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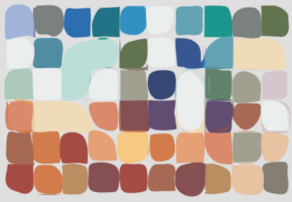

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P-1

Morphological Relationship between Tooth and Craniofacial Structure

Mirinae Park, Mun-Sun Kim, Seung-Weon Lim, Kyung-Min Lee

Department of Orthodontics, School of Dentistry, Chonnam National University

Objectives : The purpose of this study is to investigate the morphological relationship between Tooth and Craniofacial Structure. We quantified the classification of facial length by cephalometric analysis and analyzed the correlation between facial length and the ratio of maxillary central incisor and lateral incisor.

Material and Methods : Sixty-nine patients (aged 25-39 years) who visited the Department of Orthodontics, Chonnam National University Dental Hospital were examined using lateral cephalogram and diagnostic dental model. The crown length of maxillary cental incisor and lateral incisor, the width of the crown, and ratio of width/length of crown were measured. Based on SN/MP plane angles, the patients were divided into three groups: brachycephalic group, normal group, and dolichocephalic group. the correlation between tooth morphology and craniofacial structure was anlyzed according to three groups.

Results : There are no statistically significant differences of crown length, crown width, and the ratio of width/length of crown among the three groups include brachycephalic growth, normal growth, and dolichocephalic growth. In addition, there was no correlation between SUM, gonial angle, FMA, and contour of height of crown, which are other indicators of facial length, based on cephalometric analysis of 69 patients, regardless of group.

Conclusion : There is no correlation between the ratio of width/length of crown and craniofacial structure.

P-2

Facial Soft Tissue Thickness Measurements of Facial Asymmetry Individuals Using Cone-Beam CT Images

Jin-An Jung, Da-Nal Moon, Seung-Weon Lim, Kyung-Min Lee, Jin-Hyoung Cho, Hoi-Jeong Lim

Department of Orthodontics, School of Dentistry, Chonnam National University

Objectives : The purpose of this study is to assess the measurements of the facial soft tissue (ST) thickness of facial asymmetry individuals using cone-beam computed tomography (CBCT) images.

Material and Methods : The CBCT images of 30 adult subjects with evident facial asymmetry were acquired and then were constructed into three dimensional images. The 24 bilateral landmarks for ST thickness were determined. Using ST thickness measurement program, thicknesses were measured at each landmark. The means and standard deviations were obtained for each measurements and the data of chin-deviated side were compared with those of opposite side. Correlation analyses were performed between the deviated and opposite side differences of each measurement and degree of hard tissue facial asymmetry.

Results : In the comparison of ST thickness between the chin-deviated and the opposite side, the measurements of Mental tubercle (Most prominent point on the mental tubercle), Supra-M1 (Most prominent point on alveolar margin of the maxillary first molar), Mid-ramus (Center of the ramus, horizontally middle point between anterior and posterior border of mandibular ramus, vertically the halfway point between mandibular notch and antegonial notch), Infra-M1 (Most prominent point on alveolar margin of the mandibular first molar), Mid-mandibular (Center of the manibular body, horizontally lined up with mandibular first molar and vertically at the level of mental foramen) showed statistically significant differences. The measurements of Mental tubercle, Supra-M1, Mid-ramus, Mid-mandibular presented larger values of thickness in the deviated side and the measurements of Infra-M1 presented larger values of thickness in the opposite side. The degree of menton deviation and frontal ramal inclination difference showed low correlation with the right and the left differences of ST thickness in the landmarks which presented statistically significant difference.

Conclusion : The results of the study indicate that the difference of ST thickness of the subjects with facial asymmetry should be taken into consideration in facial reconstruction.

P-3

Evaluation of posterior palatal alveolar process for orthodontic mini-implant using CBCT

Jeong-Ah Lee[1], Li-In Lim[2], Byung-Suh Rhim[3], Soon-Jung Park[4], Ki-Ho Park[2], Seong-Hun Kim[2]

[1]Real-Line dental clinic, Seoul, Korea
[2]Department of Orthodontics, Kyung Hee University Dental Hospital
[3]Is dental clinic, Hwaseongsi, Gyeonggido
[4]Lime dental hospital, Seoul, Korea

Objectives : We evaluated the interradicular space and hard and soft tissues of the posterior palatal alveolar process. Among the interradicular distances in the different anteroposterior areas at the same vertical depth, the widest space was between the second premolar and the first molar. The area between the canine and the first premolar and that between the first and second premolars showed narrower spaces than that between the first and second molars.

Material and Methods : Among palatal bone thicknesses at interdental sites in different anteroposterior areas at the same vertical depth, the palatal bone thickness was the thickest between the first and second premolars, followed by that between the canine and the first premolar. The palatal bone was the thinnest between the second premolar and the first molar at the vertical depth of 4mm, and between the first and second molars at the vertical depths of 5,6,7,and 8mm. Among palatal soft-tissue thickness in different anteroposterior areas at the same vertical depth at interdental sites, the palatal soft tissue was the thickest between the canine and the first premolar at the vertical depths of 4 and 5 mm, and between the premolars at the vertical depths of 6,7,and 8mm. The palatal soft tissue was the thinnest between the molars at all vertical depths.

Results : There were significant gender differences in the palatal bone and soft-tissue thicknesses in some areas, but the difference was less than 0.5mm, and the clinical relevance was questionable. Palatal bone and soft-tissue thicknesses showed a positive correlation with the vertical depth.

Conclusion : we added the mean of the palatal bone and soft-tissue thicknesses and schematized the result. The data are expected to guide the clinical situation of OMI placement in the posterior palatal alveolar process for nonsurgical maxillary expansion using BBRMEs. However, individual variations are present, which might require individual 3D imaging.

P-4

Quantitative analysis of lip morphology according to different type of skeletal malocclusion

Jae-Jun Kim, Hyeon-Jong Lee, Dong-Soon Choi, Insan Jang, Bong-Kuen Cha

Department of Orthodontics, College of Dentistry, Gangneung-Wonju National University

Objectives : To compare the differences in lip vermilion shapes according to anteroposterior dentoskeletal patterns and facial divergences.

Material and Methods : The samples were composed of frontal facial photographs of 117 adult females who satisfied all the cephalometric measurements for each group (Class I normodivergent, Class II normodivergent, Class III normodivergent, Class I hyperdivergent, Class II hyperdivergent, and Class III hyperdivergent). The shapes of the lip vermilions were evaluated and compared between groups.

Results : Lower lip height tended to be greater in Class III group than Class I and Class II group. In normodivergent groups, lip height to width ratio was smaller and superior margin of the upper vermilion was more curved in Class II group than that of the Class I group. In hyperdivergent groups, the angle between right cheilion, stomion inferius, and left cheilion was smaller in Class III group than that of Class II group. Lower facial height, interlabial gap, ratio of the height to the width of the lip vermilion, and the commissure height was larger in the hyperdivergent groups than the normodivergent groups. However, upper lip height and philtrum height did not differ between hyperdivergent and normodivergent groups.

Conclusion : There were differences of the frontal shape of the lip vermilion according to anteroposterior dentoskeletal patterns.

P-5

Computational analysis of airflow dynamics for predicting collapsible sites in the upper airway

Heekyu Jung[1], Ju-Young Kang[1], Hwi-Dong Jung[2], Hyung-Ju Cho[3], Joon Sang Lee[1,4], Yoon Jeong Choi[1,4]

[1]Department of Orthodontics, The Institute of Craniofacial Deformity, College of Dentistry, Yonsei University
[2]Department of Oral and Maxillofacial Surgery, Oral Science Research Institute, Yonsei University College of Dentistry
[3]Department of Otorhinolaryngology, Yonsei University College of Medicine
[4]Department of Mechanical Engineering, Yonsei University

Objectives : Our aim was to reveal the detailed relationship between flow and structure characteristics and collapsibility in obstructive sleep apnea.

Material and Methods : Using a computational approach, we performed flow and structure simulations on the upper airways of two patients (skeletal Class II and III). Transient flow simulation was performed using a prescribed volume flow rate in order to observe flow characteristics within the upper airways with an unsteady effect.

Results : In skeletal Class II patient, the maximum magnitude of velocity and pressure drop with velocity shear and vortical motion were observed at the oropharyngeal level, while, the magnitude of velocity and pressure were overall relatively small in skeletal Class III patient. To identify the cause of pressure drop in skeletal Class II patient, pressure gradient components induced by the flow were examined. Of note, vortical motion was highly related to pressure drop. Structure simulation was performed to observe deformation and collapsibility of the soft tissue using the surface pressure obtained from the flow simulation. When the flow rate reached a peak level, the soft tissue of skeletal Class II patient was highly expanded, and a collapse was observed at the oropharyngeal and epiglottis levels.

Conclusion : First, mandibular retrognathism can cause direct restriction of the posterior pharyngeal space. Second, from an aerodynamics point of view, the position of the mandible and its surrounding components is highly associated with pressure drop, in-there vortical motion, and friction at the space. Finally, as the mandible is located at a posterior position, a rapid pressure drop can occur at the oropharyngeal and epiglottis levels. Consequently, this causes the surrounding soft tissue to expand and the upper airway to collapse.

P-6

The posterior space available for distalization of lower molars assessed using Cone Beam Computerized Tomography

Shi-feng Li, Hyo-sang Park, Hyun-hee Yun

Department of Orthodontics, School of Dentistry, Kyungpook National University

Introduction : The accurate measurement or proper prediction of posterior space of dental arch is of great importance in treatment planning. With CBCT, accurate measurements can be performed in all the three-dimensions.
The measurements on the distance between roots of the mandibular molars and lingual cortical plate on the course of distalization of the mandibular molars in different skeletal patterns can provide invaluable information in treatment planning of molar distalization or whole arch distalization.
The purpose of this study was to investigate the anatomical limit for the distal movements of the mandibular second molar among various facial types by using CBCT

Discussion : There are some limitations in this study. The soft tissue of the retromolar pad area was not considered in this study, soft tissue accumulation and coverage could be another major obstacle for molar distalization. In this study, we assumed that the movement of molar was bodily movement, not tipping movement. The movement is done with tipping moment, the results from this present study cannot be applied.

Conclusion : For mandibular second molar distalization, the true limit was the lingual cortical bone at root level, not the anterior border of ramus. The root contact ratio in hyperdivergent group was much higher than normal and hypodivergent groups, and the horizontal and vertical shortest distance was smaller in hyperdivergent group. In the absence of a three-dimensional image, the lateral cephalogram can be used to predict the posterior shortest distance and vertical shortest distance. The safety range of molar distalization and intrusion should not exceed 2 mm. If it is needed to distalize or intrude more than 2 mm, cases should be evaluated with a CBCT.

P-7

Comparison of mandibular posterior alveolar bone thickness between skeletal class III and class I malocclusions

Hyerim Ki, KyungSuk Cha, JinWoo Lee, Dong-Hwa Chung, SangMin Lee

Department of Orthodontics, College of Dentistry, Dankook University

Objectives : To compare alveolar bone thickness of mandibular posterior teeth between skeletal class III and class I malocclusions.

Material and Methods : Cone beam computed tomography images of 60 patients, including 30 class I patients (16 males and 14 females) and 30 class III patients (22 males and 8 females) were analyzed. ANB angle was used as the criterion for classifying sagittal skeletal pattern. Total alveolar bone thickness (ABT), buccal cortical bone thickness (CBTB), and lingual cortical bone thickness (CBTL) were measured for posterior teeth at three different depths.

Results : There was no significant difference in mean age, gender distribution, or vertical skeletal pattern (SN-GoGn) between the two groups. In both groups, ABT was increased from the premolar to the second molar. When comparing two groups, ABT of group 1 was thicker than that of group 2 in most regions. The closer to the alveolar crest, the more statistically significant differences were found in more teeth. CBTB had no significant difference between the two groups while CBTL showed similar tendency to ABT. When cortical bone thickness was compared between buccal and lingual sides, all measurement values of both groups showed statistically significant differences between the two sides. From the first premolar to the mesial root of the first molar, CBTL was thicker than CBTB and vice versa for the second molar.

Conclusion : Total alveolar bone thickness of mandibular posterior teeth appears to be thinner in skeletal class III malocclusion patients than that in class I. Such difference in total alveolar bone thickness between the two groups is probably due to lingual cortical bone thickness.

P-8

Cone-beam computed tomography analysis of the association between sella turcica bridging and palatally impacted canine

Soo-Min Gil, Sang-Cheol Kim

Department of Orthodontics, College of Dentistry, Wonkwang University

Objectives : The aim of this study was to analyze the association between sella turcica bridging (STB) and palatally impacted canine and to investigate the correlation between the angular measurements of palatally impacted canine and STB using cone beam computed tomography (CBCT) images.

Material and Methods : The impaction group included 36 subjects (16 males and 20 females; mean age, 16.97 6.00 years) who had at least one palatally impacted canine. The control group consisted of 36 subjects (16 males and 20 females; mean age, 16.89 3.52 years) who had normally erupted canines without any dental anomalies. A total of 72 CBCT images were reconstructed using OnDemand3D 1.0 software (Cybermed, Seoul, Korea). Sella turcica dimensions were measured to evaluate the differences between the impaction and control groups, and STB ratios were analyzed to compare the differences between the impacted and non-impacted sides. Correlation coefficients were calculated between the angular measurements of palatally impacted canine and STB ratio.

Results : In the impaction group, interclinoid distance and STB ratio were significantly smaller than those of the control group ($p < 0.001$). The distribution of STB type II which means partial calcification of interclinoid ligaments was significantly higher in the impaction group than in the control group ($p < 0.05$). However, there was no significant difference of STB between the impacted and non-impacted sides ($p > 0.05$) in the unilateral impaction group. Further, STB ratio was negatively correlated with the mesiodistal angulation and the buccolingual inclination of the palatally impacted canine ($p < 0.05$).

Conclusion : The STB was more frequently found in patients with palatally impacted canine, and the degree of STB was significantly associated with the angular measurements of impacted canine.

P-9

Effect of ASPH-treatment on improving osseointegration of orthodontic mini-implants

Je Hyeok Park, Jong Ghee Kim, Young-Mi Jeon

Department of Orthodontics, School of Dentistry, Chonbuk National University

Objectives : Orthodontic mini-implants is widely used in clinical fields. However, literatures cite that orthodontic mini-implants has typical problem of relative high failure rates. This study is conducted to evaluate the osteo-conductive properties of methods enhancing surface bioactivity of Ti-6Al-4V alloy plate & orthodontic mini-implant in vitro.

Material and Methods : Ti-6Al-4V alloy plate (20mm X 10mm X 1mm) (n=32) were pre-treated with Sic paper polishing & acid etching. Anodization treatment for making TiO2 nanotubes, silica-immersing, pre-calcification and heat treatment (ASPH treatment) was done for each specimen. To evaluate the bioactivity of ASPH-treated specimen, FE-SEM observation, SBF immersion test, EDS analysis, XRD test and MTT assay were performed. Also, prototype of orthodontic mini-implants were fabricated to further investigate the ASPH treatment in vitro.

Results : FE-SEM images showed densely arranged nanotubes on the Ti-6Al-4V alloy surface fabricated by anodization treatment. Subsequently, compact HAp film on the nanotubular TiO2 layer was precipitated using a cyclic precalcification treatment. EDS analysis and XRD test images also revealed formation of HAP on the alloys in treated group. In MTT assay, surface treated alloy showed similar biocompatibility with pure titanium. Similar results were found in the surface treated orthodontic mini-implants.

Conclusion : The results demonstrated that the ASPH treatment of Ti-6Al-4V alloy and mini-implants enhanced the condition of HAp precipitation. Thus, these results propose that ASPH-treated orthodontic mini-implants can be applied in clinical use.

P-10

Effect of anodic oxidation and precalcification treatments on Ti-6Al-4V alloy orthodontic miniscrew

Kang Gyu Lee[1], Tae-Sung Bae[2], Jong Ghee Kim[1], Young-Mi Jeon[1]

[1]Department of Orthodontics, School of Dentistry, Chonbuk National University
[2]Department of Dental Biomaterials, School of Dentistry, Chonbuk National University

Objectives : As a skeletal anchorage, the orthodontic miniscrew provides convenience and efficiency in clinical fields. Instead of using extra-oral devices, it has been used for enhancement of anchorage, intrusion, distalization of dentition and so on. Moreover it also began to be utilized in orthopedic treatment to improve skeletal disharmony recently. However miniscrew is maintained mechanically while most prosthetic implant acquires fixation through osseo-integration. Therefore, miniscrew has high possibility of fixation failure in initial stage. If the miniscrew could induce bone osteogenesis at initial stage, fixation failure can be reduced and resistance from early loading can be more stable.
The Ti-6Al-4V alloy has better mechanical property when compared with pure titanium. It is reported that Ti-6Al-4V alloy's surface modified with anodization and cyclic precalcification induces bone osteogenesis. Therefore Ti-6Al-4V miniscrew with modified surface can be osseointegrated with alveolar bone at initial stage and provides solid fixation along with mechanical retention, which can make the fixation failure lower and improve early loading stability.
The purpose of this study is to investigate the effect of the anodization and cyclic precalcification on the surface of orthodontic miniscrew.

Material and Methods : The anodized and precalcificated miniscrews were installed to calvaria of rabbit. Two and four weeks after installation, removal torque of the miniscrew, bone density and bone morphology around miniscrew's surface were examined.

Results : The removal torque was significantly higher in surface treated group than non-surface treated group. The bone density was increased after two weeks in surface treated group when non-treated group increased after four weeks. The generated bone tends to be seem denser in surface treated group.

Conclusion : As a result, the stability of orthodontic miniscrew is improved by anodization and pre-calcification surface treatments. It comes from osseointegration between modified Ti-6Al-4V surface and bone. So, it can reduce the fixation failure and improve early loading stability in clinical field.

P-11

Novel anti-biofouling poly(methyl methacrylate) by incorporating carboxybetaine methacrylate to prevent the formation of multi-species biofilm

Jin Jie[1], Ji-Yeong Kim[1], Myung-Jin Lee[1,2], Ji-Young Seo[1,2], Jaehun Yu[1], Kwang-Mahn Kim[2], Chung-Ju Hwang[1], Jae-Sung Kwon[2], Sung-Hwan Choi[1]

[1]Department of Orthodontics, The Institute of Craniofacial Deformity, College of Dentistry, Yonsei University
[2]Department and Research Institute of Dental Biomaterials and Bioengineering

Objectives : The aims of this study were to incorporate carboxybetaine methacrylate (CBMA) into poly(methyl methacrylate (PMMA), to achieve the anti-biofouling effects of CBMA to prevent the formation of multi-species biofilm without impairing the critical mechanical properties of PMMA.

