Oral Neuroscience 2019

May 25th, 2019

Program & Abstract

Venue
Osaka University
Graduate School of Dentistry
Osaka, Japan

大阪大学 OSAKA UNIVERSITY

Challenge to Intractable Oral Diseases

Remarks

All attendance including oral or poster presenters, chairmans and staffs, please attend with wearing casual (informal) clothes (e.g., no jacket, no tie).

Oral Neuroscience 2019

Program & Abstract

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Osaka University Graduate School of Dentistry

Osaka, Japan

Organizing Committee

Kazuhiro Takuma*, Dept. of Pharmacology, Osaka Univ.

Satoshi Wakisaka, Dept. of Oral Anatomy and Developmental Biology, Osaka Univ.

Mikihiko Kogo, First Dept. of Oral and Maxillofacial Surgery, Osaka Univ.

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* Chair

** Secretary

Cosponsor

“Challenge to Intractable Oral diseases” from Osaka University Graduate School of Dentistry

Contact

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Access

Oral Session & Poster Session: Yumikura memorial hall (Building F, 5F)

Osaka University Graduate School of Dentistry

1-8 Yamadaoka, Suita, Osaka, Japan 565-0871

Information exchange meetings (18:00-)

La Scena, Faculty of Engineering, GSE Common East 15F

(about five minutes' walk from Dental faculty building)

Registration Fees

General: JPY 3,000; Students: Free

Oral presentation information

As you prepare for your oral presentation at Oral Neuroscience 2019, please find important information concerning your oral presentation.

Presentation time

- ✓ The time allowed for the slide presentation of Lectures is 30 minutes including 5 minutes for discussion.
- ✓ The time allowed for the slide presentation of Plenary Lecture is 60 minutes including 10 minutes for discussion.

Please bring your presentation on your PC and/or USB flash Drive.

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Please bring your PC to the PC staff at break times or below times and check your presentation before your presentation (12:15-12:45).

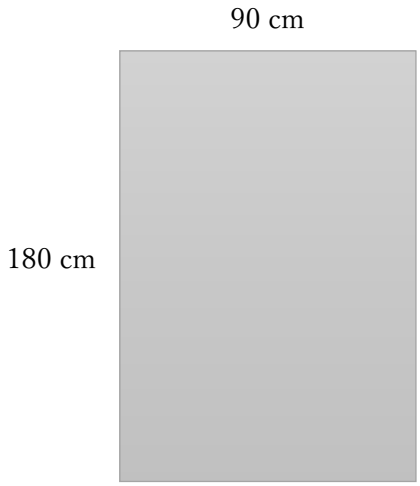
- ✓ We appreciate if you bring your data (USB drive) before the onset of session.

Poster presentation information

As you prepare for your poster presentation at Oral Neuroscience 2019, please find important information concerning your poster presentation.

Presentation time: 14:05-14:30, 15:30-16:30

- ✓ Area of poster presentation: Height 180 cm x Width 90 cm
- ✓ Thumbtacks will be supplied on site.
- ✓ Please mount your poster on the board of your poster number by noon.
- ✓ Posters must remain on display until the end of your poster session.
- ✓ Posters must be removed by 17:45 following your poster presentation.
- ✓ No photography is permitted in the poster sessions.



Oral Neuroscience 2019

Yumikura memorial hall (Dental faculty building F, 5F)

13:00- Opening Remarks Kazuhiro Takuma

Session 1 (13:05-14:05)	Chair	Hiroki Toyoda

13:05- [Lecture-1] Complex and multisensory receptive field characteristics of rat trigeminal ganglion neurons innervating fungiform papillae
Hajime Sato (Graduate School of Dentistry, Osaka University)

13:35- [Lecture-2] Olfactory Bulbotomy Impairs Licking Responsiveness to Preferred, but not Avoided, Taste Stimuli in Mice
Chizuko Inui-Yamamoto (Graduate School of Dentistry, Osaka University)

Coffee Break and Poster Session (14:05-14:30)

Session 2 (14:30-16:00)	Chair	Takanobu Nakazawa

14:30- [Lecture-3] Presymptomatic abnormalities and associated channelopathies in spindle afferent trigeminal Mesencephalic V neurons in the SOD1G93A mouse model for Amyotrophic Lateral Sclerosis
Soju Seki (Graduate School of Dentistry, Osaka University)

15:00- [Lecture-4] Exploration of *in vivo* function of mitochondrial protein p13
Norihito Shintani (Graduate School of Pharmaceutical Sciences, Osaka University)

15:30- [Lecture-5] Mechanism linking Periodontitis to Alzheimer's disease: Critical roles of Cathepsin B in Neuroinflammation
Junjun Ni (Faculty of Dental Science, Kyushu University)

Coffee Break and Poster Session (16:00-16:25)

Plenary Lecture (16:25-17:25)	Chair	Kazuhiro Takuma

16:25- Small-animal neuroimaging-based integrated approaches for brain science
Yilong Cui (RIKEN Center for Biosystems Dynamics Research)

17:25- Closing Remarks

18:00- Information exchange meeting at the La Scena, GSE Common East 15F

Poster presentations

[Poster-1]

Comparison of standardized palpation between masseter and temporal muscles for referred pain and sensations in healthy individuals

