fractographic study can reveal a wide variety of extrinsic and intrinsic defects or damage to limit strength of CAD/CAM-milled zirconia specimens. The result of this study implicates more optimum parameters for milling process and pre-sintering conditions of dental zirconia block. Fractography is indispensable tool to identify the failure origins and failure mode for dental ceramic prostheses.

[Keywords]
CAD/CAM, zirconia, defects, damage, fractography