Material and Methods : CBMA (0.75-7.5 wt%) and 2-methacryloyloxyethyl phosphorylcholine (MPC, 3 wt%) as a positive control were incorporated to PMMA. Firstly, the wettability and mechanical properties were investigated. Then protein adsorptions and fungal and bacterial adhesion and viability on PMMA surfaces were studied using Candida albicans, Actinomyces naeslundii and Veillonella parvula. Further, the thickness and biomass of the human saliva-derived biofilm model cultured on test and control samples were analyzed. Finally, occlusal splints were fabricated, and then aesthetic properties and fractured surface characterization were investigated.

Results : Wettability of PMMA was increased as contents of CBMA increased. Incorporation of 3% CBMA into PMMA achieved significant protein repellent and anti-biofouling effects, without compromising the mechanical properties. A similar trend was observed in the attachment of 3 types of fungi and bacteria and saliva-derived biofilm and the results surpassed those of positive control. Occlusal splints using 3% CBMA were successfully fabricated and showed clinically acceptable aesthetic properties with slight turbidity due to homogenous dispersion of CBMA into PMMA.

Conclusion : Addition of an appropriate amount of CBMA along with PMMA leads to inhibition of the attachment of multi-species fungi and bacteria on its surface, as well as inhibition of biofilm growth. Process of fabricating appliance and acceptable aesthetic properties of CBMA-incorporated PMMA showed applicability in clinical practice.

P-12

Effects of reversing the coiling direction of nickel-titanium closed-coil springs on the force-deflection characteristics

Hwan Hyung Park, Seung Hak Baek

Department of Orthodontics, School of Dentistry, Seoul National University

Objectives : To investigate the effects of reversing the coiling direction of nickel-titanium closed-coil springs (NiTi-CCSs) on the force-deflection characteristics.

Material and Methods : The samples consisted of two commercially available conventional NiTi-CCS groups and two reverse-wound NiTi-CCS groups (Ormco-Conventional vs. Ormco-Reverse; GAC-Conventional vs. GAC-Reverse; n = 20 per group). The reverse-wound NiTi-CCSs were directly made from the corresponding conventional NiTi-CCSs by reversing the coiling direction. Tensile tests were performed for each group in a temperature-controlled acrylic chamber (37ι.
After measuring the force level, the range of the deactivation force plateau (DFP) and the amount of mechanical hysteresis (MH), statistical analyses were performed.

Results : The Ormco-Reverse group exhibited a significant shift of the DFP end point toward the origin point (2.3 to 0.6 mm), an increase in the force level (1.2 to 1.3 N) and amount of MH (1.0 to 1.5 N) compared to the Ormco-Conventional group (all $p < 0.001$), which indicated that force could be constantly maintained until the end of the deactivation curve. In contrast, the GAC-Reverse group exhibited a significant shift of the DFP-end point away from the origin point (0.2 to 3.3 mm), a decrease in the force level (1.1 to 0.9 N) and amount of MH (0.6 to 0.4 N) compared to the GAC-Conventional group (all $p < 0.001$), which may hinder the maintenance of force until the end of the deactivation curve.

Conclusion : The two commercially available NiTi-CCS groups exhibited different patterns of change in the force-deflection characteristics when the coiling direction was reversed.

P-13

Surface characteristics and mechanical behavior of retrieved orthodontic microimplants

Lu Lu, Hyo-sang Park, Sun Hyong Kim

Department of Orthodontics, School of Dentistry, Kyungpook National University

Objectives : The purposes of this study were to test the null hypothesis that there is difference among new microimplants, retrieved microimplants from artificial bone and retrieved microimplants from patients in surface characteristics and mechanical behavior in clinically simulative experimental conditions and to investigate the feasibility of microimplant reuse.

Material and Methods : The microimplants retrieved after their successful use in patients were grouped as retrieved microimplants from patients(RMIP). The micromiplants removed from the artificial bone block immediately after insertion were grouped as retrieved microimplants block(RMIA).
The surface morphological changes at the tip and thread edges of microimplants were observed via the SEM images. EDS (energy-dispersive x-ray spectroscopy) was performed to analyse the relative weight percentage of surface elemental composition on the tip part of microimplants using FE-SEM. The Maximum Insertion Torque(MIT) and insertion time were recorded and calculated to evaluate the mechanical behavior.

Results : The tip and thread edges of retrieved microimplants were worn out with different degrees. In the RMIP group, traces of iron (Fe), sulphur (S) and calcium (Ca) were detected. The mean MIT values and the insertion time of retrieved microimplants were increased in the retrieved microimplants, compared with new microimplants(MIA).

Conclusion : Within the limitation of the current study, the null hypothesis was accepted because retrieved microimplants from different sources exhibited different degrees of changes in surface characteristics and mechanical behavior. The ones retrieved from patients showed more wear at the tip and thread edges, thin surface deposits on the surface, and more increased maximum insertion torque and insertion time. For the same patient, the reuse of microimplants for immediate relocation at a certain insertion angle can be considered based on specific clinical conditions, but we will not recommend the reuse for postponed relocation especially in terms of small microimplants.
For different individuals, the reuse of microimplants is not recommended in clinical practice.

P-14

Fracture resistance of Gum Metal Archwire induced by pH and thermocycling: An in vitro study

JaeYoung Lee[1], KwangHoon Shin[2], YaeJin Kim[1], DongYul Lee[1]

[1]Department of Orthodontics, Korea University Guro Hospital
[2]Department of Orthodontics, Graduate School of Clinical Dentistry, Korea University

Objectives : This study aimed to evaluate fracture resistance of Gum Metal Archwire induced by a combination of pH and thermocycling.

Material and Methods : Four orthodontic archwires were used – (1) Stainless Steel (OrthoForce, USA) (2) Nickel –Titanium (Superelastic Nickel Titanium, USA) (3) Titanium-Molybdenum (TitanMoly, USA) (4) Gum Metal Archwire (Toyota R &L labs inc., Japan). One of the five subgroups served as control, while the other four were be subjected to 30 days of incubation at 37Б under artificial saliva (AS) (two subgroups) or combined with a session of thermocycling (AS+Th) treatment at the end of incubation (two subgroups). The treatments were performed under two different pH conditions: 6.25 and 3.75. A Universal Testing Machine (Shimadzu corporation, Japan) was used for the measurements of the ultimate tensile strength, yield strength and modulus of elasticity of the test samples. For the statistical analysis, Shapiro-Wilk test, Two-way ANOVA, non-parametric methods, Tukey post hoc test, Mann-Whitney U-test were used.

Results : All wires showed decrease of UTS when subjected to acidic pH. No significant differences were seen on the control group and samples immersed in pH 6.25. Nickel titanium alloy was affected mostly by both pH and thermocycling compared to other tested wires. Stainless steel was the smoothest wire; it had the highest values for UTS, YS and E, while NiTi presented with the lowest strength and low elastic modulus with intermediate smoothness. TMA showed intermediate smoothness, with intermediate UTS, YS and E values. Gum Metal behaved like an elastic material with very low E, while maintaining high UTS.

Conclusion : Tensile strength of test wires was mostly affected by pH than thermocycling. Gum Metal begaces like an elastic material with a low elastic modulus and can be particularly useful for initial stage of treatment.

P-15

Enamel Anti-Demineralization Effect of Orthodontic Adhesive Containing Bioactive Glass and Graphene Oxide: An In-Vitro Study

Seung-Min Lee, Woo-Sung Son, Soo-Byung Park, Seong Sik Kim, Yong-Il Kim, Sung-Hun Kim, Se Young Park, Hye-jin Kim

Department of Orthodontics, School of Dentistry, Pusan National University

Objectives : The purpose of this study was to evaluate mechanical and biological properties of orthodontic bonding adhesive enriched in graphene oxide and bioactive glass.

Material and Methods : Graphene oxide (GO) with a bioactive glass (BAG) mixture(BAG@GO) was added to Low Viscosity Transbond XT(LV) in a ratio of 1, 3, 5%. The composites characterization and its physical and biological properties were verified with scanning electron microscopy(SEM) and X-ray diffraction(XRD); its microhardness, shear bond strength (SBS), cell viability, and adhesive remnant index (ARI) were also assessed. Efficiency in reducing WSL was evaluated using antibacterial activity of S. mutans. Anti-demineralization was analyzed using a cycle of the acid-base solution.

Results : Adhesives with 3 or 5 wt.% of BAG@GO showed significant increase in microhardness compared with LV. The sample and LV groups showed no significant differences in SBS or ARI. The cell viability test confirmed that none of the sample groups showed higher toxicity compared to the LV group. Antibacterial activity was higher in the 48-hour group than in the 24-hour group; the 48-hour test showed that BAG@GO had a high antibacterial effect, which was more pronounced in 5 wt.% of BAG@GO. Anti-demineralization effect was higher in the BAG@GO-group than in the LV-group; the higher the BAG@GO concentration, the higher the anti-demineralization effect.

Conclusion : Mechanical properties of orthodontic bonding adhesive enriched in graphene oxide and bioactive glass were appropriate to the clinical application.Biological properties of orthodontic bonding adhesive enriched in graphene oxide and bioactive glass were safe for application to patients. More studies, especially in vivo studies, are needed to extensively test orthodontic bonding adhesive containing BAG@GO.

P-16

Chromium ion release and its effect on surface characteristics of flexible spiral wire retainer

Orakatul Jannat[1], Epifanio Abarro, Jr.[2]

[1]Centro Escolar University Manila
[2]Centro Escolar University Manila

Purpose : To quantify the released chromium ion in artificial saliva, acidic pH and fluoridated media from flexible spiral wire (FSW) retainer and determine the surface characteristics of the FSW.

Materials and methods : Sixty three sectioned specimens of 0.0175 multistranded FSW retainers were dipped into artificial saliva, acidic pH and fluoridated media for 12 hours. The samples were analyzed by Atomic Absorption Spectrophotometer to determine the chromium ion release and the FSW retainers were examined using SEM at X500 magnification to reveal the surface characteristics. ANOVA and post hoc test Tukey and Bonferroni were used to compare the mean values of released chromium ion concentration and the wire surface characteristics after dipping in three kinds of media.

Results : The released chromium ion in three different media is higher than the WHO guideline for chromium in drinking water but much lower than the toxic level. The acidic pH played a vital role in chromium ion release and showed significant effect on the surface characteristics of the FSW in comparison to artificial saliva and fluoride media.

Conclusions : The present study suggests that the pH of the medium is a decisive factor for chromium ion release from FSW retainers and acidic medium brings the most changes in surface characteristics of FSW retainers.

P-17

Comparison of Soft Tissue Changes Between Incisor Tipping and Translation in Premolar Extraction Case

Won-Kyeong Baik, Jung-Yul Cha, Hyung-Seog Yu, Kee-Joon Lee

Department of Orthodontics, The Institute of Craniofacial Deformity, College of Dentistry, Yonsei University

Objectives : The aim of this study was to compare the changes of hard and soft tissues after extraction of 4 premolars followed by maximum retraction of anterior teeth, depending on the type of anterior teeth movement, tipping and translation.

Material and Methods : The subjects were retrospectively collected from the patients presenting lip protrusion and who had undergone orthodontic treatment with extraction of four premolars followed by retraction of anterior teeth. The study group was divided into two subgroups: Group 1 (tipping group, n=27) with less than 1 mm retraction of upper and lower incisor root apex, and more than 10 decrease in upper and lower incisor axis, Group 2 (translation group, n=26) with more than 3 mm retraction of upper and lower incisor root apex, and less than 10 decrease in upper and lower incisor axis. Lateral cephalograms were taken before and after treatment, and the changes of hard and soft tissues were evaluated.

Results : The root apex of the upper and lower incisors showed retractions of 0.33 mm and 0.26 mm, respectively, in tipping group, and 5.02 mm and 5.31 mm, respectively, in translation group. A point and B point moved posteriorly 0.06 mm and 0.05 mm, respectively, in tipping group, and 0.61 mm and 1.98 mm, respectively, in translation group. Posterior movement of soft tissue point A and soft tissue point B were 0.61 mm and 1.25 mm, respectively, in tipping group, and 1.10 mm and 3.25 mm, respectively, in translation group, and both showed significant differences.

Conclusion : The more incisor root apex is retracted, the more posterior movement of A point and B point occurs, and eventually leads to the more posterior movement of the soft tissue point A and B. And this nature appears to be more distinct in case of lower incisor and lower lip.

P-18

Non-surgical treatment of an adult with a skeletal class III malocclusion combined with a functional anterior shift, severely overclosed vertical dimension, and a reverse smile

Minji Kang[1], Soonshin Hwang[1], Kyung-Ho Kim[1], Tung Nguyen[2], Chooryung J. Chung[1]

[1]Department of Orthodontics, Gangnam Severance Dental Hospital, The Institute of Craniofacial Deformity, College of Dentistry, Yonsei University
[2]Department of Orthodontics, University of North Carolina

Introduction : Orthodontic camouflage treatment of class III malocclusion often includes proclination of the maxillary incisors and retroclination of the mandibular incisors. These dental changes can improve the overall occlusion yet worsen the profile by increasing apparent chin projection and negatively affecting smile esthetics. In order to improve the facial convexity and chin prominence as well as occlusal relationship in adult class III hypodivergent patients, active clockwise rotation of the mandible can improve the profile, occlusion as well as smile esthetics by reducing the lower incisors display.

Case Summary : An adult female presented skeletal Class III malocclusion exacerbated by a functional anterior shift that resulted in a severe overclosure of the mandible and a reverse smile. To maximize the soft tissue and smile esthetics while idealizing the occlusion, active clockwise rotation of the mandible was induced along with mandibular molar uprighting and sequential leveling. In the maxilla, full arch distalization was achieved following second molar extraction. The treatment provided a satisfying esthetic and functional outcome and has remained stable.

Conclusion : Non-surgical camouflage treatment of an adult with a skeletal Class III overclosure combined with functional anterior shift and reverse smile was successfully treated by clockwise rotation of the mandible, along with sequential leveling and molar distalization.

P-19

Mapping of 3-dimensional centers of resistance of each dental arch segment

Ji Yoon Jeon[1], Hyeon Gi Hong[1], Moon-Bee Oh[1], Bo Woo Jeong[1], A-Ra Jo[2], Gwang-Mo Jeong[2], Sung-Seo Mo[2], Kee-Joon Lee[1]

[1]Department of Orthodontics, The Institute of Craniofacial Deformity, College of Dentistry, Yonsei University
[2]Department of Orthodontics, Seoul St. Mary`s Hospital, The Catholic University of Korea

Objectives : Tooth movement with orthodontic appliances stands on biomechanics even in simple cases. As complicated tooth movement became feasible with development of skeletal anchorage, anticipating wanted segments precise movement is a must. In this respect, understanding 3-dimensional (3D) centers of resistance of each maxillary, mandibular anterior and posterior segment with finite element model analysis should be done before its application in clinical trials.

Material and Methods : Through several collaborative research projects with The Catholic University of Korea, Seoul ST.Marys Hospital, 3D-finite-element models were constructed to simulate orthodontic movement and determine 3D centers of resistance of each segment.

Results : - Maxillary, Mandibular 4 incisors : around half of the lateral incisor root
- Maxillary, Mandibular 6 incisors : around half of the canine root
- Maxillary, Mandibular molars : around central groove & interradicular area of molars in furcation level
- Maxillary, Mandibular molars and 2nd premolars : around central groove & half of distal/distobuccal root of 1st molar in furcation level
- Maxillary, Mandibular molars and premolars : around central groove & distal surface of mesial/mesiobuccal root of 1st molar in furcation level
- Maxillary total dentition : around mesial half of the 2nd premolar
- Mandibular total dentition : around interradicular area of first molar and 2nd premolar

Conclusion : Treatment goal achievement in estimated time is a nonnegligible concern of an orthodontist. Optimal strategy with evidence-based approach and thorough understanding of biomechanics will prevent round tripping which can result in unfavorable outcomes with various side effects at worst.

P-20

A finite element analysis of a running loop using indirect skeletal anchorage

Mi-Jung Kim[1], Young-Jun Lee[2], Jong-Moon Chae[2], Na-Young Chang[2], Sun-Ock Yun[1]

[1]Department of Orthodontics, College of Dentistry, Wonkwang University
[2]Department of Orthodontics, Wonkwang University Daejeon Dental Hospital

Objectives : The aim of this study was to determine the amount of effective bending angles needed for the bodily movement of mandibular second molars and the mechanics when running loops are used to control mesial movement of mandibular second molars in combination with indirect skeletal anchorage.

Material and Methods : A three-dimensional finite element model was developed for predicting tooth movement, and a mechanical model based on the beam theory was constructed for clarifying the force systems.

Results : In the case of a running loop without bends, the second molar moved mesially 6.4 mm, tipped mesially 14.4T rotated mesiolingually 4.1Ơand tipped lingually 0.6Ţ These angles were about the same as those estimated by the beam theory. This movement caused a 2.9 mm extrusion in the buccal cusp and 1.2 mm in the lingual cusp. When increasing the tip back and toe-in angles to 11.0T almost bodily movement of the second molar was achieved. The second molar moved mesially 2.4 mm, tipped distally 0.2T rotated mesiolingually 0.1Ơand tipped buccally 1.2Ţ This movement caused 0.2 mm extrusions in the buccal cusp and 0.4 mm in the lingual cusp.

Conclusion : Mesial translation of a mandibular second molar without any significant movement of anterior teeth was achieved during protraction by controlling the tip back and toe-in angles and enhancing anterior anchorage with the combined use of a running loop and indirect skeletal anchorage.

P-21

Assessment of cortical bone microdamage following insertion of microimplants using optical coherence tomography (OCT)

Hemanth Tumkur Lakshmikantha, Hyo-Sang Park, Jaemin Kum

Department of Orthodontics, School of Dentistry, Kyungpook National University

Objectives : The aim of the study was to; 1) to present OCT images showing the microdamage occurrences around the microimplant, and 2) to compare OCT images with micro-CT images, in order to evaluate the efficacy of OCT for examining cortical bone microdamage.

Material and Methods : A total of 20 conical-shaped titanium self-drilling microimplants of the AbsoAnchor System (Dentos, Daegu, Korea) with identical design were selected for this study. In this study, a commercial spectral optical coherence tomography system (OCS1310V1; Thorlabs, Newton, NJ) producing cross-sectional (2D) and volumetric (3D) optical imaging was used. OCT images were taken to evaluate the cortical bone structure before insertion of the microimplant (2D and 3D), and after insertion of microimplant (2D and 3D). Intensity analysis is done for OCT images in the horizontal and vertical direction of the image. The three-dimensional microstructure of the bone sample was assessed by micro-computed tomography (Skyscan 1076, Skyscan, Kontich, Belgium). The acquired images were visually aligned with the OCT images to obtain a qualitative comparison.