Manabu Masuda[1], Takashi Iida[1], Akiko Shimada[2], Osamu Komiyama[1]

[1]Division of Oral Function and Rehabilitation, Department of Oral Health Science, Nihon University School of Dentistry at Matsudo; [2]Department of Geriatric Dentistry, Osaka Dental University

[Poster-2]

Associations between rhythmic masticatory muscle activity and sleep arousals in sleep bruxism children

Yuki Shiraishi[1,2], Masaya Tachibana[3,4], Ai Shirota[1], Ikuko Mohri[3,4], Masako Taniike[3,4], Takashi Yamashiro[2], Takafumi Kato[1,3,4]

[1]Department of Oral Physiology, Osaka University Graduate School of Dentistry; [2]Department of Orthodontics and Dentofacial Orthopedics, Osaka University Graduate School of Dentistry; [3]United Graduate School of Child Development, Osaka University; [4]Sleep Medicine Center, Osaka University Hospital

[Poster-3]

Evaluation of material used for soft palate augmentation in dogs with the aim of improvement of velopharyngeal insufficiency

Makoto Matsukawa[1], Emiko T. Isomura[1,2], Ryou Mitsui[1], Kiyoko Nakagawa[1], Mikihiko Kogo[1]

[1]First Department of Oral and Maxillofacial Surgery, Osaka University, Graduate School of Dentistry; [2]Unit of Dentistry, Osaka University Hospital

[Poster-4]

New method to count the number of chewing by distortion of the ear canal using customized sensor

Akihiro Yoshino[1, 2], Ryosuke Shimono[2], Hideaki Sugo[2], Takafumi Kato[3], Yuji Masuda[1]

[1]Dept of Oral and Maxilofacial Biol, Grad Sch of Oral Med; [2]Dept of Prosthodont, Matsumoto Dental Univ; [3]Dept Oral Physiol, Grad Sch of Dent, Osaka Univ

[Poster-5]

5-HT_{2A} receptor activation augments postsynaptic glutamatergic responses in the dendrites of the masseter motoneurons by enhancing the function of the GluN2A-containing NMDA receptors through the Src kinase

Tomio Inoue[1], Masanori Dantsuji[1], Shiro Nakamura[1], Kiyomi Nakayama[1], Ayako Mochizuki[1], Sook Kyung Park[2], Yong Chul Bae[2], Masahiko Ozeki[3]

[1]Department of Oral Physiology, Showa University School of Dentistry; [2]Department of Oral Anatomy

and Neurobiology, School of Dentistry, Kyungpook National University; [3]Department of Implant Dentistry, Showa University School of Dentistry

[Poster-6]

Upregulation of calcitonin gene-related peptide, neuronal nitric oxide synthase, and phosphorylated extracellular signal-regulated kinase 1/2 in the trigeminal ganglion after bright light stimulation of the eye in rats

Ayano Katagiri[1,2], Koichi Iwata[2]

[1]Department of Oral Physiology, Osaka University Graduate School of Dentistry; [2]Department of Physiology, Nihon University School of Dentistry

[Poster-7]

Nicotinic activity differentially modulates synaptic plasticity in layers III and VI pyramidal neurons of the mouse insular cortex

Hiroki Toyoda, Hajime Sato, Dong Xu Yin and Takafumi Kato

Department of Oral Physiology, Osaka University Graduate School of Dentistry

[Poster-8]

Cortical and Subcortical Projections of Granular Insular Cortex Receiving Proprioception from Jaw-Closing Muscle Spindles

Yumi Tsutsumi[1], Yoshihisa Tachibana[2], Yume Uemura[1], Fumihiko Sato[1], Takahiro Furuta[1], Masatoshi Fujita[3], Katsuro Uchino[4], Atsushi Yoshida[1]

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[Poster-9]

Enhancement of incision-induced face mechanical hypersensitivity in adulthood associated with the neonatal facial skin incision

Kumi Soma[1,2], Masamichi Shinoda[2], Tetsuo Shirakawa[1], Koichi Iwata[2]

[1]Department of Pediatric Dentistry, Nihon University School Dentistry; [2]Department of Physiology, Nihon University School Dentistry

[Poster-10]

Enhancement of theta-frequency band electroencephalogram activities during unmatched olfactory–taste stimulation

Saori Maeda[1,2], Hiroshi Yoshimura[1]

[1]Dept. Mol. Oral Physiol., Inst. Biomed Sci., Tokushima Univ. Grad. Sch.; [2]Dept. Oral Health Sci., Fac. Nursing and Health Care, BAIKA Women's Univ.