Results : It is seen from the A-scan plots that the microcracks (sudden intensity drops) around the 45° angulated microimplants are higher in number than the 90° angulated microimplants. . Clear and distinct microcracks around the bone-implant interface are represented in the inset. In our study we found that, whilst the μCT system is adequate to image deeper lying structures, the OCT system offers more contrast and therefore more image detail of hard tissue at comparable nominal resolutions.

Conclusion : OCT represents an interesting alternate to micro-CT and other non-invasive imaging modalities used in detection of microdamage on the cortical bone following immediate placement of a microimplant. OCT can achieve the best resolution of all known non-invasive imaging methods and is non-destructive to tissues being studied, capable of producing images that can be processed and studied as a 3-dimensional model.

P-22

Management of Class II malocclusion with openbite and high canine

Marie Antoinette Caldoza

Centro Escolar University

Introduction : Class II malocclusion with open bite can be treated in many ways; camouflage by tooth movement, non extraction treatment with Class II elastics, retraction of the upper incisors into a premolar extraction space and distal movement of the upper teeth; intrusion of overerupted molar using orthodontic miniscrew implants. Proper oral hygiene maintenance and with the administration of adjunct antibiotic prophylaxis to prevent infective endocarditis was highly advised with this patient.

Summary : This is an ongoing case treated as an extraction case, primarily with TPA in conjunction with a high-pull headgear with multiloop edgewise archwire technique. Main objective is to achieve an acceptable overjet and overbite and bring the upper canines into Class I relationship. Patient was diagnosed with RHD and had restrictions.

Conclusions : Correction of class II malocclusion with anterior open bite with high upper canines was achieved with the retraction of the upper canines together with the anterior teeth on the premolar extracted spaces. The use of a TPA in conjunction of a high pull headgear is highly effective to achieve acceptable overjet and overbite. With patients diagnosed with RHD, proper oral hygiene maintenance and strict preventive measures on sterilization of all materials prior to placement in the oral cavity is highly advocated to prevent the development of endocarditis.

P-23

Effect of number of Micro-osteoperforation on rate of tooth movement and periodontal response in mice

Jung-Yul Cha[1,2], Tselmuun Erdenebat[1,2], Se-yeon Lee[1]

[1]Department of Orthodontics, The Institute of Craniofacial Deformity, College of Dentistry, Yonsei University
[2]BK PLUS project, Yonsei University College of dentistry

Objectives : Micro-osteoperforations (MOPs) using mini-implants may facilitate orthodontic tooth movement without raising flaps, reduce surgical risk, and increase patient acceptance. To evaluate the biological effects of number of micro-osteoperforations of applied force on the rate of tooth speed and the potential risk for root resorption in mice model.

Material and Methods : Thirty-six 8-weeks old male CD1 (wild type) mice were divided into 4 groups based on number of micro-osteoperforations, as follows: control (no tooth movement), orthodontic tooth movement (F) only, 2 micro-osteoperforation (2MOP), 4 micro-osteoperforations (4MOP). After the mice were anesthetized, 2 and 4 MOPs with No. 1/4 round bur were operated from mesial to distal of palatal root of the maxillary first molar. The force were delivered from the maxillary first molar to the maxillary incisors using 25-g nickel-titanium springs.Tooth movement occurred for 14 days. Tooth movement was measured, using Hyperscope. Micro-CT was performed to evaluate alveolar bone density (BMD), bone volume fraction (BVF) and tissue density (TD), and root resorption. Histomorphometry, including tartrate-resistant acid phosphatase (TRAP) staining, was performed to quantify the number of osteoclast of the periodontal tissue in the region of the maxillary first molar on day 14.

Results : The distance of tooth movement in the 2MOP (0.36+0.08 mm) and 4MOP (0.39+0.12 mm) groups was showed 1.25-fold increase in tooth movement compared with the F group (0.31+0.03 mm). According to the Micro-CT volumetric analysis, the 2MOP and 4MOP groups (4.3% and 3%) showed statistically significant decrease in bone volume fraction (BV/TV) compared with the F group (12.6%) .Regarding the changes in BMD, we determined not significant between both experimental groups compared with the F group.

Conclusion : The data suggested that the alveolar decortication enhances the rate of tooth movement but not affected by decortication number. There were no significant differences in micro-computed tomography bone parameters, related to the number of decortication.

P-24

Prediction of skeletal response to miniscrew-assisted rapid palatal expansion: Bone density and morphology of maxilla

Jae-Hong Choi, Myung-Su Kim, Yoon-Ji Kim, Eon-Hwa Lee

Department of Orthodontics, Korea University Anam Hospital

Objectives : The aim of this study was to evaluate the bone mineral density and morphology of maxilla using cone-beam computed tomography (CBCT) in order to figure out whether they can be a potential predictors of the skeletal response to miniscrew-assisted rapid palatal expansion (MARPE).

Material and Methods : 45 patients (26 males, 19 females; ages, 22.9 7.8 years) who had been treated with MARPE were selected. CBCT exams were taken before and after MARPE. The bone mineral density ratio of midpalatal suture and inferior-most area of zygomatic buttress, palatal thickness, curvature of zygomatic process of maxilla (ZM angle), the stage of midpalatal suture maturation, chronologic age, and sex were evaluated before treatment. To assess the palatal expansion after MARPE, distances between left and right side of ANS and PNS points were measured, respectively.

Results : Compared to male patients, female patients showed significantly higher ZM angle ($P < 0.01$), while showing borderline-significance of large proportion of stage C among stages C, D, and E ($P = 0.07$). The anterior expansion ratio, measured from ANS points, were significantly correlated to midpalatal suture density ratio and the ZM angle (both $P < 0.01$). The posterior expansion ratio, measured from PNS points, showed statistic significance with age, the stage of midpalatal suture maturation, and the ZM angle (all $P < 0.01$). The bone density ratio of zygomatic buttress and palatal thickness showed non-significance on neither of anterior or posterior expansion ratio.

Conclusion : Assessing the bone mineral density and morphology of maxilla using CBCT is thought to be helpful for predicting the skeletal response of MARPE and deciding the needs of surgical intervention.

P-25

The relationship between estrogen receptor 1 gene polymorphism and mandibular prognathism in Asian

Tae-Hee Lee[1], Ye-Seul Lee[2], Jong-Won Kang[3], Won-Jong Roh[4], Ki-Ho Park[2], Young-Guk Park[2]

[1]BABA orthodontic clinic
[2]Department of Orthodontics, Kyung Hee University Dental Hospital
[3]Barune orthodontic clinic
[4]W style dental clinic

Objectives : Multiple genetic factors are involved in the development of mandibular prognathism. The purpose of this study was to investigate the correlation between ESR1 gene SNPs and mandibular prognathism in Korean.

Material and Methods : We studied 101 patients who showed mandibular prognathism and 86 controls who had a normal mandibular sagittal relationship.
Epithelial cells were collected from the buccal mucosa. Then, genomic DNA was extracted and sequenced. When selecting ESR1 SNPs to be analyzed, coding SNPs within the range of genetic data were selected and heterozygosity and minor allele frequency greater than 0.05 were selected in the East Asian group. As a result, rs2228480, rs1801132, rs6557170 and rs7754762 were selected.
To investigate the association between mandibular prognathism and rs2228480, rs1801132, rs6557170 and rs7754762, we performed statistical analysis on gene and genotype models. The skeletal differences were analyzed according to the genotypes in each SNPs.

Results : In the analysis of allele frequency, rs2228480, rs1801132, rs6557170 and rs7754762 were not significantly associated with MP.
Through genetic inheritance model analysis, significant relationship of genotype distributions between rs2228480, rs1801132 and rs7754762 in ESR1 and MP was not found. However, in recessive model of rs6557170, there was a significant difference.
Genotype AA of rs2228480 had significantly greater SNB compared to genotype GG and GA. In the male subgroup, genotype AA of rs2228480 had significantly greater SNB, effective mandibular length and ramal height compared to genotype GG and GA. In rs7754762, there were no significant different cephalometric variables according to genotype of total subjects. However, similar with rs2228480, in the male subgroup, subjects with genotype AA have a greater ramal height compared to those with genotype GG and GA.

Conclusion : ESR1 SNPs appeared to have correlation with mandibular prognathism. Furthermore, especially in certain genotypes, there are differences in the skeletal patterns between males and females reflecting gender specific effects of estrogen hormone.

P-26

Assessment of mineral density in the posterior part of alveolar bone by ages

Kyoungsun Lim[1], Yoonji Kim[2,1]

[1]Department of Orthodontics, Graduate School of Clinical Dental Science, The Catholic University of Korea
[2]Department of Orthodontics, Seoul St. Mary`s Hospital, The Catholic University of Korea

Objectives : The aim of this study was evaluate bone mineral density in the posterior part of alveolar bone in male orthodontic patients with two different ages, by comparing Hounsfield Unit (HU) value with cone-beam computed tomography (CBCT) images.

Material and Methods : A total of thirty nine patients including twenty male patients aged in their 20s (Group 1) and nineteen male patients aged over age 40s (Group 2) were selected from patients who visited the Department of Orthodontic at Seoul St. Marys Hospital, the Catholic University of Korea (Seoul, Korea). CBCT scanning was done before orthodontic treatment. Measurement of HU was performed at the maxillary and mandibular first molars, incisal edges of central incisors, and other non-tooth bearing region. Bone densities of buccal cortical bone, interradicular cancellous bone, lingual or palatal cortical bone were measured at each selected tooth.

Results : There was no statistically significant differences between Group 1 and Group 2, except that Group 2 had significantly lower HU values only in the incisal edges of the lower incisors and the palatal cortical bones of the maxillary first molar. In addition, the density of buccal cortical bone in maxillary molar was significantly higher than that of palatal cortical bone in both Group 1 and Group 2. The mandible showed the same tendency. There was no statistically significant difference between the cancellous bones of the maxillary and mandibular posterior teeth.

Conclusion : The bone mineral density of posterior alveolar cortical bone did not showed significant difference between the two age groups, except for the maxillary palatal cortical bone and lower incisal edges.

P-27

Dynamics of alveolar bone healing after the removal of orthodontic temporary anchorage devices

Jong Hoon Han[1], Young Don Ha[1], Sujin Kim[2], Won Lee[2], Tung Nguyen[3], Chooryung Chung[2]

[1]Private practice
[2]Department of Orthodontics, Gangnam Severance Dental Hospital, The Institute of Craniofacial Deformity, College of Dentistry, Yonsei University
[3]Department of Orthodontics, University of North Carolina at Chapel Hill School of Dentistry

Objectives : The aim of this study was to investigate the dynamics of alveolar bone formation and healing pattern after the removal of orthodontic temporary anchorage devices (TADs).

Material and Methods : Miniscrews (N=32) were inserted into the buccal inter-radicular alveolar bone in beagle dogs. Afterwards, miniscrews were removed at different time points during a 13-week period and six different in vivo fluorescent markers were injected at 1, 2, 6, 8, 10, and 12 weeks. Serial changes in bone apposition at the removal and intact control sites were evaluated using 샔, histology and bone histomorphometry.

Results : Gradual bone apposition at the TAD removal site was noted with bone volume/tissue volume (BV/TV) reaching the level of the control alveolar bone by 7 weeks. Histologically, newly formed woven bone was detected within the removal site which was distinct from the surrounding pre-existing alveolar bone at 13 weeks. Accelerated mineral apposition rate (MAR) and bone formation rate (BFR) were noted between 2-6 weeks in the removal site ($p<0.05$). Although MAR and BFR gradually decreased after its peak at 2-4 weeks, BFR in the removal site was still higher than the control site at 10-12 weeks ($p<0.05$).

Conclusion : Spontaneous bone healing was noted after TAD removal with regional acceleration of MAR and BFR within 2-6 weeks. However, the removal site was mainly filled with woven bone even after 13 weeks, suggesting a longer healing period is required for the quality of the alveolar bone to reach levels comparable to the surrounding alveolar bone.

P-28

Comparison of Age-related bone density before orthodontic treatment in anterior part of alveolar bone

Pilwoo Jeong[1,2], Yoonji Kim[3,2]

[1]Seoul the better dental clinic
[2]Graduate School of Clinical Dental Science of the Catholic University, Department of orthodontics
[3]Department of Orthodontics, Seoul St. Mary`s Hospital, The Catholic University of Korea

Objectives : The objective of this study was to measure and compare anterior part of alveolar bone at different ages in male. Bone mineral density is measured as Hounsfield Unit (HU) value through cone beam computed tomography (CBCT).

Material and Methods : For this study, total 39 patients including 20 male patients aged 20s, and 19 male patients over 40 years of age were selected. All patients came to St. Mary's hotpital for orthodontic treatment. CBCT scanning was done before orthodontic treatment. Measurements of HU were done at anterior part of alveolar bone including A point, Gnathion, upper incisal edge and lower incisal edge.

Results : There was no significant difference in bone mineral density (BMD) between young and old group except for buccal cortical bone of the upper right lateral incisor and trabecular bone between upper right lateral incisor and upper right canine. Within each group, HU value of lingual (palatal) cortical bone was significantly higher than that of buccal bone.

Conclusion : This study shows that there is not a statistically significant difference in the HU value of upper and lower anterior alveolar bone in male according to age. In the upper and lower anterior alveolar bone, the lingual cortical bone density was higher than the buccal bone density.

P-29

Assessment of mineral density changes in the alveolar bone before and after orthodontic treatment

Donghwan Jo[1,3], Yoonji Kim[2,3]

[1]Mokdong Plant Dental Clinic
[2]Department of Orthodontics, Seoul St. Mary`s Hospital, The Catholic University of Korea
[3]Department of Orthodontics, Graduate School of Clinical Dental Science, The Catholic University of Korea

Objectives : The purpose of this study was to compare the bone mineral density of the cortical bone and cancellous part of the alveolar bone before and after orthodontic treatment in adult male patients.

Material and Methods : Twenty male patients (mean age 21.9 years) who were treated at the Department of Orthodontics, The Seoul St. Marys Hospitals were selected to compare bone mineral density before and after treatment. These samples were healthy without any medical history, and there was no missing tooth or craniofacial deformities. Bone mineral density was evaluated by measuring Hounsfield Unit (HU) with cone-beam computed tomography (CBCT). The buccal cortical bone, trabecular bone, and lingual cortical bones around the maxillary right central, lateral incisors, maxillary first molars, and mandibular first molars were measured. The non-tooth bearing bones such as at the A point, Gnathion were also measured.

Results : The HU before and after orthodontic treatment did not show statistically significant differences at all measured areas. Hounsfield Unit showed similar bone density changes in the upper and lower alveolar bone before and after treatment.

Conclusion : This study demonstrated that there was no statistically significant changes in the bone density after orthodontic treatment. Orthodontic treatment did not result in the changes of bone density both in the tooth-bearing alveolar bones and non-tooth bearing bones.

P-30

Alveolar bone changes after mandibular second molar protraction into mandibular first molar space

Kyungjae Han[1], Jaeyool Jung[2], Yaejin Kim[1], Dongyul Lee[1]

[1]Department of Orthodontics, Korea University Guro Hospital
[2]Graduate School of Dentistry, Korea University

Objectives : To observe the alveolar bone changes of mandibular second and third molars after mandibular second molar protraction to close the space caused by missing mandibular first molar (L6) or mandibular second premolar with a retained deciduous molar (LE).

Material and Methods : 24 patients whose missing space of L6 or LE was treated with second molar protraction were included. Patients underwent CBCT at pretreatment (T1) and after second molar protraction (T2). They were classified with the group 1(normal or resorption in distal bone of second molar) and group 2(bone formation). Factors associated with alveolar bone change were assessed using Firth's logistic and linear regression analyses.

Results : Compared in the alveolar bone level of the two groups at T1 and T2, significant differences were observed in the bone changes of 7L, 7DB and 7DL at T1 between 2 groups. The amount of protraction and angulation changes of the second molars were not significantly different between the two groups. Impaction of the third molar at T1 was a significant factor for bone formation distal to the second molar. ML, DL alveolar bone of second molar at T1, and age are significant factors for prediction of alveolar bone level distal of second molar measured at T2.

Conclusion : The alveolar bone is likely to be formed in the distal second molar when the third molar is impacted after treatment. When the patient is older and the lingual alveolar bone level was low at pretreatment, the distal alveolar bone level of the second molar was low after treatment.

P-31

Bone density changes following 2-jaw surgery using computed tomography: A pilot study

Young-Joo Lee[1], Jong-Moon Chae[1], Na-Young Chang[1], Mi-Young Lee[2], Ye-Ji Seo[1]

[1]Department of Orthodontics, Wonkwang University Daejeon Dental Hospital
[2]Departments of Orthodontics, Seoul National University Gwanak Dental Hospital, Seoul, Korea

Objectives : The aim of this study was to evaluate the pre- and postsurgical bone densities in alveolar and extra-alveolar sites following 2-jaw orthognathic surgery.

Material and Methods : The sample consisted of 10 patients (mean age, 23.2 years; range, 18.0-27.8 years; 8 males, 2 females) who underwent 2-jaw orthognathic surgery. A three-dimensional imaging program (Invivo 5) was used on multidetector computed tomography (MDCT) images taken pre- and postoperatively (which were obtained 32.3 6.0 days before surgery, and 5.8 2.6 days after surgery, respectively), for the measurement of bone densities in the following sites: (i) alveolar bone in the maxilla and mandible, and (ii) extra-alveolar sites such as top of head, menton (Me), condyle and third cervical vertebrae (C3).

Results : When pre- and postsurgical bone densities were compared, there was an overall tendency of bone density decrease. There was a statistically significant ($P < 0.05$) decrease in bone densities: in cancellous bone in several areas of the maxillary alveolar bone; cortical and cancellous bone in most areas of the mandibular alveolar bone; cortical bone in Me; cancellous bone density in C3. There was no statistically significant difference of bone density with regard to depths of the alveolar bone. In a comparison of the bone densities between groups with and without genioplasty, there was almost no statistically significant difference.

Conclusion : The results of this study confirmed the reduction of bone density following orthognathic surgery which might imply the accelerated tooth movement. In addition, this study offered insights into bone metabolism change following orthognathic surgery, providing direction for further investigations in this field.

P-32

Bone regeneration in a canine artificial jaw cleft model using bone marrow-derived mesenchymal stem cells

Takaharu Abe[1], Ryo Kunimatsu[1], Yoshimi Yuki[1], Yuji Tsuka[1], Awada Tetsuya[2], Keisuke Sumi[3], Kotaro Tanimoto[2]

[1]Department of Orthodontics and Craniofacial Developmental Biology, Hiroshima University Graduate School of Biomedical and Health Sciences
[2]Department of Orthodontics, Division of Oral Health and Development, Hiroshima University Hospital
[3]Hayami Orthodontic Office

Purpose : Cleft lip and palate (CLP) is a common anomaly of the orofacial region. Mesenchymal stem cell (MSC) transplantation has been a focus of regenerative medicine and its application to the repair of bone defects in CLP patients is highly anticipated. This study investigated the potential for using MSCs to regenerate bone in a jaw cleft as well as the survival of transplanted MSCs using a canine model of CLP.

Materials and methods : MSCs collected from the bone marrow of beagle dogs were transplanted along with carbonate hydroxyapatite (CAP) into jaw clefts that were made in the same beagle dogs. The bone regeneration was evaluated radiographically and histologically at 1, 2 and 3 months. Moreover, MSCs labeled with fluorescent silica nanoparticles were also transplanted and histological analysis was performed 3 months later to evaluate MSC survival.

Results : In the radiographic evaluation, CAP granules were absorbed early and bone like opacity was observed on the experimental side in comparison with the control side.
HE staining of tissue from the implantation site showed that more mature new bone tissue was observed on the experimental side, but residual CAP and fibrotic bone formation were detected on the control side.
The fraction of fluorescently labeled MSCs relative to the number of transplanted cells was about 5.7%.

Conclusions : Transplanted MSCs promote bone regeneration, although their survival rate is low.

P-33

Protraction of the second molar and the impacted third molar into the missing molar space

Donghyun Hwang

Thebaruni orthodontic clinic

Introduction : In case of losing a molar, a dental implant is a general treatment option. However, if there is a third molar in the same quadrant area, protraction of the third molar is also an appropriate and alternative treatment option. This case report illustrated the successful treatment replacing the molar missing area by traction of the impacted third molar.

Case Summary : 25 years old female patient visited with a chief complain of crowding. The patient had an orthodontic treatment 10 years ago. As a result of the previous treatment relapsed, the patient had crowding and deepbite. In addition, the upper right first molar was extracted due to a severe dental caries. We decided to replace the molar missing area by protracting the upper right second molar and the impacted third molar instead of placing a dental implant. Orthodontic miniscrew was inserted into the distobuccal surface of the upper right second premolar. Indirect anchor was assembled by connecting the miniscrew and the the upper right canine with 017X025 stainless steel wire and composite resin. Using the indirect anchor, the second molar and the third molar were protracted without a reciprocal distal movement of the anterior teeth.
After 21 months of orthodontic treatment, Class I canine and molar relationships with proper overjet and overbite were achieved. The second and the third molar were successfully protracted without any complications in relatively short treatment time.

Conclusion : Our result of this clinical report suggests that protraction of a third molar is a proper and alternative treatment option of tooth missing. Indirect anchor is an appropriate tool for traction of molars.

P-34

Use of mini-Implants for orthodontic anchorage in a Class II div.2 deep overbite case

SUNG HO JANG, HYE IN KIM

YON-SEI GAJIRUN-E ORTHODONTIC DENTAL OFFICE

Introduction : Orthodontic skeletal anchorage system has been highly developed using mini-implants. Mini-implants provide maximal anchorage without patient cooperation and minimize the action-reaction reciprocal force mechanics in anchorage control. We present a case of skeletal class II div.2 deep overbite patient who have achieved good occlusion using mini-implants.

Case Summary : This case is a 21 year old male patient who has low angle skeletal Class II div.2 malocclusion. He had class II molar relationship, severe deep overbite, occlusal plane canting and scissor bite on both 1st premolars and 2nd molars. The upper incisors were at a 71.3 angle relative to SN plane, the lower incisors were at a 104.0 angle relative to mandibular plane and the overbite was 9.0mm. Because the upper and lower lips protruded -1.2 and -4.9mm relative to the E-line and there were just mild crowding on upper dentition, we planned non-extraction treatment with total distalization of upper arch and upper anterior segment intrusion using mini-implants.
The mini-implants were positioned root apex between U1 and U2 on the both side of maxilla and intrusive force was applied. After 3 years, Class I molar and canine relationships were obtained with normal overjet and overbite. Good occlusion and facial esthetics were achieved.

Conclusion : The remarkable intrusion of maxillary incisors was achieved and there was no significant root resorption and side effects. This represents that the mini-implant anchorage system is useful for excellent improvement of a dental deep overbite.

P-35

The skeletal and dental changes after MARPE in young adult with class III malocclusion

Woon-Seok Jang[1], Hojin Kim[1], Sang-Min Kim[1], Jong-Kyoon Yoon[1], Hee-Moon Kyoung[2]

[1]Design orthodontic clinic
[2]Department of Orthodontics, School of Dentistry, Kyungpook National University

Introduction : The patients with Class III malocclusion usually have a concave profile and a posterior crossbite, resulting from its deficient maxilla. The transverse problem in the adults have been necessary to be treated with surgical intervention. However, these days many studies have introduced about the MARPE and showed that these devices have greater skeletal effects and lesser dental side effects in adults. Additionally, a few studies showed that the maxilla was moved forward after the maxillary expansion in children, though it was controversial, it could be also helpful to improve the concave profile in Class III patients. The following is a case report on skeletal and dental changes after using MAPRE in Class III young adult.

Case Summary : A 21-year-old Korean female presented to us with the chief complaint, My posterior teeth are inclined outward. She had a class III malocclusion with concave profile and bilateral posterior crossbite. We planned the maxillary skeletal expansion with MARPE and distalization of whole lower dentition using microimplant. After treatment, the skeletal and dental transverse widths were increased by the skeletal effect of MARPE. In the antero-posterior dimension, the values of SNA and ANB were increased because the maxilla was moved forward. As a result, the concave profile was slightly improved and the amount of distalization in the lower dentition was actually decreased than the initial plan, thus the treatment period could be a little shortened.

Conclusion : The introduction of MARPE has provided for orthodontists and patients to correct the transverse deficiency of the maxilla in adults. And the MARPE allowed to get a sufficient amount of skeletal expansion without undesired side effects, such as tipping of teeth and alveolus, gingival recession, and alveolar bone dehiscence. It could also help to improve the concave profile due to the forward movement of the maxilla in this case.

P-36

Orthodontic treatment for patients with gummy smile using skeletal anchorage

Byoung gu Lim, Jong Ghee Kim, Young Mi Jeon

Department of Orthodontics, School of Dentistry, Chonbuk National University

Introduction : Patients who show excessive vertical development of the maxilla exhibit over exposure of gingiva and gummy smiles at rest. When choosing premolar extraction to resolve protrusion in a patient with vertical overgrowth of the maxilla, a carefully planned force mechanism is necessary, because, if not, gummy smile can be aggravated during the space closing process, and TAD can be an intuitive and efficient tool to utilize.

Case Summary : A 21-year-old female came in with chief complain of gummy smile and congenital missing of mandibular anterior dentition. She showed a skeletal Class II relationship, anterior crowding on maxillary dentition, and protruding upper lip caused by undergrowth of the mandible. She also exhibited large overjet and spacing on the mandibular anterior dentition due to congenital missing of both mandibular lateral incisors. Based on her problem list, extraction of maxillary first premolars and TAD were utilized in the treatment plan. Due to the concern on linguoversion of the maxillary anterior dentition during space closure, TAD was placed on the mesial side of both maxillary second premolars for bodily movement of the maxillary anterior dentition. After orthodontic treatment, her facial appearance was improved, and proper occlusion was achieved.

Conclusion : Excessive gingival exposures and maxillary protrusion are esthetically less acceptable and often require orthodontic treatment. There have been many reports on effective treatment of maxillary protrusion and gummy smile with extraction and TAD. This force mechanism implies large movement of anterior teeth. Therefore much attention is needed on the inclination, root resorption of the anterior teeth and their roots coming in contact with cortical bone.

P-37

Camouflage treatment for an adolescent patient with skeletal Class III

Jin Jeon, Jong Ghee Kim, Young-Mi Jeon

Department of Orthodontics, School of Dentistry, Chonbuk National University

Introduction : In skeletal Class III, orthognathic surgery may be the best option for improving facial aesthetics and correcting skeletal and dental discrepancies. But some skeletal Class III patients can be successfully treated with non-surgical camouflage treatment. Many authors like Kerr, Stellzig-Eisenhauer and Schuster suggested criteria for successful skeletal Class III camouflage treatment. This case report presents the camouflage orthodontic treatment of an adolescent patient with skeletal Class III malocclusion and compared with these criteria.

Case Summary : A 12 year-old female patient came in with a chief complaint of anterior crossbite. She had a concave profile with protruded lower lip and chin. She showed skeletal Class III, Angles Class I molar relationship, anterior & posterior crossbite on left side and crowding on both dentition. Her right upper lateral incisor, both upper second premolar were congenitally missing and upper & lower incisors were relatively lingually inclined. Maxillary expansion was performed using skeletal RPE with posterior bite block. Space was regained for dental implantation on missing upper right lateral incisor. Both lower first premolars were extracted, and spaces were closed with T-loop. Class III elastics were used and upper molars were intentionally extruded and it caused clockwise rotation of the mandible which significantly improved her profile. Total treatment period was 25 months. To maintain the regained space for upper right lateral incisor until completion of growth, a removable retainer was delivered.

Conclusion : In adolescent patient, skeletal Class III malocclusions can treated by orthognathic surgery or orthodontic camouflage. However it is difficult to determine whether a skeletal Class III patients need surgical approach or camouflage treatment. Many author suggest criteria that can help to decide a treatment plan but are not absolute standard. With a careful evaluation and accurate diagnosis, functionally and esthetically satisfying results can be achieved from camouflage treatment.

P-38

Orthodontic treatment with extraction for a middle-aged patient with lip protrusion

Cheol Soo Park, Young Mi Jeon, Jong Ghee Kim

Department of Orthodontics, School of Dentistry, Chonbuk National University

Introduction : Recently, more and more elderly patients visit orthodontic clinics and they generally have strong internal motivations to be treated. Therefore they have good consent and cooperation for treatment. However, thorough consideration is needed on systemic diseases and drug history. In addition, the presence of periodontal disease and TMD requires constant management and may be limited in use of some mechanics such as elastics.

Case Summary : A 54-year-old female patient visited our department with the chief complaint of protrusion of upper anterior teeth. She had generalized chronic periodontitis and missing of #44 by trauma. She had history of hysterectomy and thyroidectomy, and is currently on hormone therapy. She underwent a plastic surgery of nose three years ago for aesthetic purposes. It was evident that she was strongly motivated to improve her profile through orthodontic treatment.
She was diagnosed with Skeletal Class and Angle's Class molar relationship. Class camouflage treatment was performed to improve her profile with extraction of #14, 24 and 35. To prevent deep bite during space closure, mandibular anterior teeth was intruded using mini-screw. However, the mini-screw failed shortly after the installation, so compensation curve on upper dentition and a reverse curve of spee on lower dentition were given instead. As a result, upper anterior teeth were linguoverted, and lower anterior teeth were labioverted. Patient's chief complaint was resolved and the harmonious overjet and overbite were obtained.

Conclusion : Elderly patients have good understanding and cooperation in orthodontic treatment, but there are many factors to consider. Age of elderly patients is not a limiting factor for comprehensive orthodontic treatment with successful result, when accurate diagnosis, proper treatment planning and careful treatment are carried out. Orthodontists can actively improve quality of life of middle aged patients.

P-39

Orthodontic Treatment in a Patient with Congenital Missing of the Maxillary Lateral Incisor

Kihyun Kim, Jeongho Son

GGBARUNEE Dental Clinic

Introduction : Orthodontists often encounter patients with missing teeth. Since the maxillary lateral incisors are the third most common congenitally missing teeth after the wisdom teeth and the mandibular second premolars, replacement of these teeth raises several important treatment planning concerns. Therefore, it is beneficial to use an interdisciplinary treatment approach to obtain the most predictable outcome. There are multiple treatment options for the replacement of congenitally missing maxillary lateral incisors, including canine substitution, single-tooth implant, and tooth-supported restorations. In this case report, a young adult woman with congenitally missing maxillary lateral incisor was described. She had full-fixed orthodontic treatment with three second premolars extraction and the canine was substituted.

Case Summary : A 20-year-old female patient presented with chief complaints of congenital missing of the maxillary left lateral incisor. There was a moderate crowding of the mandibular anterior arch. Radiographically, the mandibular posterior space was not sufficient, and third molars were developing. Cephalometically, the patient had a normal skeletal pattern. Facial photographs showed a straight profile with full lips and the maxillary midline shifted to the left. Lip position and overall soft-tissue relationships were acceptable. Her oral hygiene was not good and multiple teeth caries were existed. She had full-fixed orthodontic treatment with three second premolars extraction. Temporary anchorage devices(TADs) were placed to correct the maxillary dental midline. Her maxillary left canine was substituted with restorative treatment and reshaping. The orthodontic treatment took approximately 28 months and a functional occlusion was established. The patient was satisfied with treatment outcomes.

Conclusion : For a patient with congenital missing of the maxillary incisor, canine substitution can be an excellent treatment option. However, through cooperative interdisciplinary treatment approach it was possible to achieve a good functional occlusion.

P-40

Orthodontic treatment of deep overbite in adult patient

Bum Jun Lee, Sung Jun Kim, Ji-Yeon Lee, Jung-Hoon Kim

Department of Orthodontics, National Health Insurance Service Ilsan Hospital

Introduction : There are two treatment methods for deep overbite patients. The first is intrusion of anterior teeth and the second is extrusion of posterior teeth.
For the former, we need to consider the vertical relationship between the upper lip and the maxillary incisors. If the exposure of the maxillary incisor is normal range, it is desirable to adjust the mandibular incisors by intruding. If the exposure of the maxillary incisors is excessive, intrusion of maxillary incisors will be needed.
For the latter, we should consider the anterior facial height. If facial height is short, extrusion of molars is preferable.

Case Summary : This case report is for a 43-year-old woman with skeletal class I and class I molar key. She has deep overbite, large overjet and hyperdivergent profile. When considering the stability after extrusion of molars, an anterior intrusion was considered as a treatment plan.
Because the upper incisor exposure was normal and the lower incisors extrusion caused deep curve of Spee, intrusion of mandibular incisor was planned. TADs were placed to induce the pure intrusion of the mandibular six anterior teeth. After segmented wire direct bonding on six anterior teeth, the light force was applied. The mandibular incisors were purely intruded. And then, all other teeth was bonded by fixed orthodontic brackets and treatment was finished as planned. Every visit we complied with supportive periodontal therapy. And anterior teeth were checked by periapical radiographs to prevent apical root resorption.

Conclusion : The evaluation of maxillary incisor exposure and anterior facial height is needed to establish treatment plan for deep overbite patients. In case of pure intrusion through the above method, management of periodontal tissue and root resorption is important. When appropriate treatment for deep bite correction is performed through accurate diagnosis, proper overbite, overjet and smile line can be obtained.

P-41

Treatment of functional class III with prefabricated functional appliance(Preortho)

DuckYoung Yoon[1], YoungGyu Lee[2], ChungSik Do[3], UHyeong Cho[4]

[1]Busan Ye dental clinic
[2]Ulsan BS orthodontics
[3]SmileLine dental Clinic
[4]The Goreun Orthodontics Clinic

Introduction : In planning treatment for patients with anterior crossbite, when they are with primary or early mixed dentition, It is important to differentiate skeletal problem (of deficient maxillary or excessive mandibular growth) from crossbite due only to displacement of teeth. To treat functional Cl III malocclusion, though we often uses facemask and Frankel appliance, We introduce to treat functional Cl III patients with prefabricated functional appliance(Preortho). This appliance is made in various sizes to fit the shape of the dental arch. This appliance should only be taken at night about 10 hours and should be accompanied by myofunctional therapy(muscle strength exercises).

Case Summary : We report the cases the treatment of anterior crossbite patients with primary or early mixed dentition using prefabricated functional Appliance(Preortho). The patients with anterior crossbite had some skeletal and dental problems, but it was difficult to distinguish and to predict how to grow, because they are too young. However they were close to functional Cl III and the treatment was decided. They took the prefabricated functional appliance(Preortho) for the night time nearly 8-12 hours. Patients were well adapted and the treatment was effective. They were trained with myofunctional therapy during treatment.

Conclusion : Prefabricated functional appliance with Myofunctional therapy was effective for functional Cl III patients with primary and early mixed dentition. However the growth of the mandible should be continuously observed.

P-42

Camouflage treatment of severe anterior openbite patient using miniscrews - sudden visit after 7 years!

Je Hyeok Park, Young-Mi Jeon, Jong Ghee Kim

Department of Orthodontics, School of Dentistry, Chonbuk National University

Introduction : Anterior openbite is caused by various factors such as skeletal, dental, functional, and habitual. Posterior intrusion with miniscrews is suitable treatment for skeletal Class II openbite patients by counterclockwise rotation of mandible. Wed like to report long-term follow-up patient who had severe anterior openbite and treated with posterior intrusion using miniscrews.

Case Summary : 20-year-old female patient came for treatment with chief complaint of open bite. She showed skeletal Class II, Class I molar relationship, severe openbite with reverse smile arc. Considering her past thumb sucking habit and normal vertical pattern, the patient was diagnosed dental openbite. Camouflage treatment with posterior intrusion was planned utilizing miniscrews. Posterior intrusion was done at the early leveling stage. Her overbite and overjet was considerably improved with counterclockwise rotation of mandible. Anterior vertical elastics were used for occlusal detailing. Long-term stability was concerned, so we decided to save posterior miniscrews preparing for the possible relapse. Patient was highly satisfied with her smile and occlusion, but she did not show off for a long time regardless of repeated recall contact. After 7 years, patient suddenly visited our clinic to remove her miniscrews. Surprisingly, her vertical overlap and occlusion, even her miniscrews was stable. Remained miniscrews were safely and easily removed.

Conclusion : Long-term stability of posterior intrusion treatment is commonly doubted. In this case, the patient showed stable occlusion for 7 years after treated with posterior intrusion using miniscrews. Taking account of her past thumb sucking habit, we can presume that balanced environment was achieved with her occlusion. With careful diagnosis of etiology and appropriate application of miniscrews, successful treatment of severe openbite can be achieved without surgery.

P-43

Strategic surgical planning of patient with multiple anterior missing teeth on maxilla

Je Hyeok Park, Young-Mi Jeon, Jong Ghee Kim

Department of Orthodontics, School of Dentistry, Chonbuk National University

Introduction : Making proper position of maxillary incisors is key to success of surgery combined orthodontics. The three most important lateral cephalometric interrelationships that must be considered are vertical position of maxillary incisors, A-P position of maxillary incisors, and angulation of occlusal plane. But if maxillary incisors are lost, establishing surgery plan would be a difficult job. In this case report, wed like to present surgery patient who lost all of her maxillary incisors due to accident.