Plenary Lecture

Small-animal neuroimaging-based integrated approaches for brain science

Yilong Cui

Laboratory for Biofunction Dynamics Imaging
RIKEN Center for Biosystems Dynamics Research, Kobe, Japan

Modern neuroimaging techniques, e.g., positron emission tomography (PET) and functional magnetic resonance imaging (fMRI), are fascinating techniques that provide a global overview of human brain activity underlying complex psychological processes noninvasively. However, because of the technical limitations and ethical issues in human studies, it is difficult to understand the detailed neural and molecular mechanisms behind these processes. On the other hand, with recent advances in the spatial resolution of PET, this technique is increasingly used in studies of the rodent brain. To develop core technologies for complement of human neuroimaging studies, we are trying to establish an integrated research system that combines small-animal PET imaging and classic research techniques including electrophysiology, behavioral pharmacology, histology, and genetic engineering approaches, and to thereby carry out a comprehensive investigation covering the entire hierarchy of molecules, cells, organs, and systems. Recently, we have developed a small-animal neuroimaging method combining 2-[18F]fluoro-2-deoxy-D-glucose (FDG) PET imaging with statistical parametric mapping analysis to evaluate regional brain activity in the entire rat brain. Since, FDG is taken up by activated brain regions and remains within the system for at least an hour. Therefore, FDG-PET imaging could provide a powerful method for evaluating brain activity free from the effect of anesthesia, as image scanning can be conducted after FDG uptake without anesthesia. Using the method, we have successfully identified nociceptive pathways in several chronic pain model rat, such as migraine, neuropathic pain and visceral pain. In a chronic neuropathic pain model, the regional brain activity was significantly increased in the primary somatosensory cortex hind limb area, primary motor cortex, centrolateral thalamic nucleus, and posterior thalamic nucleus. In this symposium, we will provide a new line evidence that hierarchical brain regions in the rats could be involved in Pavlovian conditioning-induced placebo analgesia, and discuss the usefulness of small-animal neuroimaging-based integrated approaches for understanding some fundamental brain functions that have rarely been touched upon, such as placebo effect.

Abstract
Oral Session

Lecture-1

Complex and multisensory receptive field characteristics of rat trigeminal ganglion neurons innervating fungiform papillae

Hajime Sato[1,2], Archana Kumari[2], Charlotte M. Mistretta[2], Robert M. Bradley[2].

[1]Department of Oral Physiology, Osaka University Graduate School of Dentistry, Suita, Osaka, Japan; [2]Department of Biologic and Materials Sciences, School of Dentistry, University of Michigan, Ann Arbor, Michigan, USA.

Anterior tongue fungiform papillae are complex sensory organs innervated by both the facial (chorda tympani, CT) and trigeminal nerves (lingual, LN). CT geniculate ganglion neurons innervating fungiform papillae are multimodal and variable in receptive field (RF) characteristics (Yokota and Bradley, 2016 and 2017), while RF characteristics of afferent fibers of LN trigeminal ganglion (TG) neurons innervating the same fungiform papillae have not been investigated. To characterize electrophysiological and RF properties of LN/TG neurons innervating fungiform papillae, we recorded extracellular responses from LN/TG neurons to lingual application of mechanical and thermal stimuli in adult rats. RF size was mapped by mechanically stimulating individual fungiform papillae using a hand held nylon filament and strain gauge. Thermal stimuli were distilled water at 4°C, and at 25-30°C applied to the anterior two-thirds of the tongue via an in-line heater. Thirty-three single mechanoreceptive LN/TG neurons were isolated. Sixteen were classified as rapidly adapting (RA) and 17 as slowly adapting (SA). RA neuron fields were distributed mainly on anterior and middle portions of the anterior two-thirds of the tongue while SA units were distributed over the entire anterior two-thirds of the tongue. The average RF size of RA units was 5 ± 2 fungiform papillae (mean ± SD; range = 2-10) and that of SA units was 4 ± 2 (range = 2-11) papillae. Most RFs (25) were oval-shaped whereas 8 were linearly arranged. A subset of LN/TG mechanoreceptive units also responded to thermal stimulation: 4 SA and 3 RA units responded to cold stimuli; 2 SA and 1 RA units responded to warm stimuli. The mechanoreceptive/thermal LN/TG units had a mean RF size of 5 ± 3 fungiform papillae. Overall, LN/TG neurons incorporate a moderate number of fungiform papillae in the RF and respond to touch and temperature. The fungiform papillae in LN/TG neuron fields, together with multimodal CT/GG projections to the papillae, constitute exquisite multisensory lingual organs for initial nutrient discrimination.

Lecture-2

Olfactory Bulbotomy Impairs Licking Responsiveness to Preferred, but not Avoided, Taste Stimuli in Mice

Chizuko Inui-Yamamoto[1,2], Ginder D. Blonde[2], Fabienne Schmid[2], Tadashi Inui[2], Lindsey A. Schier[3], Alan C. Spector[2], Satoshi Wakisaka[1]

[1]Department of Oral Anatomy & Development Biology, Osaka University Graduate School of Dentistry, Suita, Osaka, Japan; [2]Department of Psychology and Program in Neuroscience, Florida State University, Tallahassee, FL, USA; [3]Department of Biological Sciences, University of Southern California, Los Angeles, CA, USA.