Case Summary : 19-year-old female were referred to our clinic from prosthetic department, due to difficulty of prosthetics. The reason of difficulty was her prognathism of mandible. Her Class III molar relationship was not severe, but she lost all of her six incisors long time ago and alveolar loss of maxillary anterior area worsened her skeletal Class III pattern. Pre-surgical orthodontic treatment was conducted with four prosthetic space consolidation through careful modification of maxillary archform. By help of 3D prosthetic set-up, position of incisors was decided and 1-jaw surgery was planned. During surgery, implantation of incisors was performed simultaneously to shorten treatment time. Final prosthesis was done after 24 months of total treatment period, and patient was satisfied with her treatment outcome.

Conclusion : Alveolar bone loss after missing of anterior teeth happens upward and inward, which makes harmonious prosthesis with mandibular teeth difficult. Proclined prosthesis is not esthetic and functional. In this case, strategic pre-surgical orthodontic treatment allowed shorter time and less number of prosthetics. Utilizing mandibular set-back surgery and incisor positioning using 3D set-up could make a better environment for treatment outcome.

P-44

Longitudinal management of recurrent temporomandibular joint ankylosis in perspective of surgical and orthodontic treatment

Seung-Weon Lim[1], Jin-Young Choi[3], Seung-Hak Baek[2]

[1]Department of Orthodontics, School of Dentistry, Chonnam National University
[2]Department of Orthodontics, School of Dentistry, Seoul National University
[3]Department of Oral and Maxillofacial Surgery, School of Dentistry, Seoul National University

Introduction : The onset of temporomandibular joint (TMJ) ankylosis at early age can result in severe functional and esthetic problems, including limited mouth opening, mandibular retrusion, and facial asymmetry. To minimize these problems, TMJ ankylosis should be treated as soon as possible. Condylectomy, arthroplasty, mandibular distraction osteogenesis, and TMJ reconstruction have been used as treatment modalities for TMJ ankylosis. In order to understand the treatment flow for TMJ ankylosis, it is necessary to perform longitudinal follow-up for patients with recurrent ankylosis. Here we describe the longitudinal management of recurrent TMJ ankylosis from infancy to adulthood in perspective of surgical and orthodontic treatment.

Case Summary : A 2-year-old girl was referred with restricted mouth opening and micrognathia due to bilateral TMJ ankylosis. For stage I treatment during early childhood (6 years-old), high condylectomy and interpositional arthroplasty were performed. However, TMJ ankylosis recurred and symptoms of obstructive sleep apnea (OSA) developed. For stage II treatment during early adolescence (12 years-old), gap arthroplasty, coronoidectomy, bilateral mandibular distraction osteogenesis, and orthodontic treatment with extraction of the four premolars were performed. However, TMJ ankylosis recurred. Because the OSA symptoms reappeared, she began to use a continuous positive airway pressure device. For stage III treatment after completion of growth (20 years-old), low condylectomy, coronoidectomy, reconstruction of the bilateral TMJs with artificial prostheses along with counterclockwise rotational advancement of the mandible, genioglossus advancement, and orthodontic treatment were performed. After stage III treatment, the amount of mouth opening exhibited a significant increase. Mandibular advancement and ramus lengthening resulted in significant improvement in the facial profile, Class I relationships, and normal overbite/overjet. The OSA symptoms were also relieved. These outcomes were stable at the one-year follow-up visit.

Conclusion : The treatment flowchart suggested in this report could be used as an effective guideline for determining the appropriate timing and methods for the treatment of TMJ ankylosis.

P-45

Report of two cases of long-term treated Class III: surgery & non-surgical orthodontic treatment

EUNAH CHOI

Choi Eunah Orthodontic Clinic

Introduction : It is very challenging to make a treatment plan for young Class III patients. Most patients with developing Class III malocclusion display anterioposterior maxillary deficiency with a normal to slightly protruded mandible. Many clinicians successfully treat these patients with maxillary protraction and palatal expansion. But the long-term stability of phase 1 treatment for Class III patients is still unclear, and relapse can occur. The key factor is growth potential of the patients. In this presentation, I will show two cases treated surgically and non-surgically, each. And I will discuss the reason for each treatment modality.

Case Summary : Case 1
KR Park 8Y 1M/Female
Class III with total crossbite, upper severe crowding
Treated by Face mask, #14, 24 extraction & upper aligning, growth observation, and surgical orthodontic treatment
Case 2
YH Park 6Y 11M/Female
Class III with anterior crossbite
Treated by Face mask, growth observation, and non-extraction orthodontic treatment

Conclusion : In many cases, treatment of Class III patients takes a long time. This is because not only actual treatment period but also period of growth observation is needed. An important factor that determines the direction of the final treatment of surgery or non-surgical treatment will be the patient's growth pattern, but at each stage of growth, the orthodontist must constantly determine the direction of treatment to provide the patient with the best result. The ultimate goal is to provide patients with good occlusion and facial aesthetics.

P-46

Case report of the complicated bilateral maxillary canines impaction

Sohyun Park

Department of Orthodontics, Dankook University Jukjeon Dental Hospital

Introduction : With the exception of the third molars, impaction of the maxillary permanent canines is the most common form of tooth impaction. The incidence of maxillary canine impaction is in the range 0.27-2.4%, according to the race. There are many and varied reasons for impaction of the maxillary canines; local hard tissue obstruction, local pathology, departure from or disturbance of the normal development of the incisors, and hereditary or genetic factors. This case report shows the complicated bilateral maxillary canine impaction.

Case Summary : We report the case of a 12-year male patient who had a skeletal Class I malocclusion (Class II molar key on the right side), impaction of #13, 23, and prolonged retention of #53, 63. He had inverted impaction of #13 and horizontal impaction of #23. He had deficient eruption space for impacted #13, 23. The window opening and bonding attachment at the palatal surface of the impacted #13, 23 were performed. We attracted theses impacted teeth with TMA spring and TPA. After checking on and confirming the positional change of the impacted teeth, maxillary teeth were bonded with fixed orthodontic appliance (MBBS) and we start to regain the spaces for #13, 23. Gradually, the canines were correctly oriented and the crown was erupted. Then, fixed orthodontic brackets on the erupted #13, 23 were attached and arranged. Later, the labial fixed orthodontic treatment of mandibular arch was performed together for effective, esthetically-pleasing appearance, and stable occlusion. The total duration of treatment was 4 years and 9 months. They were well trained and arranged without the root dilacerations or root resorption, and did not accompany sequelae such as gingival recession.

Conclusion : The maxillary canine impaction has varied types of impaction. The complicated type of canine impaction can also be treated properly by accurate diagnosis and appropriate appliances, although it takes a little longer.

P-47

Orthodontic treatment for an adolescent with absent and damaged maxillary anterior teeth due to trauma

Jae Yoen Kang, Jong Ghee Kim, Young Mi Jeon

Department of Orthodontics, School of Dentistry, Chonbuk National University

Introduction : The maxillary central incisor is the most often affected tooth during trauma especially in young ages. Treatment options for the absent maxillary central incisor are replacing with a dental implant, bridge or premolar auto-transplantation, along with orthodontic space closure. However, prosthodontic treatment must be postponed until completion of growth which can be frustrating to both patients and clinicians. This case report examines a treatment method for orthodontists to engage shortly after the trauma to rehabilitate trauma-affected maxillary incisor in growing patients. Closing the space orthodontically with the movement of lateral incisors towards midline followed by prosthodontic modification can be a reasonable treatment option for the missing maxillary central incisor resulting esthetically and functionally satisfying outcome.

Case Summary : A 14 year-old male patient had avulsion of a maxillary left central and right lateral incisor and horizontal crown fracture of maxillary right central incisor from a car accident. Due to his remaining growth potential, dental implants and bridges were not a possible immediate treatment option. Wearing a partial removable appliance through his growth period for future prosthodontic works could have been esthetically acceptable. However it would have no functional benefit and result in alveolar bone loss through long waiting period. Therefore protraction of the lateral incisor and canine to replace the maxillary anterior teeth, followed by porcelain veneer were chosen as a treatment method.

Conclusion : Mesial movement of maxillary lateral incisor and canine followed by reshaping of the teeth through prosthodontic touch is a conservative treatment method to preserve an alveolar bone, therefore can be an effective treatment option especially in young patients. When replacing missing central incisors with lateral incisors orthodontists must inform patients on esthetical limitations of the treatment. Also the patients should have realistic expectations about the treatment results.

P-48

Long-term stability of miniscrew-assisted rapid palatal expansion(MARPE): a report of 15 years follow-up cases

Ung Ki Cho, Hyeon-Gi Hong, Ji Yoon Jeon, Kee-Joon Lee

Department of Orthodontics, The Institute of Craniofacial Deformity, College of Dentistry, Yonsei University

Introduction : Transverse maxillary deficiency is a common problem in orthodontics and is often accompanied by posterior crossbite or crowding. As a non-surgical treatment option, miniscrew-assisted rapid palatal expansion (MARPE) has been in use. However, reports on its long term stability has been scarce. This case report is about long-term (around 15 years) stability of MARPE in adult patients with transverse maxillary deficiency.

Case Summary : We report cases with MARPE in young adult patients with transverse maxillary deficiency. PA cephalogram records and dental casts were obtained at several time points. Through cast analysis and radiographic analysis, skeletal and dental changes were measured as minimal (less than 1mm) in each cases, indicating clinically acceptable long-term stability. Periodontal changes were also subclinical level.

Conclusion : Transverse maxillary deficiency is accompanied by posterior crossbite or crowidng. MARPE has been used to expand the maxillary arch and mid-palatal suture and correct transverse deficiency, posterior crossbite or crowidng. Non-surgical expansion using MARPE is a reliable treatment modality in adults and once proper transverse relationship is established, it remained stable for a long period of time. There is no evidence of posterior crossbite or edge-to-edge bite, respectively. These findings suggest that MARPE can be a clinically acceptable and stable treatment modality for maxillary constriction for long-term period.

P-49

Orthodontic treatment of skeletal class II openbite by rotating occlusal plane using Miniscerws

Donghyun Hwang

Thebaruni orthodontic clinic

Introduction : In case of treating openbite malocclusion with insufficient incisal showing, rotating of an upper arch is a proper treatment option to increase incisal showing. This case report illustrated the successful orthodontic treatment of skeletal class II openbite by rotating of the upper and lower occlusal planes using minscrews.

Case Summary : 24 years old female patient visited with a chief complain of anterior openbite. The patient had an anterior openbite and the patients incisal showing was insufficient. The cephalometric analysis showed a skeletal Class II relationship with a hyperdivergent facial pattern. To close the openbite with increasing the incisal showing, we rotated the upper occlusal plane clockwise by applying retraction force on the anterior teeth with miniscrews in the posterior areas. The lower occlusal plane rotated counterclockwise by intrusion of the molars and retraction of anteriors using miniscrews in the posterior areas.
After 20 months of orthodontic treatment, Class I canine and molar relationships with proper overjet and overbite were achieved. Incisal exposure while resting increased after rotation of upper occlusal plane. Mandible rotated counterclockwise by intrusion of lower molars.

Conclusion : Our result of this clinical report suggests that miniscrews facilitate correcting Openbite by rotating occlusal plane. In case of treating openbite malocclusion, incisal exposure should be considered. Intrusion of lower molars is an appropriate treatment option for closing openbite.

P-50

Midline correction through molar distalization using mini-screws and mini-plates

Ji-min Yoon[1], Jung Han[1], Ui-lyong Lee[2], Hye-won Kim[1], Won-cheul Choi[1]

[1]Department of Orthodontics,Dental Center,Chung-Ang University Hospital
[2]Department of Oral and Maxillofacial Surgery, Dental Center, Chung-Ang University Hospital

Introduction : The causes of dental midline deviation are asymmetry of jaw or arch, premature loss or extraction of teeth, crowding, and ectopic eruption. Traditional treatments to solve this problem include asymmetric tooth extraction, stripping, and the use of inter arch elastics. But, unilateral tooth extraction can lead to incorrect posterior relationship, arch disharmony, and tipping of the tooth. Also, the intraoral elastics may cause lack of stability and canting of the occlusal plane. In this study, we introduce two cases of improving the midline through the use of mini-screws and mini-plates, which is an effective alternative to minimize side effects.

Case Summary : Patient 1 presented with mandibular asymmetry to the right, and displacement of the midline to lateral
side. A mini-plate on the left mandible was used to correct the molar relationships and midline.

Patient 2 presented with crowding of upper left teeth, and well aligned midline. A mini-screw was used on the mid palatal area for upper left molar distalization by applying trans-palatal arch. The unilateral molar distalization was successfully achieved and midline was also maintained.

Conclusion : Mini-screws and mini-plates used unilaterally can improve midline and molar relationships. Adjusting the direction and size of force according to the position for screws can also help alter the cant of occlusal plane. A careful understanding of biomechanics is required for successful inter-arch coordination.

P-51

Non-extraction treatment of anterior openbite patients with transverse discrepancy

Jae-Hong Choi, Yoon-Ji Kim, Eon-Hwa Lee

Department of Orthodontics, Korea University Anam Hospital

Introduction : Anterior openbite results from the interaction of various factors such as skeletal or dentoalveolar factors, oral habits, temporomandibular disorder. Various treatment modalities including orthognathic surgery, extraction therapy, extrusion of anterior teeth, intrusion of posterior teeth can be considered according to their severity. This case report describes the non-extraction treatment of patients with anterior openbite and transverse discrepancy by maxillary skeletal expansion followed by vertical control of anterior and posterior teeth.

Case Summary : We report the cases of two adult patients with anterior openbite and different anteroposterior skeletal relationship. Maxillary skeletal expansion with MARPE was done in both patients to correct the transverse discrepancy. In the Class II openbite case, intrusion of upper molars with miniscrew and extrusion of upper and lower incisors was done. As a result of molar intrusion, counterclockwise rotation of mandible was achived. In the Class III openbite case, extrusion of upper and lower incisors and counterclockwise rotation of lower occlusal plane by distalization of lower arch with miniscrew was done. After treatment, we could establish proper occlusion and anterior teeth relationship.

Conclusion : Non-extraction treatment of anterior openbite patients with different skeletal relationship was performed to correct the patients' malocclusion and improve occlusal function. Improvement of oral habit and regular observation are required for stability after treatment.

P-52

Unilateral scissor bite correction using mini-implants with partial orthodontic treatment.

Yong-Ick Kwon, Seo-Rin Jeong, Sung-Hoon Lim

Department of Orthodontics, College of Dentistry, Chosun University

Introduction : A scissors bite in the posterior teeth occurs when the upper teeth are positioned totally buccal to the lower teeth in centric occlusion and it is observed most frequently in the upper and lower second molars. we report the case of a 25-year-old man who had a unilateral scissors bite on right second molars with effective and stable treatment results.

Case Summary : Two mini-implant placed in the maxillary palatal and mandibular posterior region were performed to treat his problem. the palate side lever pulled the upper right second molar in the direction of the disto-palatal side while applying intrusive force on it. in addition, the traction force was applied on the buccal side of the mandibular second molar using a mini-implant placed in disto-buccal side of it. the posterior bite raising effect was insufficient so the removable appliance was delivered for the effective treatment result. mini-tube appliances were used to help arranging the teeth with inserting nickel-titanium(NiTi) arch wires into mini-implant holes.

Conclusion : By using the mini-implant for direct orthodontic anchorage, it was possible to correct the patient's malocclusion with partial orthodontic treatment by improving the scissors bite of the second molar. when applying an mini-implant, it can eliminate the need to use teeth as anchors and also provide an anchorage point for a pushing or pulling force.

P-53

Multidisciplinary approach of upper anterior dentofacial esthetics combined with orthodontic treatment

Seung Hee Lee

DOGOKSTAR28 dental clinic

Introduction : The patients with transverse discrepancy of upper and lower dental arch showing severe upper anterior crowding and cross-bite, significantly lingual malpositioned or poor size and shaped lateralis, upper dental midline shift toward the unilateral congenitally missing lateral incisor or impacted canine, mutiple diastema and open bite have been corrected by multidisciplinary approach as orthodontic, priodontic and restorative treatment.
This case report presents the advanced upper anterior dentofacial esthetics in patients with anterior dental esthetic, structural, functional and biological problems through the interdisciplinary esthetic dentistry.

Case Summary : The adolescent patients and young adult males who were contraindicated osseous implant for restoration, having signs & symtoms of transverse arch discrepancy, crossbite, openbite,crowding, severe malpositioned lateral incisor or impacted canine, malformed or congenitally missing lateral incisor and mild facial asymmetry were orthodontically rehabilitated of functional occlusion and ideal anterior overjet and overbite using of rapid palatal expansion , dual arch alignment, orthodondic miniscrew accompanied with frenectomy/frenotomy, correcting of crown width-length ratio by gingival plastic surgery, provisional restoration during orthodontic tooth movement converting into final restoration.
The adult female having lip protrusion and chronic periodonntal disease, multiple anterior diastema and oversized , discolored teeth having been filled with interproximal resin several years ago, multiple cervical abfractions and cracks was proceeded periodontic healthy recover care prior to orthodontic all space closure and occlusal adjustment accompanied with esthetic tooth grinding anything but overall anterior interproximal restoration.

Conclusion : Multidisciplinary approach of upper anterior dentofacial esthetics combined with orthodontic treatment showed the satisfactory esthetic and functional advancement .

P-54

Treatment for the patient with functional anterior crossbite through changing occlusal plane

Kang Gyu Lee, Young-Mi Jeon, Jong Ghee Kim

Department of Orthodontics, School of Dentistry, Chonbuk National University

Introduction : Comparing with true Class III patients, the diagnosis of pseudo-Class III malocclusion patients needs to be more careful in verifying centric relation and centric occlusion discrepancy. Moreover, additional skeletal analysis is required to remove exaggerated mandibular protrusion by functional factor. Especially, for the pseudo-Class III malocclusion with anterior deep bite, it is essential to recover occlusal plane deformity and remove occlusal interference. This case report presents the treatment with removable appliance and skeletal anchorage for the patient who having pseudo-Class III malocclusion, anterior deep bite and occlusal plane deformity.

Case Summary : A 25-year-old male patient came with chief complaint of anterior crossbite. He had anterior cross and deep bite, Class III molar relationship with functional factor. In addition, severe curve of Spee on mandible and anterior teeth extrusion on both jaws with posterior open bite was examined in centric relation occlusion. As a treatment, removable inclined plane was fabricated for eliminating occlusal interference and making labioversion of maxillary anterior teeth. The occlusal plane deformity was flattened by extruding posterior teeth with interdental elastics. The molar relationship was corrected by mandibular full arch distalization using skeletal anchorage device.

Conclusion : It is important to distinguish between true and pseudo-Class III malocclusion because not negligible number of patients having chief complaint with anterior crossbite are diagnosed pseudo-Class III malocclusion with functional factor. For the accurate analysis of pseudo-Class III, cephalometric analysis should be done with centric relation and counter-clockwise rotation of mandible. The prior treatment goal for them is eliminating occlusal interference and recovering vertical deformity of occlusal plane while true Class III patient focusing on antero-posterior problem. Therefore, after accurate diagnosis and treatment plan are established with considering differences between true and pseudo-Class III patients, appropriate treatment and good results could be accomplished.

P-55

Orthodontic protraction of the third molars to the posterior teeth missing area

Kang Gyu Lee, Jong Ghee Kim, Young-Mi Jeon

Department of Orthodontics, School of Dentistry, Chonbuk National University

Introduction : The prolonged neglect of the posterior teeth missing area may cause mesial drift, extrusion, unexpected movement of the adjacent teeth and alveolar bone loss with occlusion collapse. Therefore it is recommended to treat the area by the prosthesis as soon as possible after tooth loss. However, if orthodontic treatment is used to move the remaining teeth, it can create more biomechanically advantageous dentoalveolar environment.

Case Summary : The first case is a 19-year-old female patient who lost the first molars on both sides of maxilla, the second molars on both sides of mandible and the first molar on the left of mandible by caries. The second patient is a 24-year-old male who suffered from missing of the first molars on both jaws, the second molar on the left of maxilla and the second molar on the right of mandible. Both patients closed the space with mesial movement of the impacted third molars. The area where both the first and second molar defected was reduced the space for one implant.

Conclusion : The two patients took 24 and 62 months of total treatment. Despite of similar treatment methods, the main reason for differences in treatment duration is thought to differences in mesio-distal angulation of the third molars being protracted. The first patient had distal angulated third molars on both side of mandible, while the second patient had mesial angulated third molars. The distal angulated teeth are moved in a way uprighting the tooth axis, but mesial angulated teeth are exacerbated mesial angulation.
The use of the third molars in teeth missing area provides an advantage in minimizing prosthesis. However, crown shape, location, soundness and possible of eruption failure should be considered. Nevertheless, it is the efficient treatment for closing the posterior space with protracting the distal angulated third molars within relatively short period.

P-56

Bracketless fixed orthodontic treatment with simple-tubes

Eun-Ji Kim, Seo-Rin Jeong, Sung-Hoon Lim

Department of Orthodontics, College of Dentistry, Chosun University

Introduction : A Simple-tube is a tube without a bonding base which is bonded to the teeth by covering it with flowable resin. This treatment method is preferred for patients with a hygienic and aesthetic advantage and it is effective for adults, especially middle-aged patients who have difficulty in attaching brackets due to non-esthetic and requiring a long-term treatment period. The purpose of this case report is to report the result of a more prospective treatment with widening the application range of orthodontic treatment using simple-tubes.

Case Summary : We report the case of a 36-year-old man who had both anterior teeth crowding with missing mandibular right first molar and mesially tilted mandibular right second molar, poor oral hygiene and gingival recession in both posterior teeth. There were extruded maxillary right molars because mandibular right first molar was missing for the caries treatment. Simple-tube appliances were performed to treat his dental problems, and dental implants helped restore his masticatory function. Pre-treatment and post-treatment of this patient demonstrate effective, esthetically-pleasing treatment results.

Conclusion : Braketless fixed orthodontic treatment with simple-tubes was performed to correct the patient's malocclusion and improve esthetics with minor tooth movement effectively. Clinician should have the ability to choose a suitable case that can be treated with the most effective treatment method.

P-57

Treatment of multiple impacted teeth: report of two cases

Inhee Chung[1], Geonwoo Kang[2], Seungho Jeong[2], Hwa Sung Chae[1], Jeong Won Shin[1], Young Ho Kim[1]

[1]Division of Orthodontics, Department of Dentistry, Ajou University Medical Center
[2]Department of Orthodontics, Graduate School of Clinical Dentistry, Ajou University

Introduction : Previous studies have reported the prevalence of an impacted tooth, excluding the third molar as 4~5%, and most of them had one impacted tooth. However, multiple teeth impaction has been reported to be a rare condition. Orthodontists should consider various factors if a decision for orthodontic treatment is made.

Case Summary : In this report, we presented two clinical cases with multiple impacted teeth. The first case is a 9-year-old girl with the upper right, upper left, and lower right canine impacted. The other 11-year-old girl showed both lower first molars impaction. Orthodontic treatment of forced eruption on all the impacted teeth is performed employing fixed appliances and skeletal anchorage devices. Successful treatment result is achieved including stable occlusion, esthetically pleasing facial profile as well as forced eruption of all the impacted teeth.

Conclusion : Forced eruption on multiple impacted teeth can be a clinical challenge. For successful treatment on the impacted tooth, clinicians should figure out the exact 3-dimensional location of the impacted tooth by taking CT. Once the treatment plan of orthodontic intervention is made, it is critical to decide when to start the treatment. Based on the CT data, setting the eruption path of the impacted tooth is a crucial factor that leads to a successful outcome.

P-58

Maximum profile change of a Class II deep bite patient through vertical control with microimplant

Kyung Ho Park[1], Yeo Hong Gok[1]

[1]Misogreeda orthodontic clinic
[2]Department of Orthodontics, School of Dentistry, Kyungpook National University

Introduction : most conventional camouflage treatment modalities for class II deep bite patients often result in limited improvement in profile esthetics. Orthognathic surgery could be a viable alternative to satisfy their esthetic needs, but nearly all patients tend to look for relatively inexpensive, nonsurgical option whenever possible. With the advent of microimplant, forward positioning of the chin point led by counterclockwise rotation of the mandible has become possible through absolute intrusion of the posterior teeth, which is considered the most difficult tooth movement in orthodontics.

Case Summary : A 22-year-old female presented with a skeletal class II malocclusion due to a retrognathic mandible. Intraoral photographs indicated that she had a severe deep bite, bilateral class II canine and molar relationship, and crowding. Extraction of the maxillary first premolars and mandibular second premolars was planned to resolve crowding and improve profile. Intrusion of the incisors in both arches were carried out to produce anterior openbite intentionally to make room for counterclockwise rotation of the mandible. Forward rotation of the mandible for profile improvement was achieved through intrusion of the molars in both arches following the creation of the anterior openbite. After 38 months of treatment, the profile esthetic was improved by increased chin prominence, and she was debonded in good Class I canine and molar relationship without any significant root resorption.

Conclusion : Facial profile of Class II deep bite patient could be improved by counterclockwise rotation of the mandible through intrusion of the entire dentition in both arches with microimplant.

P-59

Extraction of lateral incisor and canine substitution : case reports

KyungEun Kim, TaeYoung Ha, KilYoung Jung, MinJung Baek, JaeHa Park

Department of Orthodontics, Sun Dental Hospital

Introduction : Extraction of premolars is a common treatment option for anterior crowding. However, when lateral Incisor severely lingual in its position, the lateral incisor extraction can be considered. There are several factors that need to be considered in the treatment, which include the anterior aesthetics, functional occlusion, and treatment period. We are presenting 3 cases to discuss about planning of lateral incisor extraction treatment.

Case Summary : Case 1 : A 12-year-old female had a crossbite with lingual positioned upper lateral incisors(peg-lateral and dens invaginatus). We treated patient with extraction of bilateral upper lateral incisors and bilateral lower first premolars to achieve teeth alignment.
Case 2 : A 33-year-old female had a crossbite with lingual positioned upper lateral incisors. We treated patient with extraction of bilateral upper lateral incisors and bilateral lower first premolars. We planned to extract of the upper lateral incisors to reduce the black triangle and shorten treatment period. Total treatment period was 26 months.
Case 3 : A 11-year-old female with unilateral cleft palate had a history of cleft palate surgery. The patient presented upper left lateral incisor missing and anterior crossbite with lingual positioned right upper lateral incisor. We treated patient with extraction of upper right lateral incisor and bilateral lower first premolar to achieve teeth alignment and midline correction.

Conclusion : There are several factors should be considered in lateral incisor extraction case. Which are canine shape/color/size, functional occlusion, anterior Bolton ratio and midline. In selected cases, lateral incisor extraction provide advantages such as offering minimal black triangle and short treatment period. As a result, we were able to obtain aesthetically and functionally satisfactory results.

P-60

3 pubertal Class II cases which mandibular growth being expressed anteriorly using temporary anchorage device

Hyung Sik Yoon

Korea Level Anchorage System Society

Introduction : Orthodontic treatment of pubertal cases with protrusive maxilla and retrusive mandible is regarded as one of difficult treatments. It is because we not only need to make good occlusion but also need to induce mandibular growth in order to obtain good results. We achieved good results in terms of functional and esthetic aspects for pubertal cases with protrusive maxilla and retrusive mandible using TAD(temporary anchorage device).

Case Summary : We report 3 pubertal cases who had a skeletal Class II malocclusion, large overjet, a vertical maxillary excess, and severe Class II molar relationship. In order to improve facial profile and functional occlusal ability, maxillary 1st premolars and mandibular 2nd premolars were extracted. Two miniscrews were placed at the maxillary buccal alveolar bone and at mandible. We used .017.025 inch stainless steel(SS) wire as main arch wire. After treatment, all of the patients chief complaints were relieved and an esthetic facial profiles were obtained. A Class I molar relationship and normal overjet/overbite were achieved.

Conclusion : Ability of TAD to control dentition vertically and horizontally can make mandibular growth expressed anteriorly in the treatment of Class II pubertal cases. And it helps to achieve good results in terms of functional and esthetic aspects for pubertal cases with protrusive maxilla and retrusive mandible.

P-61

Non-surgical dental decompensation in skeletal Class III via root movement of lower incisors

Ung Ki Cho, Hyeon-Gi Hong, Ji Yoon Jeon, Kee-Joon Lee

Department of Orthodontics, The Institute of Craniofacial Deformity, College of Dentistry, Yonsei University

Introduction : Traditionally, Skeletal Class III patients have two different treatment options. One is mandibular setback surgery with orthodontic dental decompensation and the other is camouflage treatment which increases the dental compensation. However, severe lingual tipping of lower incisor and labial tipping of upper incisor may worsen facial profile and complicate the occlusal reconstruction. Recent advances in the orthodontic mechanotherapy includes precise anteroposterior control of incisors and molars with combined use of rectangular continuous archwire and interradicular miniscrew(s). Therefore, lingual translation or root movement of incisors with or without molar distalization may contribute to the formation of the adequate occlusion and may replace radical surgical intervention. Our recent clinical trials evidenced precise root movement of the lower incisors for decompensation in non-surgical treatment with improvement of facial profile in skeletal Class III cases.

Case Summary : We report cases with skeletal Class III malocclusion patients. In these cases, distalization of the posterior segment followed by root movement or bodily movement of lower incisors induce improvement of facial profile. Related to this, lower anterior alveolar bone remodeling was confirmed. This remodeling induces backward relocation of B point in cephalometric analysis. Accordingly, soft tissue B point was also relocated, leading to better defined mentolabial sulcus, contributing to acceptable chin profile.

Conclusion : Taken together, precise distalization and retraction of lower teeth, namely, dental decompensation for non-surgical treatment may be suggested as a new alternative modality for moderate skeletal discrepancies.

P-62

Vertical control of bimaxillary protrusion with gummy smile using an antero-posterior lingual retractor

Hobeen Yu[1], Jin-Young Cho[2], Young-Jun Lee[3], Su-Jung Kim[1], Hyo-Won Ahn[1]

[1]Department of Orthodontics, Kyung Hee University Dental Hospital
[2]ELine Miso Dental Clinic
[3]Rothwill Jun Dental Clinic

Introduction : The antero-posterior lingual retractor (APLR) can be an effective treatment option when large amount of retraction under good torque control is required and the vertical control of anterior and posterior teeth is critical. In this case, we present the application of an APLR for the treatment of protrusion and gummy smile with hyperdivergent vertical pattern.

Case Summary : A 21-year-old man who had bimaxillary protrusion and gummy smile with skeletal Class I malocclusion and hyperdivergent pattern came to the clinic. The treatment plan included the extraction of four first premolars and space closure with maximum anchorage on both arches. To correct gummy smile, upper incisors intrusion was required. The intrusion of upper molars was also considered to induce counterclockwise rotation of the mandible. The APLR system was chosen on the upper arch for good torque control of anteriors and vertical control of whole dentition. After the extraction of the first premolars, of an APLR was placed on the maxilla. The maxillary anterior teeth were retracted with elastomeric chains between the retraction hook of the APLR and a palatal TSAD. The retraction period for the maxillary anterior dentition using the APLR was 10 months. Simultaneously, the mandibular dentition was treated with conventional labial fixed appliances. After 24 months of treatment, Class I canine and molar relationship, balanced competent lips, an adequate gingival display was achieved. The superimposition between pretreatment and posttreatment showed a slight reclination of the maxillary incisiors (U1-FH, 123Ơto 117Σ during 4.0 mm intrusion and 6.0 mm retraction of the incisal edge. The maxillary molars were intruded up to 1.0 mm, which was followed by autorotation of the mandible (mandibular plane-FH, 34Ơto 32.5Σ.

Conclusion : The APLR system provided efficient retraction and intrusion of anterior teeth, good vertical control of molars which contributed favorable profile changes in a hyperdivergent gummy smile patient.

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Camouflage treatment of skeletal class II malocclusion using miniplates

Gayeong Park, Kyoungyun Seol, Seongwon Bae, Jungwoong Yang, In-dal Kim, Jeong-Sub Lee

Department of Orthodontics, Wonju Severance Christian Hospital, Yonsei University

Introduction : Total arch retraction stable temporary anchorage devices(TADs) has been reported as an effective treatment method in the case of non-extraction orthodontic treatment. This case shows skeletal class II malocclusion patient with missing of mandibular left first molar treated by total arch retraction using TADs which resulted in improvement of occlusion and facial profile.

Case Summary : The 24-year-old female complained of crowding. Facial analysis showed lip protrusion and incompetency. In panoramic radiograph mandibular left first molar was extracted. The cephalometric analysis showed skeletal class II malocclusion and hyperdivergent facial profile.
In this case, total retraction of maxillary dentition was performed using two miniplates placed on both maxillary infrazygomatic crests. After treatment, lip protrusion and incompetency was relieved and facial profile was improved.

Conclusion : In camouflage treatment of patients with skeletal Class II malocclusion with large overjet, successful treatment results can be obtained by a stable and predictable skeletal anchorage. As a temporary anchorage device, miniplate provides several advantages. It is more stable than other TADS and there is less risk of anatomical root damage without disturbing tooth movement during total arch retraction. In this case, total arch retraction using skeletal anchorage was successfully performed and provides patients with satisfaction of esthetic and functional results.

P-64

Interdisciplinary treatment of complicated openbite malocclusion with trauma-induced ankylosis of the maxillary central incisors

Woo Kang Yoon[1], Jong-Ki Huh[2], Sunjai Kim[3], Soonshin Hwang[4], Kyung-Ho Kim[4], Chooryung Chung[4]

[1]Private Practice, Paju, Korea
[2]Department of Oral and Maxillofacial Surgery, Gangnam Severance Dental Hospital, College of Dentistry, Yonsei University
[3]Department of Prosthodontics, Gangnam Severance Dental Hospital, College of Dentistry, Yonsei University
[4]Department of Orthodontics, Gangnam Severance Dental Hospital, The Institute of Craniofacial Deformity, College of Dentistry, Yonsei University

Introduction : Ankylosis of the central incisors due to childhood trauma may cause severe vertical discrepancies and associated esthetic issues. This report illustrates the successful interdisciplinary treatment including orthodontics, orthognathic surgery and prosthetics of an adult openbite malocclusion associated with trauma induced ankylosis of the maxillary central incisors and protrusion.

Case Summary : An 18-year-old male indicated severe anterior openbite with reverse smile line and lip protrusion. He experienced subluxation of the central incisors at the age of 7 and multiple orthodontic attempts to improve occlusion during his adolescence at a local clinic. Based on morphological and functional evaluation, both of the central incisors were confirmed as ankylosis. Conventionally, an ankylosed tooth with favorable prognosis can be segmented and repositioned to balance the well-aligned neighboring teeth. In this case 2 ankylosed teeth with two different vertical bone and gingival margins were involved. However, because the left central incisor root was anatomically nearly touching the nasal floor without bone support in the apical region, individual segmental reposition of each central incisor was at risks of insufficient blood supply. To overcome the issues, maxillary anterior segment from canine to canine was surgically repositioned to the pre-planned incisor position following anterior retraction of the mandible. Conservative prosthodontic reshaping of the ankylosed incisors further improved the micro-esthetics.

Conclusion : Precise treatment planning and interdisciplinary cooperation provided a satisfying esthetic outcome for an adult openbite malocclusion associated with trauma induced ankylosis of the maxillary central incisors.

P-65

Differential alveolar bone modeling following orthodontic retraction

Won Lee[1], Sooin Jung[1], Hosik Jang[1], Minji Kang[1], Tung Nguyen[2], Chooryung Chung[1]

[1]Department of Orthodontics, Gangnam Severance Dental Hospital, The Institute of Craniofacial Deformity, College of Dentistry, Yonsei University
[2]Department of Orthodontics, University of North Carolina at Chapel Hill School of Dentistry

Introduction : Distinct, irregular and hard nodular protuberances similar to the morphologic features of exostoses can occasionally be noted on the labial surface of the alveolar bone after orthodontic retraction of anterior teeth in adults. These have long been believed to be exostoses developed in response to loading. However, specific characterization of this phenomenon has not been documented.

Case Summary : Three cases displaying multiple irregular labial bony protuberances following retraction of anterior teeth are reported. These protuberances appeared during retraction and became more prominent with additional retraction. Based on serial clinical photos, lateral cephalograms, digital models, CBCTs along with 3-dimensional superimpositions, the irregular protuberances appear to be the result of differential alveolar bone modeling, with more resorption of bone covering the tooth root than that of interdental bone, and not of true bone overgrowth or deposition (i.e. exostoses).

Conclusion : Clinicians should note that these protuberances are a possible outcome when large amounts of bodily retraction and root movement of anterior teeth are planned. While this study demonstrates that these protuberances are the result of differential modeling, they may still be perceived by patients as outgrowths which may cause concerns related to esthetics or comfort. Patients who experience psychosocial problems with this phenomenon may be candidates for alveoloplasty.