Recent years, we found that bulbotomy the surgical interruption of the connections between the olfactory bulb and more central brain sites, disrupted the ability of mice to express an experience-dependent discrimination learning between glucose and fructose in a brief access test (Schier LA et al., 2019). Here, to elucidate whether licking responses to taste solutions are influenced by bulbotomy, we tested the concentration-dependent licking responses of bulbotomized mice to preferred and avoided taste solutions. We used maltodextrin/sucrose (Experiment 1) and Intralipid (fat emulsion)/sucrose/Na-saccharin (Experiment 2) as preferred stimuli, and quinine hydrochloride (QHCl)/citric acid (Experiment 3) as avoided ones. To examine the effect of "sweet taste receptor" to maltodextrin and sucrose, we used T1R2+T1R3 knockout (KO) and C57BL/6J wild type (WT) in Experiment 1, and only WT mice in Experiment 2 and 3. Mice were trained and tested in gustometers with a concentration series of the taste solutions in a brief-access test (10-s trials). After training, half of the mice were bulbotomized (BulbX), and another half of mice were sham operated (SHAM). In Experiment 1, SHAM KO mice showed lower licking to sucrose, but not maltodextrin, than SHAM WT mice. This result means that maltodextrin has peripheral mechanisms that differ from sucrose. However, interestingly, licking responses to maltodextrin and sucrose were severely blunted in both BulbX KO and WT mice in relative to SHAM mice (p's$\leq$0.001). In Experiment 2, licking responses to Intralipid and sucrose were severely blunted (p's$\leq$0.001) in BulbX WT mice relative to SHAM mice; BulbX WT mice also had moderate decreases in Na-saccharin licking (p=0.026). In contrast, licking of QHCl and citric acid did not differ between BulbX and SHAM WT mice (p's$\leq$0.001). These results indicate that the licking responses to sucrose and Na-saccharin, caloric and non-caloric sweet taste solutions, are influenced by bulbotomy regardless of absence of sweet taste receptor or not. The fact that the responses to maltodextrin and Intralipid, but not QHCl and citric acid, was also severely impaired, suggests that an intact anatomical connection between the olfactory bulb and its central targets is necessary for normally preferred taste stimuli to maintain their efficacy at driving licking in a brief access test.

Lecture-3

Presymptomatic abnormalities and associated channelopathies in spindle afferent trigeminal Mesencephalic V neurons in the SOD1G93A mouse model for Amyotrophic Lateral Sclerosis

Soju Seki[1, 5],Antonios Pantazis[4], Riccardo Olcese[3,4], Mikihiko Kogo[5], Susumu Tanaka[5], Scott H Chandler[1,2], Sharmila Venugopal[1]

[1]Department of Integrative Biology & Physiology; [2]Brain Research Institute UCLA, Los Angeles, CA, USA; [3]Dept. of Ophthalmology UCLA, Los Angeles, CA, USA; [4]Department of Anesthesiology & Perioperative Medicine UCLA, Los Angeles, CA, USA; [5]The 1st Department of Oral and Maxillofacial Surgery Osaka University, Suita, Osaka, Japan.

Amyotrophic Lateral Sclerosis (ALS) is a neurodegenerative disease wherein upper and lower motor neurons (MNs) progressively degenerate leading to muscle atrophy, paralysis and death. Recent evidence has suggested involvement of the fusimotor system in contributing to motor neuron vulnerability (Lalancette-Hebert et al., 2016, PNAS.). Here we propose involvement of spindle afferent neurons in early disease development. In the present experiments, we used in vitro patch-clamp methods to record from primary sensory Mesencephalic V (Mes V) neurons that relay reflex and proprioceptive inputs from jaw muscle spindles to trigeminal MNs. We demonstrate early (P8-P14) abnormalities in membrane properties of these neurons in the well-characterized SOD1G93A mouse model (mSOD1) for ALS when there are no phenotypic behavioral deficits. Such neuronal changes included hypo-excitability and irregularity in spike discharge patterns of Mes V neurons and reduction of persistent and resurgent sodium conductances. Immunostaining illustrate that Nav protein could be lesser in mutant compared to WT. The restoration of normal levels of sodium conductances using realistic computational models and dynamic-clamp technique to control membrane excitability and reverse abnormal changes in mSOD1 Mes V neurons. We are able to reverse irregular spike patterns in mSOD1 Mes V cells in vitro via injection of biophysically based resurgent sodium current. Neither Trigeminal ganglion neurons which are cultured and retinal ganglion neurons which are related visual system didn't show any abnormalities in mSOD1. Together these experiments offer the first evidence of circuit-level dysfunction and spindle afferent sensory changes due to multiple channelopathies. This result is transformative in our understanding of disease development in ALS, and suggest novel directions for biomarker search and design of multifaceted strategies for disease management.

Lecture-4

Exploration of *in vivo* function of mitochondrial protein p13

Norihito Shintani, Hitoshi Hashimoto

Laboratory of Molecular Neuropharmacology, Graduate School of Pharmaceutical Sciences, Osaka University

Gene-targeting studies, such as *in vivo* overexpression/knockout experiments, have been powerful and indispensable approaches to validate whether the target gene is druggable as well as to disclose undefined machineries regulating the organism's phenotypes. However, the so-called "indispensable gene" might be not so much, since more than 80% mutant mice we have phenotyped are viable and exhibit apparently normal phenotypes. In this talk, we show our recent data indicating *in vivo* function of a 13-kDa protein (p13), which we originally identified as a protective factor of pancreatic islets under diabetes and whose knockout mice exhibit remarkable phenotypic changes. Immunoblot analysis indicated that p13 is highly expressed in heart and liver, and thalamus and midbrain among nine brain regions. CRISPR/Cas9-mediated disruption of *p13* gene caused growth defects and severe postnatal mortality. Besides, the surviving knockout mice exhibited several behavioral defects and severe organ defects including testicular hypoplasia. On the other hand, heterozygous *p13* knockout mice exhibited normal basal phenotype, and rather showed tolerance against neurotoxin's toxicity in the experimental Parkinson's disease (PD) model. In this model, p13 knockdown blocked the toxin-induced locomotor defects and midbrain neurodegeneration without alteration of brain glial activation. Further mechanic studies using the mutants and dopaminergic cell lines indicated the involvement of p13 in the functional regulation of mitochondrial respiration complexes. Accordingly, these results suggest that p13 is one of the indispensable gene having vital importance, and that manipulating p13 expression might be a promising avenue for therapeutic intervention in some diseases including PD.