P-66

Rescue therapy with orthodontic traction to manage impacted mandibular second molars and alveolar bone defect

Yoon Jeong Choi[1], Sujin Kim[2], Woochan Hwang[2], Soonshin Hwang[2], Chooryung Chung[2], Kyung-Ho Kim[2]

[1]Department of Orthodontics, The Institute of Craniofacial Deformity, College of Dentistry, Yonsei University
[2]Department of Orthodontics, Gangnam Severance Dental Hospital, The Institute of Craniofacial Deformity, College of Dentistry, Yonsei University

Introduction : We report an adult with vertically impacted mandibular second molars accompanied by severe apical root resorption of the first molars. Our aims were to describe and discuss the treatment and the 3.5 years of successful retention in which the vertically impacted second molars were orthodontically moved into their appropriate positions without additional apical root resorption of the first molars.

Case Summary : A 19-year-old man presented with impaction of the mandibular second molars vertically impacted beneath the distal roots of the first molars, which showed severe apical resorption of distal root and slight extrusion. Two orthodontic mini-implants were placed in the retromolar areas on each side. when the impacted second molars were surgically exposed, we connected them to mini-implants with nickel-titanium coil springs. After 23 months of traction, the second molars were positioned distal to the first molars, and locking was resolved. The impacted second molars were fully erupted and brought into occlusion and there was no additional apical root resorption of the mandibular first molar. After 3.5 years of retention, the treatment results were maintained. However, the left second molar showed deficient buccal and distal alveolar bones. No further apical root resorption occurred on the first molars, and their vitality and mobility were maintained throughout the retention period.

Conclusion : Orthodontic traction of impacted second molars can stop apical root resorption of the adjacent first molars and contribute to improving the alveolar bone level of the impacted teeth and the adjacent teeth by building up the osteoperiodontal tissues distal to the first molars. In addition, functional occlusion can be achieved by bringing the impacted teeth into occlusion. However, early diagnosis of the impaction could prevent the pathologic changes and would shorten the treatment duration by making the treatment simpler.

P-67

15-year retention after a lower incisor extraction and keeping the maxillary canine–premolar transposition

Soonshin Hwang, Hosik Jang, Minji Kang, Woochan Hwang, Chooryung Chung, Kyung-Ho Kim

Department of Orthodontics, Gangnam Severance Dental Hospital, The Institute of Craniofacial Deformity, College of Dentistry, Yonsei University

Introduction : This report demonstrates the successful treatment of a Class I patient with moderate crowding in the lower arch, transposition of an upper right canine–first premolar, and peg-shaped upper lateral incisors who was treated by extracting a lower incisor and keeping the transposed positions. Treatment results were well maintained up to the 2-year retention period, but upon a 15-year follow-up visit, the retainers had been removed, lower anterior crowding had reoccurred, and the transposed upper canine showed detrimental effects from occlusal interference.

Case Summary : A 12-year, 6-month–old boy presented with skeletal Class I malocclusion, upper right canine located buccally between the first and second premolars with insufficient keratinized tissue, peg-shaped upper lateral incisors, lower anterior crowding, and severe rotation of the lower right first premolar. A removable appliance with an anteroposterior screw was used to regain space for the upper right canine and premolar and elastics were used to move the upper right premolar to the canine position. A lower incisor was extracted and brackets were bonded for alignment. The upper right canine and premolar were aligned in their transposed positions with minimal gingival recession, and the lower arch was aligned while maintaining a Class I molar relationship as well as a good facial profile. A circumferential retainer was used in the upper arch, and lingual fixed retainers were bonded on the lower arch.

Conclusion : A transposed maxillary canine and premolar were successfully aligned by keeping the transposed positions, with stable 2-year postretention results using a removable retainer. However, during the 15- year postretention period, the retainers were lost, leading to extrusion of the transposed canine, causing occlusal interference, gingival recession, and loss of tooth vitality. A fixed retainer is recommended for the transposed maxillary canine– premolar to maintain stable occlusion in the long term.

P-68

Multidisciplinary treatment in a patient with dentofacial deformities following radiotherapy for retinoblastoma and nasopharyngeal cancer.

So-Hyun Kim[1], You-Sun Lee[1], Jong-Gon Lee[2], Tae-Hyun Choi[1], Deuk-Won Jo[3], Young-Kyun Kim[2], Nam-Ki Lee[1]

[1]Department of Orthodontics, Seoul National University Bundang Hospital
[2]Department of Oral and Maxillofacial Surgery, Seoul National University Bundang Hospital
[3]Department of Prosthodontics

Introduction : Patients, who treated with radiotherapy for head and neck tumors in childhood, undergo developmental alternation in craniofacial area due to impaired growth of the irradiated regions. These deformities may have significant functional and aesthetic impacts, following physiological and social troubles. The therapeutic solutions are mostly multidisciplinary.

Case Summary : A 19-year-old patient, who had a history of retinoblastoma, was treated by enucleation of right eye and external beam radiotherapy on left eye at 100 days after the birth. Afterwards, he underwent cancer therapy due to secondarily developed nasopharyngeal cancer at 11 years.
As a result of early radiation and cancer therapy, he presented skeletodental deformities of the middle third of face, showing a skeletal Class III pattern. In a clinical and radiographic examination, he had a bilaterally tridimensional (sagittal, transverse, and vertical) growth retardation of the maxilla and midface, maxillary hypodontia and severe anterior and posterior crossbite. The treatment plan included orthodontic treatment with two jaw surgery and multiple prosthetics including implants.
The patient underwent surgical-orthodontic treatment combined with maxillary advancement by Le Fort I osteotomy and mandibular setback, and followed by prosthetic rehabilitation for increase of vertical dimension and congenital missing teeth in upper arch.
After this multidisciplinary treatment, facial esthetic and function were enhanced with the improvement of occlusion and skeletal discrepancy.

Conclusion : In a patient with dentofacial deformities due to early cancer therapy prior to jaw and teeth development, interdisciplinary treatment among orthodontist, oral and maxillofacial surgeon and prosthodontist results in a favorable oral rehabilitation.

P-69

Orthodontic treatment of a patient with severe condylar resorption

Gye-Hyeong Lee[1,6], Sangmi Lee[2,6], Danal Moon[3,6], Jae Do Sohn[4,6], Yosook Kim[5,6]

[1]21st century orthodontic clinic
[2]Star Orthodontic Clinic
[3]Seonigowoon Orthodontic Clinic
[4]Seoul EOS orthodontic clinic
[5]Esmile orthodontic clinic
[6]Roth Orthodontic society

Introduction : Orthodontic treatment of patients with TMD is regarded as one of the most challenging procedures for clinicians because of the TMD symptoms and the constantly changing occlusion caused by an unstable condylar position. This instability means that clinicians do not have a criteria for orthodontic evaluation, so the TMJ structures should be stabilized prior to active tooth movement to identify the true mandibular position. Improvement of TMD symptoms can also be expected after stabilization of the TMJ.

Case Summary : A 40-year-old female presented with concerns about her anterior protrusion. She reported having migraine and other facial and neck pain in addition to sleep disorders. She showed lip fullness and a convex profile, but she had no significant facial asymmetry. Because of chronic facial pain, the patient showed stiff facial expression. Intraoral examination found severe anterior open bite.
A panoramic radiograph showed severely flattened and backwardly inclined condylar heads on both sides. Lateral cephalometric analysis indicated a skeletal Class II pattern with a hyperdivergent growth pattern. On a CBCT image, both mandibular condyles exhibiteda flattened form which indicated resorption of the condyle, but they were covered with a definite cortical layer. Considering the patients age and cortical continuity of the condyle, the condylar resorption in this patient was thought to be inactive.

Conclusion : With these findings, it was determined that a definitive diagnosis should be made after stabilization of the TMJ. Changes in condylar position were monitored regularly with the MPI data during splint therapy. A stabilization splint was prescribed with an ideal occlusal scheme of mutually protected occlusion.
After stabilizastion, four maxillary and mandibular premolars were extracted. All appliances were removed after 27 months of treatment. Proper overbite and overjet were achieved with orthodontic treatment.

P-70

Orthodontic treatment with a proper eruption guidance in the mixed dentition

Seokpil Kim[1], Sangmi Lee[2], Kyunghun Lyu[3]

[1]Seonigoun Orthodontic Clinic
[2]Star Orthodontic Clinic
[3]Sangmu Mir Dental Clinic

Introduction : Mixed dentition is a critical stage of developing malocclusion as it is a period to start and complete the permanent dentition. Therefore, it is important to guide the eruption of permanent teeth in their own sequence.

Case Summary : If little space deficiency is found in the patient, appropriate space consolidation will be enough for eruption guidance of permanent teeth. However, special consideration must be taken if the patient has serious deficiency in the eruption space. Orthodontists generally associate this with immediate orthodontic intervention with maxillary or mandibular arch expansion. An essential precondition for this orthodontic intervention during the period of mixed dentition is that the patient is expected to have non-extraction orthodontic treatment in the future. If premolar extraction is predicted, space consolidation or expansion should carefully be reconsidered. For example, when upper canines show eruption deficiency, clinicians usually apply a sagittal appliance or an anterio-posterior (AP) screw and the upper anterior teeth move anteriorly during space consolidation. If this patient needs premolar extraction later, the anteriorly flared upper incisors will be retracted again. Therefore, an extraction analysis must precede orthodontic space consolidation to avoid unnecessary teeth movement. If a patient is expected to need premolar extraction, clinicians can take time to observe the eruption of permanent teeth in some cases. However most of the cases show that eruption space deficiency results in severe crowding and ectopic impaction or eruption, which might lead to unfavorable alveolar bone growth and periodontal problems.

Conclusion : Therefore, appropriate eruption guidance and opportune extraction of deciduous and permanent teeth in the mixed dentition is important to prevent unnecessary treatment procedures. This case report will discuss the proper treatment protocol of severe crowding patient in their mixed dentition with a clinical case.

P-71

Botulinum toxin injection to treat masticatory movement disorder corrected mandibular asymmetry in a growing patient

Yu-Min Cho[1], Ji-Eun Noh[1], Seong-Gon Kim[2], Dong-Soon Choi[1], Insan Jang[1], Bong-Kuen Cha[1]

[1]Department of Orthodontics, College of Dentistry, Gangneung-Wonju National University
[2]Department of Oral and Maxillofacial Surgery, College of Dentistry, Gangneung-Wonju National University

Introduction : The relationships between the activity and volume of the masseter muscle and craniofacial morphology have been well documented in humans and in animal models. In animal studies, Botulinum toxin(BTX-A) injection in masticatory muscles affects multiple aspects of muscle-related maxillofacial bone growth and significantly changes size and morphology.

Case Summary : An eight-year-old girl presented a unilateral chewing habit and mandible asymmetry with right masseter muscle hyperplasia and constriction of upper dental arch. She received botulinum toxin-A (BTX-A) injection and orthodontic treatment with the removable active plate. After BTX-A injection combined with orthodontic treatment, unilateral mastication habit corrected and revealed diminished unilateral bulging of the right masseter muscle. Cone-beam computed tomography images revealed that the height of the left mandibular ramus had increased by 2.3 mm, considerably more than on the right side, the discrepancy in mandibular ramus height between the left and the right decreased dramatically. Single injection of BTX-A combined orthodontic treatment showed simultaneous correction of habitual unilateral mastication and harmonious growth of the mandible. Interestingly the discrepancy between the left and the right mandibular ramus height decreased. We supposed that the change in masseter muscle activity had influence on the mandibular ramus height in the short term. This is the first case report of a method for skeletal growth modification using BTX-A injection. We assumed that BTX-A injection can be an alternative treatment modality to modify asymmetric mandibular growth.

Conclusion : In short period, BTX-A injection combined with orthodontic treatment modified asymmetric mandibular growth in a growing patient.

P-72

Bone remodeling on lingual cortical plate during retention, after lower dentition distalization

Ho-Jin KIM[1], Woon-Seok JANG[1], Hyo-Sang PARK[2]

[1]Design orthodontic clinic
[2]Department of Orthodontics, School of Dentistry, Kyungpook National University

Introduction : By virtue of skeletal anchorage devices, in essence, there is no limit for moving the teeth, such as direction and amount, and even it enabled the jaws to be modified in some cases. Nevertheless, the biology of the tissues around the tooth is a critical issue to be considered during the movement. One of those considerations might be the alveolar bone housing, presenting a limitation of tooth movement. Besides, a cone beam computed tomography(CBCT) scan enables an effective investigation for the relationship of those structures.
The following is a case report on anatomical limitations, related to alveolar bone housing, of the mandible and bone remodeling around the teeth after the distal movement of lower dentition.

Case Summary : A 21-year-old man had finished retreatment for anterior open bite and Class III malocclusion. During the retreatment, a remarkable amount of distal movement was performed on whole lower dentition, producing the penetrations of the incisor and the second molar roots into those lingual cortical plates of the mandible. Though dehiscences of the cortical plate were found when evaluating CBCT images, no side effects, such as root resorption or gingival recession, were observed during treatment and retention. After 36 months of retention, the CBCT scan was taken for evaluating those penetrated cortical plates and showed the bone recovery around the roots protruding through the lingual cortex.

Conclusion : A significant bone remodeling occurred on the lingual cortical plate of the mandible in which the bone dehiscence had been observed, after 36 months of retention. This finding provides noteworthy evidence with respect to bone regeneration, enhanced by the intact periodontal ligament producing osteoblastic cells and metabolisms, even in the cortical plate penetrated by the orthodontic movement.

P-73

Modified serial extraction treatment in a growing patient

Sang Hee Hwang

Dpet. of Dentistry, Keimyung University Hospital

Introduction : In cases of severe crowding that require extraction, serial extraction that starts from the mixed dentition state is one good method of treatment.
Serial extraction is a sequential plan of premature removal of deciduous teeth and following removal of permanent teeth in order to improve the alignment of permanent teeth.
Rolf Frankel might be one of the most notable orthodontists using functional appliances. His outstanding long-term three dimensional results were very impressive and have had an effect on many orthopedic orthodontists. Also, many considerations such as carefully selected patients, good timing, well designed appliance, and maximal patient compliance are very important to achieve such good treatment results.
In the present case report, appropriate time for intervention in growing patients with Frankel appliances and modified serial extraction treatment can shorten the total treatment time with fixed brackets.

Case Summary : A 8-year-old girl had 2 maxillary high canines and class II malocclusion in mixed dentition.
The first attempt was Frankel appliance to correct skeletal class II malocclusion. And, delivery of space regainer and modified serial extraction were followed to resolve crowding in dentition.
Pre-treatment and post-treatment photographs of this patient demonstrated effective, esthetically-pleasing, and stable treatment results. The patient was scheduled to be followed during retention period.

Conclusion : In many cases, careful selection of patients and appropriate time for intervention were based on accurate diagnosis and orthodontists' experience.
It would be considered important to make an exact diagnosis of the cause and remove the mechanical obstruction instantly for the orthodontic treatment.
The usage of well-selected functional appliance and exact intervention time will be very helpful tools to correct severe malocclusion and improve facial esthetics especially in growing children. The patient and their parents were satisfied with the treatment results. The accurate understanding of 2-phase treatment has been instrumental in achieving the successful orthodontic treatment results.

P-74

A case report of surgery first approach with sagittal and vertical control

Mi Young Lee[1], Sung Jin Park[2]

[1]Department of Orthodontics, Gwanak Seoul National University Dental Hospital
[2]Department of oral and maxillofacials, Gangnam CHA University Hopstial

Introduction : Surgery-first approach in orthodontic treatment has many advantages including short treatment time, patient's satisfaction. However, indications of surgery-first approach are limited. It is applicable to patients who have well-aligned or mild crowding, flat to mild curve of Spee, normal to mild proclination/retroclination of incisors, minimal transverse discrepancy. These case reports will describe the treatment of 2 patients who were treated with surgery first approach.

Case Summary : These 2 patients treated with surgery first approach in orthodontic treatment.
A 30-year-old female's chief complain was protruded lips and long face. She had a convex profile due to protruded maxilla. And she had vertical skeletal pattern with a gummy smile . Her dentition was well aligned except rotation of lower left second premolar.
Second, a patient was 21-year-old female and her chief complain was protrusion and square face. She had skeletal class II with protruded maxilla and horizontal skeletal pattern. In posterior-anterior view, her mandibular angle was very strong.
They were done orthognathic surgery first before orthodontic treatment. LeFort I osteotomy and bilateral sagital split ramus osteotomy(BSSRO), genioplasty, angle reduction were done for sagittal and vertical control. After orthognathic surgery, orthodontic treatment was done and total treatment time was 8,15 months each.

Conclusion : We treated 2 cases through surgery-first approach successfully. If applied to appropriate cases, surgery-first approach can reduce the duration of treatment and increase patient satisfaction.

P-75

Non-extraction Distalization Orthodontics - 1st category of Tooth Preservation Orthodontics

Nakchun Choi

Misosmile dental clinic-Jongno

Introduction : There are ambiguous cases at the boundary between the extraction and the non-extraction. If more space than necessary is expected in case of premolar extraction, otherwise if space is not sufficient without extraction, we can use Non-extraction Distalization treatment as an alternative.

Discussion : Considerations for Non-extraction Distalization treatment are:
1. First of all, it is necessary to check a space back of the molars to move the entire dentition except for the wisdom tooth.
2. We must decide whether to distalize the whole dentition all at once (total distalization) or to distalize molars first and then move the other teeth (segmental distalization).
3. During distalization, vertical and horizontal change as well as anteroposterior movement should be considered.
4. It is important to control the torque of the anterior teeth during Non-extraction Distalization treatment.
5. Additional space can be obtained by appropriately using the arch expansion and IPR. When the whole dentition is moved backward by the mini-screws in the buccal sides, arch expansion ensues biomechanically.
6. If there is ambiguity in the boundary between extraction and non-extraction at diagnosis, therapeutic diagnosis of Non-extraction Distalization treatmnent is recommended.

Conclusion : The needs of customers who wish to get orthodontic treatment are also shifting toward preserving the natural teeth if possible. Also, Non-extraction Distalization treatment method is effective for preventing unwanted extraction side effects
Our clinics ratio of extraction to non-extraction of orthodontic patients diagnosed in 2018 is 19%(Ext.):81%(Non-ext.). However in 2008, 10 years ago, the extraction rate of orthodontic patients was much higher, 64%(Ext.):26%(Non-ext.). Over the past few years, the proportion of non-extraction patients has continued to increase. If we move our vision and center of gravity to the direction of saving natural teeth when establishing diagnosis and treatment plan, orthodontic treatment will be able to escape the negative paradigm represented by the extraction.