Lecture-5

Mechanism linking Periodontitis to Alzheimer's disease: Critical roles of Cathepsin B in Neuroinflammation

Junjun Ni[1], Zhou Wu[1,2]

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Neuroinflammation, inflammation of the brain, strongly impact on Alzheimer's disease (AD), which can be enhanced by systemic inflammation. On the other hand, periodontitis, as a common oral chronic infection that elicits systemic inflammatory responses. Recently, the concept of periodontitis involving in AD has been suggested, because growing clinical evidence have shown that chronic periodontitis is closely linked to the initiation and progression of AD. As high percentage of adults are suffering from periodontitis and the prevalence of periodontitis increases with age, periodontitis can be a significant source of covert systemic inflammation within the general population. In the present talk, we will introduce our recently works on clarifying the mechanisms linking between periodontitis and AD, thereby helping to understand how does oral infection impact on brain.

We have found that Cathepsin (Cat) B plays a critical role in inducing AD-like phenotypes, including microglia-mediated neuroinflammation, intracellular Aβ accumulation in neurons and memory impairment in the middle-aged mice following chronic systemic exposure to LPS from *P.gingivalis* (PgLPS), and the Aβ accumulation in neurons are dependent on PgLPS-induced microglia CatB production. We further explore the novel mechanisms of CatB involving in microglia-mediated neuroinflammation. Firstly, CatB involves in chronically NF-κB activation in microglia, result in prolonging microglia-mediated neuroinflammation. Secondly, leakage of CatB in aged microglia are responsible for mitochondria-derived reactive oxygen species (ROS) generation result in accelerating neuroinflammation during aging.

In conclusion, CatB involves in microglia-mediated neuroinflammation are dependent on mitochondria-derived ROS generation and NF-kB activation. We propose that CatB may as a therapeutic target for preventing periodontitis-associated cognitive decline in AD.

Abstract
Poster Session

Poster-1

Comparison of standardized palpation between masseter and temporal muscles for referred pain and sensations in healthy individuals

Manabu Masuda[1], Takashi Iida[1], Akiko Shimada[2], Osamu Komiyama[1]
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【Aims】
The aims of this study was to compare the incidence of referred pain/sensations between masseter and temporal muscles with standardized palpation.
【Materials and methods】
Participants comprised 64 pain-free individuals (mean age, 26 ± 5 years) according to the Diagnostic Criteria for Temporomandibular Disorders. Participants was divided two groups as masseter and temporal muscle groups in randomized order. In each group, the right masseter and temporal muscles were equally divided into 15 test sites, respectively. Nine types of Mechanical sensitivity was assessed with three mechanical stimuli (0.5 kg, 1.0 kg, or 2.0 kg) applied to the 15 test sites with three different durations (2 sec, 5 sec , or 10 sec) using palpometers. Participants scored the intensity of perceived pain and unpleasantness for the nine mechanical stimuli on a 0-50-100 numerical rating scale (NRS) after each stimulus. Furthermore, if the participant reported referred pain/sensations after a stimulus, they were asked to indicate areas of referred pain/sensations on a digital drawing.
【Results】
The incidence of referred pain/sensations in masseter and temporal muscle groups were 34.3% (n = 11/32) and 34.3% (n = 11/32), respectively. In 2.0 kg of mechanical stimuli for both groups, the number of participants with referred pain/sensations elicited by 10 sec palpation stimulus was significantly higher than that by 2 sec palpation stimulus ($P < 0.05$). Positive correlation were found between mechanical sensitivity and duration of palpation in both groups ($P < 0.05$).
【Conclusions】
The present study suggested that the incidence of referred pain/sensations from masseter muscle and temporal muscle caused by myofascial pain are similar in orofacial area. Also the present study showed that the incidence of referred pain/sensations from masseter muscle and temporal muscle were time- and intensity-dependent originating from local stimulus with increased mechanical sensitivity.

Key Words: referred pain, palpation, masticatory muscles

Poster-2

Associations between rhythmic masticatory muscle activity and sleep arousals in sleep bruxism children

Yuki Shiraishi[1,2], Masaya Tachibana[3,4], Ai Shirota[1], Ikuko Mohri[3,4], Masako Taniike[3,4], Takashi Yamashiro[2], Takafumi Kato[1,3,4]

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[Purposes] Sleep bruxism (SB) is a sleep related movement disorder characterized by the frequent occurrence of rhythmic masticatory muscle activity (RMMA) /tooth grinding during sleep. Prevalence of SB is highest during childhood and decreases with age. Sleep architecture is known to change from children to adulthood. This study aims to investigate physiological association between the occurrences of RMMA and sleep architecture in pediatric SB. **[Methods]** Overnight video-polysomnography was performed for ten children (M/F: 6/4, 10.1 ± 2.5 years old) and nine young adults (M/F: 5/4, 23.1 ± 1.4 years old) without any physical/neurological problems. Sleep variables and RMMA episodes were scored according to the standard rules. Subjects were confirmed to have moderate-severe SB (the frequency of RMMA episodes >4 times/hr of sleep). Sleep architecture, arousals and leg/body movements were compared between the two groups. **[Results]** RMMA index did not differ between children (6.0 ± 1.4 times /hr) and adults (6.5 ± 2.4 times /hr). In comparison to adults, total sleep time was longer and sleep efficiency was higher in children. Micro-arousals and awakenings less frequently occurred in children than in adults. In both groups, approximately 70% of RMMA were found to occur in light non-rapid eye movement (NREM) sleep. The occurrence of most frequently observed during the transition period from NREM sleep to REM sleep in children as well as adults. A majority of RMMA episodes were accompanied by arousals and leg/body movements in the two groups (children: 74.7 ± 13.4%, adults: 68.0 ± 16.1%) and RMMA occurred more frequently with body movements in children (51.0 ± 14.5%) than in adults (23.6 ± 18.8%) ($p<0.05$). **[Conclusion]** RMMA in children and adults can occur in light NREM sleep. However, RMMA in children is more frequently associated with the exaggerated arousal response in comparison to those in adults.

Key Words: sleep, children, bruxism

Poster-3

Evaluation of material used for soft palate augmentation in dogs with the aim of improvement of velopharyngeal insufficiency

Makoto Matsukawa[1], Emiko T. Isomura[1,2], Ryou Mitsui[1], Kiyoko Nakagawa[1], Mikihiko Kogo[1]

[1]First Department of Oral and Maxillofacial Surgery, Osaka University, Graduate School of Dentistry; [2]Unit of Dentistry, Osaka University Hospital

Velopharyngeal function plays an important role in swallowing, blowing and phonation. In patients with cleft palate, velopharyngeal insufficiency may occur due to shortfall of soft palate tissue, surgical scars, or poor reconstruction of the levetor veli palatine. Soft palate augmentation methods are used as alternatives to velopharyngeal plasty. However, materials which are suitable for soft palate augmentation methods have not been identified.

Here, we experimentally investigated optimal material for soft palate augmentation in a dog. We studied in 10 beagle dogs, assigned to 3 groups according to the materials used of augmentation: hyaluronic acid (N=3), collagen (N=3), and autogenic fat tissue (N=4). We injected 2ml hyaluronic acid, collagen, or autogenic fat tissue into the nasal mucosa of the soft palate in each dog, using a needle type device of the endoscope.

We recorded nasal air leakage, velopharyngeal presseure, and the electromyographic (EMG) activity of the levator veli palatine before injection and 6 months after injection. In all groups, nasal leakage of 6 months after injection were significantly reduced compared to that of pre-injection. Furthermore, velopharyngeal pressure and EMG of 6 months after operation were significantly increased compared to that of pre-injection only in the fat injected group.

These result showed that autogenic fat injection not only reduced nasal air leakage but also improved the levator veli palatine muscular activity and the velopharyngeal closure strength. Thus we considered that optimal material in soft palate augmentation methods was autologous adipose tissue.

Key Words: cleft palate, velopharyngeal insufficiency, transplant

Poster-4

New method to count the number of chewing by distortion of the ear canal using customized sensor

Akihiro Yoshino[1, 2], Ryosuke Shimono[2], Hideaki Sugo[2], Takafumi Kato[3], Yuji Masuda[1]
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A patent (Japanese Patent No. 5660556) has been obtained for a method of counting the number of chewing by distortion of the ear canal. In this study, we made a customized earplug sensor by impressing a shape of the ear canal, and examined the possibility of measurement of the number of chewing using the customized sensor.

The subjects were adult women. After 3D scanning of an impression of the ear canal, the 3D data of earplug was constructed with CAD. Based on the data, a rubber-like material was used in a 3D printer to produce a customized sensor. A barometer was incorporated into this sensor to detect changes of distortion in the ear canal. Three types of 100%, 110% and 120% of the actual size of the ear canal were manufactured. We asked the subject to swallow a piece of apple on one (left and right) side chewing. From the recorded pressure change, counting of chewing was performed using a chewing count device, while the number of muscle bursts was counted from the electromyogram recorded from the masseter muscle on the chewing side. The degree of coincidence of each chewing number was analyzed by the Bland-Altman analysis. Furthermore, the cross correlation function was calculated from the pressure waveform and the rectified and smoothed electromyogram, and the peak values were compared among the sensor sizes.

The 95% match limit on the Bland-Altman plot was small when chewing food at the opposite side to the recorded ear canal, and smallest when using the sensor of 110% size. The peak of the cross-correlation function was also large at the opposite side chewing, and largest with the sensor of 110% size. In making a customized earphone-type sensor, it was found that the sensor of 110% size may be effective.

Key Words: number of chewing, 3D printer, electromyogram

Poster-5

5-HT_{2A} receptor activation augments postsynaptic glutamatergic responses in the dendrites of the masseter motoneurons by enhancing the function of the GluN2A-containing NMDA receptors through the Src kinase

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5-HT modulates various motor behaviors, including oral motor functions. The masseter (jaw-closing) motoneurons receive abundant serotonergic inputs as well as glutamatergic inputs; however, it remains unknown how 5-HT affects the glutamatergic postsynaptic responses in the dendrites of the masseter motoneurons. We examined effects of 5-HT application on the responses evoked by single- or two-photon uncaging of caged glutamate (glutamate responses) in the dendrites of the masseter motoneurons in postnatal day 2–5 rats. Bath application of 5-HT depolarized the cells and increased the amplitude of glutamate responses, dose-dependently. The 5-HT_{2A} receptor (5-HT_{2A}R) agonist TCB-2 mimicked the 5-HT-induced enhancement of glutamate responses, which was blocked by the 5-$HT_{2A/2C}$R antagonist ketanserin. However, neither the 5-HT_{2B}R agonist BW723C86 nor the 5-HT_{2C}R agonist MK212 affected glutamate responses. Blockade of the NMDA receptors (NMDARs) by APV, but not AMPA receptors by CNQX, abolished the 5-HT-induced enhancement. Furthermore, the selective antagonist for the GluN2A subunit TCN 201, but not the antagonist for GluN2B subunit ifenprodil, abolished the 5-HT-induced enhancement. 5-HT increased GluN2A phosphorylation, while the Src kinase inhibitor PP2 reduced the 5-HT-induced enhancement and GluN2A phosphorylation. When TCB-2 was puffed to the dendrites, the enhancement of glutamate responses was restricted to ~60 μm of the location of the puff loci. Electron microscopic immunohistochemistry revealed that both the NMDARs and 5-HT_{2A}Rs were located close to each other in the same dendrite. These results suggest that the activation of 5-HT_{2A}Rs in the dendrite of masseter motoneurons enhances the function of GluN2A-containing NMDARs in the vicinity through the Src kinase. Such enhancement of glutamate responses by 5-HT may contribute to a wide-range regulation of the jaw-closing force during oral motor functions.

Key Words: 5-HT_{2A} receptor, NMDA, dendrite

Poster-6

Upregulation of calcitonin gene-related peptide, neuronal nitric oxide synthase, and phosphorylated extracellular signal-regulated kinase 1/2 in the trigeminal ganglion after bright light stimulation of the eye in rats

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Bright light stimulation of the eye activates trigeminal subnucleus caudalis (Vc) neurons in rats. Sensory information is conveyed to the Vc via the trigeminal ganglion (TG). Thus, it is likely that TG neurons respond to photic stimulation and are involved in photic hypersensitivity. However, the mechanisms underlying this process are unclear. Therefore, the hypothesis in this study is bright light stimulation enhances the excitability of TG neurons involved in photic hypersensitivity.

Expressions of calcitonin gene-related peptide (CGRP) and neuronal nitric oxide synthase (nNOS) were significantly higher in TG neurons from 5 min to 12 h after photic stimulation of the eye. Phosphorylation of extracellular signal-regulated kinase1/2 (pERK1/2) was enhanced in TG neurons within 5 min after photic stimulation, while pERK1/2 immunoreactivity in satellite glial cells (SGCs) persisted for more than 12 h after the stimulus. Activation of SGCs was observed from 5 min to 2 h. Expression of CGRP, nNOS, and pERK1/2 was observed in small and medium TG neurons, and activation of SGCs and pERK1/2-immunoreactive SGCs encircling large TG neurons was accelerated after stimulation.

These results suggest that upregulation of CGRP, nNOS, and pERK1/2 within the TG is involved in photic hypersensitivity.

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Key Words: bright light stimulation, trigeminal ganglion, satellite glial cells

Poster-7

Nicotinic activity differentially modulates synaptic plasticity in layers III and VI pyramidal neurons of the mouse insular cortex

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Nicotinic acetylcholine receptors (nAChRs) in the insular cortex play an important role in nicotine addiction, but its synaptic mechanisms still remain unresolved. In layer 5 pyramidal neurons of the mouse insular cortex, activation of nAChRs suppresses synaptic potentiation through enhancing GABAergic synaptic transmission. However, it has not been addressed whether and how activation of nAChRs modulates synaptic plasticity in layers 3 and 6 pyramidal neurons of the insular cortex. In this study, we demonstrate that activation of nAChRs oppositely modulates synaptic potentiation in layers 3 and 6 pyramidal neurons of the insular cortex. In layer 3 pyramidal neurons, activation of nAChRs depressed synaptic potentiation induced by combination of presynaptic stimulation with postsynaptic depolarization through enhancing GABAergic synaptic transmission via activation of β2-containing nAChRs in non-FS interneurons. By contrast, in layer 6 pyramidal neurons, activation of nAChRs enhanced synaptic potentiation through activating postsynaptic β2-containing nAChRs. These results indicate, in different layers of the mouse insular cortex, paired training-induced synaptic potentiation is oppositely regulated by activation of nAChRs which are located on GABAergic interneurons (layer 3) and on pyramidal neurons (layer 6). Thus, layer-specific modulation of synaptic potentiation may be involved in synaptic mechanisms of insular cortical changes in nicotine addiction.

Key Words: nicotinic acetylcholine receptor, insular cortex, synaptic plasticity

Poster-8

Cortical and Subcortical Projections of Granular Insular Cortex Receiving Proprioception from Jaw-Closing Muscle Spindles

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The proprioceptive signal from jaw-closing muscle spindles (JCMSs) is conveyed to the supratrigeminal nucleus, then to the caudo-ventromedial edge (VPMcvm) of ventral posteromedial thalamic nucleus (VPM), and finally to the dorsal part of granular insular cortex rostroventrally adjacent to the rostralmost part of secondary somatosensory cortex (dGIrvs2) in rats. In the present study, therefore, we examined the efferent projection features of the dGIrvs2in the rat in order to reveal the brain functions of the proprioceptive signal arising from JCMSs. After the identification of anatomical position of the dGIrvs2by recording field potentials responded to the electrical stimulation of masseter nerve and the extension of masseter muscle, we injected an anterograde tracer biotinylated dextranamine (BDA) in the dGIrvs2. After perfusion and fixation of rats, serial coronal sections were made and observed. As a result, most BDA-labeled axon terminals were presented in the cortical and subcortical structures ipsilateral to the injection site. In the cerebral cortices, a large number of BDA-labeled axon terminals were found in the insular cortex around the injection site, primary and secondary somatosensory cortices, lateral and medial agranular cortices, and dorsolateral orbital cortex. In the basal ganglia, they were found in the caudate putamen, core part of accumbens, lateral globus pallidus, subthalamic nucleus, and substantia nigra pars compacta and pars reticulata. In addition, they were observed in the central amygdaloid nucleus and extended amygdala. In the thalamus, they were seen in the reticular nucleus, ventromedial nucleus, core VPM, parvicellular part of ventral posterior nucleus, oval paracentral nucleus, medial and triangular parts of posterior nucleus and zona incerta as well as the VPMcvm that received the ascending proprioceptive signal from JCMSs. These data suggest that the JCMS proprioceptive information through the dGIrvs2 might be involved in the emotional ‘limbic’ and autonomic functions as well as the sensorimotor function.

Key Words: proprioception, muscle spindle, insula

Poster-9

Enhancement of incision-induced face mechanical hypersensitivity in adulthood associated with the neonatal facial skin incision

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Neonatal injury is known to cause neuro-plastic changes in the peripheral and central nervous system in adulthood, occasionally resulting in ubiquitous chronic pain. We examined the involvement of tetrodotoxin-resistant voltage-gated sodium channel (Nav 1.8) in trigeminal ganglion (TG) neurons in orofacial pain hypersensitivity induced by neonatal injury. Whisker pad skin was incised on neonatal day 4 (P4), and the whisker pad skin was incised again on week 7. Following re-incision, mechanical head-withdrawal thresholds in the whisker pad skin were measured, and Nav 1.8 expression in TG neurons innervating the whisker pad skin was examined. On day 14 following re-incision, mechanical hypersensitivity was further enhanced, and the increase in the number of Nav 1.8-positive TG neurons was also enhanced. Administration of Nav 1.8 blocker and CC chemokine receptor 2 antagonist to the incised skin or TG suppressed the enhancement of mechanical hypersensitivity of the whisker pad skin. Furthermore, local administration of CC chemokine ligand 2 (CCL2) induced the further increase of mechanical hypersensitivity in the incised whisker pad skin compared to the vehicle-injected rats.

The present findings suggest that neonatal orofacial incision further accelerates TG neuronal hyperexcitability in association with Nav 1.8 hyper-expression via CCL2 signaling, resulting in the enhancement of orofacial incisional pain hypersensitivity.

Conflict of Interest: The authors declare no conflict of interest.

Key Words: Neonatal injury, Nav 1.8, CCL2 signaling

Poster-10

Enhancement of theta-frequency band electroencephalogram activities during unmatched olfactory–taste stimulation

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Introduction: The senses of smell under having foods are deeply concerned with feeling of deliciousness. In addition, the senses may also have a role in recognition of foods together with taste. This study aimed to investigate how odor stimulation affects taste perception.

Methods: Electroencephalogram (EEG) signals were measured from the frontal region of the head in normal subjects, and frequency analyses were performed. Each odor stimulation was delivered while the subject tasted chocolate, using chocolate paste as the odorant for ‘matched odor stimulation’, and garlic paste for ‘unmatched odor stimulation’.

Results: Differences in EEG signals appeared between the matched and unmatched arms of the study. Comparison of the frequencies of EEGs captured under the condition of unmatched odor stimulation with those captured under the condition of matched odor stimulation showed that the occupancy rate of the theta-frequency band under the condition unmatched odor stimulation was higher than that under the condition of matched odor stimulation. Interestingly, a negative correlation existed between the occupancy rate of the theta-frequency band and the subjective feeling of chocolate sweetness.

Discussion: The present study shows that the theta band appeared while perceiving smells that did not match the food being tasted. In addition, in this case, subjective feeling of sweetness decreased, and participants tended to be unable to discern what the food was. The feeling of perturbance might induce concentration, resulting in generation of the theta rhythm activity. Indeed, error-related theta waves are observed in the medial prefrontal cortex. Although we cannot address sources of the theta rhythm, the present results suggest that theta-band brain activities emerge when cross-checking unmatched information.

Key Words: Electroencephalogram, Smell, Theta frequency