P-76

Strategic use of miniplates for treatment of bilaterally impacted mandibular second molars and anterior crossbite

You Na Lim, In-Young Park

Department of Orthodontics, Hallym University Sacred Heart Hospital

Introduction : The use of skeletal anchorage has a great advantage, since the device can be placed distally to the impacted tooth and provide the necessary uprighting and extrusion movement of this tooth. Also, skeletal anchorage enables anterior crossbite to be corrected by distalization of the mandibular molars. The practice of solely using miniscrews in patients with complex orthodontic problems often results in failure. In such patients, miniplates offer more flexibility and allow clinicians to solve problems efficiently.
This case report presents a successful orthodontic treatment in a patient with impacted mandibular second molars and anterior crossbite using miniplates as skeletal anchorage.

Case Summary : The patient, a 28-year-old man, had mesially tipped and semi-erupted mandibular second and third molars on both sides and anterior crossbite. Through minor surgery, impacted mandibular third molars were extracted and miniplates were placed in the anterior border of the mandibular ramus and the retromolar trigone. The plate's hook remained exposed in the oral cavity, practically parallel to the occlusal plane in a vestibular direction to facilitate mechanical uprighting of the tooth. With an application of orthodontic force, the impacted second molars were almost distally uprighted and consequently showed no root resorption and no mobility. Thereafter the vertical position of the plate's hook was changed to near the bracket level by bending it. This made it possible to distalize the mandibular dentition resulting in correction of anterior crossbite with adequate overjet and overbite. After 19 months of treatment, the efficient and effective treatment results were achieved by utilizing miniplates.

Conclusion : Proper anchorage systems and carefully selected biomechanical forces should be considered to deal with the complex orthodontic problems. Using miniplates as skeletal anchorage to upright impacted second molars and distalize the total lower dentition is a rational option, making the orthodontic treatment faster and more efficient.

P-77

Comprehensive treatment case of cleft lip and palate patient with distraction osteogenesis and orthognathic surgery

Yoonsoo Ahn, Chaekyung Lee, Woojin Han, Jimin Lee, Heon Jo, Sunghwan Choi, Hyungseog Yu

Department of Orthodontics, The Institute of Craniofacial Deformity, College of Dentistry, Yonsei University

Introduction : Patients with cleft lip and palate(CLP) usually present with collapsed maxillary dental arch and impaired forward growth of the maxilla as a result of scar tissue from the early surgical repair of CLP. In many cases, these problems require orthodontic treatment combined with surgical procedures such as distraction osteogenesis(DO) and/or orthognathic surgery(OGS).

Case Summary : A 14-year-old boy was referred from department of pediatric dentistry for comprehensive treatment of CLP. He had had several CLP treatment in department of oral and maxillofacial sugery & pediatric dentistry. He showed severe skeletal class III relationship with overall crossbite and congenital missing on #15,22. We planned leveling and alignment with dental decompensation and DO followed by OGS after growth completion.
After growth completion (19Y), his skeletal class III relationship worsened via impaired maxillary forward growth due to several cleft-related factors. Distraction vector was decided to translate maxilla considering center of mass in 3D simulation. Distraction was performed with internal device for two months. As the maxilla was advanced about 7.3mm and the mandible was rotated counterclockwise, facial profile was improved.
Then, OGS was done to correct remained sagittal skeletal discrepancy and asymmetry. In maxillary osteotomy, the bone formed by the DO was confirmed. To relieve midfacial deficiency, we autografted a ramal bone harvested during mandibular surgery. After six months of post-surgical orthodontic treatment, we debonded braces. Finally, harmonious facial profile was achieved.

Conclusion : The treatment for CLP patients is challenging. Harmonious facial profile can be achieved by accurate diagnosis and precise comprehensive treatment techniques with DO and/or OGS.

P-78

Orthodontic treatment using skeletal anchorage and lever arm mechanics in a patient with anterior openbite

Keunoh Lim, Won Hee Lim

Department of Orthodontics, School of Dentistry, Seoul National University

Introduction : Anterior openbite can be successfully treated non-surgically by intruding posterior teeth with miniscrews. Lever arm mechanics can be used for bodily movement of anterior teeth during space closure.

Case Summary : A 27-year-old woman had an anterior openbite with a skeletal Class II relationship, lip protrusion, and hyperactivity of the mentalis muscle. The patient had been treated with an occlusal splint due to temporomandibular joint disorder. After leveling and alignment with preadjusted fixed appliances, miniscrews were inserted around the midpalatal suture and on the buccal side of the lower posterior area. Transpalatal arch was placed on the upper arch and intrusive forces were applied to the upper and lower molars to increase overbite by inducing counterclockwise rotation of the mandible. The patient showed a lingual inclination of the maxillary incisors and a remarkable protrusion of the lower lip after the anterior openbite had been corrected so that the 4 premolars were extracted to improve the facial profile. Two additional miniscrews were inserted on the palatal side of the maxillary molars and a lever arm was bonded onto the palatal surfaces of the upper anterior teeth to retract the anterior teeth with bodily movement. As a result, the anterior openbite and lip protrusion with the mentalis muscle hyperactivity were improved maintaining the inclination of the upper incisors by the miniscrews and the lever arm.

Conclusion : Miniscrews can be useful for correction of anterior openbite and bodily movement of the maxillary anterior teeth during space closure if a lever arm is accompanied.

P-79

Using midpalatal mini-implant anchorage system and modified transpalatal arch appliance for efficient anterior openbite correction.

Jiho Ryu, Tae-Woo Kim

Department of Orthodontics, School of Dentistry, Seoul National University

Introduction : Retaining a substantial anchorage to intrude maxillary molars is one of the most important aspects to achieve a normal occlusion of anterior openbite patients. Modified transpalatal arch (TPA) appliance and a mini-implant can be used in intrusion of molars with various advantages; stability, simplicity, convenience and adequate reinforcement. The objective is to correct anterior openbite with mini-implant anchorage system and the modified transpalatal arch in non-surgical and non-extraction case.

Case Summary : This article reports the successfully treated patient who was twenty-seven years old female diagnosed as skeletal Class II relationship with anterior openbite, crowding, hyperdivergent pattern and arch width discrepancy. She has a history of splint treatment for temporomandibular joint disorder. Rapid palatal expansion (RPE) was preceded to expand maxilla. With a multi-bracket appliance and a single midpalatal mini-implant combined with replaceable modified TPA made it possible to intrude maxillary posterior teeth in efficient ways. Elastomeric chains were applied to the mini-implant securely and the intrusion force was applied directly or indirectly to the molars. The total active treatment period was 22 months. Maxillary molar intrusion for correcting anterior openbite can be efficiently done with a sole mini-implant placed in the midpalatal area where lesser anatomic interference exists and higher success rate is reported to be possible.

Conclusion : Properly positioned midpalatal mini-implant with a modified TPA appliance can effectively and efficiently correct anterior openbite malocclusion.

P-80

Unilateral surgically-assisted rapid maxillary expansion(S-RME) in the treatment of a patient with facial asymmetry

Jeong Soon Ahn[1,5], Hyun Kim[2,5], Ko Woon Kim[3,5], Sang Mi Lee[4,5]

[1]Suwan The Dental Hospital
[2]Kim Hyun Othodontic Clinic
[3]Lovelyline Orthodontic Clinic
[4]Star Orthodontic Clinic
[5]Roth Orthodontic Society

Introduction : For the treatment of a skeletal class III patient with facial asymmetry, an orthognathic surgery including maxillary canting correction and mandibular set-back is the ideal treatment plan to provide a patient with not only a functional occlusion but also good facial esthetics. Growing numbers of patients are benefitted from the orthognathic surgery while many patients are still reluctant to accept this highly invasive surgical procedure. In the cases that patients refuse orthognathic surgery, a camouflage treatment is needed as a second option.

Case Summary : An adolescent patient was visited with chief complaints of mandibular prognathism and facial asymmetry. We explained that she would need an orthognathic surgery after final growth is confirmed, but her parents did not want 2-jaw surgery and hoped her dental problem including edge to edge bite in the anterior teeth and crowding could be resolved. For correction of shallow overjet on the right posterior area due to deviation of the mandible to the right side, camouflage treatment plan using Unilateral Surgically-assisted Rapid Maxillary Expansion (S-RME) was decided. Even though surgical osteotomy was performed only unilaterally, opposite side of the maxilla also showed mild expansion, which resulted in the correction of posterior overjet on the both sides. Right and left upper first and lower right first premolars were extracted to resolve the crowding and the left lateral incisor was congenitally missing. Distal driving of the lower arch and upper anchorage loss of the posteriors could improve severe class III relation on the left.

Conclusion : Even though her facial asymmetry could not corrected from this camouflage treatment, acceptable occlusion could be attained with the application of the Unilateral S-RME and premolar extraction treatment.

P-81

Orthodontic Treatment of Class III Malocclusion with Severe Crowding using MARPE

Lee Ba Wool

St.Benedict Dental Hospital

Introduction : Posterior crossbite is found in 7.7% of patients in the deciduous or mixed dentition, but its incidence increases into adulthood. Howe et al. have shown that dental crowding appears to be related more to a deficiency in arch perimeter than to teeth that are too large. Patients with transverse discrepancy can exhibit unilateral or bilateral posterior crossbites, often accompanied with anterior dental crowding. For a successful treatment outcome, it is important to resolve transverse discrepancy by intervening in basal bone discrepancy. This case report presents the treatment of a patient aged 14 years with skeletal Class III malocclusion and severe crowding and transverse maxillary deficiency using MARPE.

Case Summary : The 14-year-old female came to the our orthodontic clinic. Her chief compliant was I have crowding in the front. Maxillary and mandibular arch length discrepancies were 10.0mm and 3.5mm, respectively. She had a unilateral posterior crossbite on the left side and skeletal Class III malocclusion. Upper dental midline was 2.0mm deviated to the left side in relation to the sagittal facial plane. Lateral cephalometric analysis was as follows: -1.0 degree ANB angle, -7.5mm Wits appraisal. By using MARPE, a 5.2mm maxillary expansion on the first molar was achieved. When the expansion was done, it lead to complete elimination of the crossbite. The patient finished treatment with Class I molar and canine relationships. Dental crowding was resolved. The total treatment time was 20 months.

Conclusion : In skeletal class III malocclusion, transverse skeletal discrepancy is often observed. This discrepancy may be related to dental crowding. Therefore, it is important to resolve the transverse maxillary deficiency. The MARPE is a clinical effective technique for correction of transverse discrepancies. MARPE provide maxillary expansion at sutural levels and decrease dentoalveolar side effects. It should be considered as an alternative for managing arch perimeter length.

P-82

Management of palatally erupting maxillary canine in mixed dentition

Jae Hwa An, Woo-Sung Son, Soo-Byung Park, Seong Sik Kim, Yong-Il Kim, Sung-Hun Kim, Yeonju Choi, Na Hee Ha

Department of Orthodontics, School of Dentistry, Pusan National University

Introduction : Premature loss of primary teeth can lead to various features of malocclusion in the mixed dentition. In particular, the space loss in mixed dentition can be caused by the displacement of adjacent teeth following the premature loss of deciduous teeth due to carious lesions or trauma. Accordingly, space regaining or permanent tooth extraction is required in case of moderate crowding problems. Meanwhile, previous studies showed that extraction of the primary canine induced 78% of mesially erupting permanent maxillary canine into a normal eruption. But if the mesiodistal location and angle of maxillary canine are poor, surgical intervention is needed.

Case Summary : A 10-year-old male patient appeared at our clinic complaining about the ectopic eruption of the upper right permanent canine. Space loss was caused by premature loss and deep caries of primary canine, and the maxillary and mandibular right canine in the mesially ectopic eruption were positioned palatally and labially in the radiographic examination, respectively. Furthermore, the right class II molar relationship and the left cross-bite were caused by mesial and lingual tilting of the maxillary molars.

In the 1st step, space was regained in maxillary dentition by molar distalization with bone-anchored pendulum appliance, and surgical uncovering of the maxillary right canine was performed to induce spontaneous eruption. In the mandible, the lingual arch was used for space maintaining and traction of mandibular right canine. In the 2nd step, maxillary arch form and arch width discrepancy were corrected using fixed appliances.

Conclusion : In this case, surgical uncovering of palatally erupting maxillary canine allowed it to erupt autonomously to the level of the occlusal plane and provided the simplified, predictable, biologically sound, and esthetic outcome. In addition, the bone-anchored pendulum appliance was an effective, minimally invasive, and compliance-free intraoral distalization appliance for achieving molar distalization without any anchorage loss.

P-83

Posterior available space for uprighting horizontally impacted mandibular second molars using orthodontic microimplant anchorage

Young-Jun Lee[1], Ki-Jun Kim[1], Jong-Moon Chae[1], Na-Young Chang[1], Hong-Ik Jang[2]

[1]Department of Orthodontics, Wonkwang University Daejeon Dental Hospital
[2]Department of Orthodontics, College of Dentistry, Wonkwang University

Introduction : Treatment of horizontally and deeply impacted mandibular molars is challenging because of the limited access and anchorage control. Direct application of an appropriate force system using skeletal anchorage in the retromolar area is a simple and effective way to upright an impacted mandibular second molars(MM2s). Also, posterior available space(PAS) in the retromolar area should be analyzed before treatment. We present two cases with unilateral and bilateral impacted MM2s considering posterior available space.

Case Summary : Case 1) Patient 1 was a 14-year-old boy with the chief complaint of bilaterally impacted MM2s. Radiographs confirmed severely mesioangulated and impacted MM2s blocked by the mandibular third molars(MM3s) on both sides. Mesially impacted MM2s were uprighted with orthodontic microimplants(OMIs), inserted in the retromolar area, following extraction of the MM3s. 18 months into treatment, full fixed orthodontic treatment begun in the mandibular arch for uprighting and mesial root movement of the MM2s. The total treatment period was 29 months.
Case 2) Patient 2 was a 17-year-old boy with the chief complaint of unilaterally impacted MM2s. His left MM2 was horizontally impacted and blocked by the MM3. Orthodontic traction of his impacted left MM2 was made possible with an OMI inserted in the retromolar area. After uprighting of MM2, full fixed treatment was done.

Conclusion : Clinicians should consider the location and desired movement of the impacted MM2 to upright them. Also, PAS should be analyzed before uprighting of impacted mandibular second molars(MM2s) to prevent periodontal problems after treatment. If PAS is not enough for uprighting impacted MM2s, alternative treatment should be considered based on the stage of growth. OMIs in the retromolar area were very efficient in uprighting horizontally and deeply impacted MM2s.

P-84

Orthodontic treatment of adolescent male patient with finger sucking habit : case report

JongHyun Lee

Lucent dental clinic

Introduction : Finger sucking habit that lasts until late age leads to serious malocclusion. Most patients have complicated problems such as labioversion of upper anterior teeth, open bite, narrow and high palate vault, transverse discrepancy, and lingual inclination of lower anterior teeth. Before starting treatment, clinician should consider the way to break habit and meeting with patient's parents is needed. In general, skeletal, teeth and soft tissue displacement is severe. For stable treatment result and retention, excessive tooth movement should not be achieved and soft tissue balance shoud be considered.

Case Summary : Cribs were attached to the RPE to solve transverse problem with breaking the habit. I asked patient's parents to observe the improvement because patient involuntarily carried out finger sucking while sleeping. Considering the patient's age, the rapid expansion of maxilla is assisted with mini-screws (MARPE). In order to improve the large overjet and openbite due to labioversion of the maxillary incisors, extraction of premolar is inevitable. The mandibular incisors are expanded forward with weak and continuous force and positioned in limits of the symphysis. Crowding is treated without premolar extraction. After treatment is completed, optimal canine and Class II molar relationship is achieved. Lips are also restored to their proper position, improved aesthetically. When patient comes two years follow up, the treatment results were stable.

Conclusion : Designs of device to break habit can be diverse. It can be treated by just a small stimulus that reminds patient of his behavior rather than a device that causes pain. In order to maintain stable result, tooth expansion within skeletal limits or extraction is determined before starting treatment. Continuous patient education and interviews with parents are essential to prevent relapse.

P-85

Skeletal Cl.III camouflage treatment using palatal expansion and unusual extraction in 42 year old patient

WON TAK CHO, SO YOUNG LEE

Daejeon Ye Dental Clinic

Introduction : Skeletal Class III malocclusion is one of the biggest challenges faced by orthodontists. There are 3 choices to treat them.
1. Growth modification in growing patients.
2. Dental camouflage.
3. Orthodontic treatment combined with orthognathic surgery in adults.
But many adult patients dont accept surgery because of many reasons. In these situations, orthodontic camouflage treatment may be an alternative, particularly if discrepancy is not severe.

Case Summary : The patient was a 42-year-old female with the chief complaint of severe crowding, buccal crossbite and chin prominence. She had gingival recession, several restorations, buccal crossbite and facial asymmetry. In spite of the need for orthognathic surgery, orthodontic camouflage treatment was chosen by patient. Palatal expansion and lower incisor extraction was proceeded to correct the transverse discrepancy and crowding. As a result, acceptable alignment and occlusion was achieved without gingival recession progression. The total treatment period was 25 months.

Conclusion : This case report demonstrates that palatal expansion and lower incisor extraction can be effective in the treatment method of a moderate adult skeletal Class III malocclusion. Palatal expansion using TAD(Temporary Anchorage Device) can provide expansion for solving crowding and transverse discrepancy and also can be considered an alternative in the camouflage treatment of skeletal Class III malocclusion.

P-86

Considerations for orthodontic traction of the labially impacted maxillary canine

Mi So Ahn, Kyu Sung Jung, Sang Hee Han, Sung Hun Kim, Yong-Il Kim, Seong Sik Kim, Soo-Byung Park, Woo-Sung Son

Department of Orthodontics, School of Dentistry, Pusan National University

Introduction : Impaction is defined that the teeth did not erupt in the appropriate site during normal growth.
Impaction may occur due to local factors such as abnormal eruptive pathways or obstructions. If a tooth has an abnormal eruptive pathway, there is a need for the orthodontic intervention. An appropriate treatment planning should be determined by an assessment of the eruption path and relationship between the location of impacted teeth and adjacent tissue.

Case Summary : A 9-year-old girl had an impacted maxillary right canine. The impacted canine was horizontally located at the nasal floor. It was difficult to self-correct the impacted canine because the eruption pathway deviated too much from the normal path. It was necessary to improve the eruption path by orthodontic traction. The treatment plan was considered to correct the eruption path of the impacted canine and align the overall dentition. Considering the position of the impacted canine and the relationship between adjacent structures, the closed eruption technique was performed. A cantilever spring was used for the traction of the impacted canine. After the impacted canine erupted, labial fixed appliances were used for alignment. The inclination of the canine was controlled by torque spring. The proper occlusal relationship was achieved.

Conclusion : There is variable consideration to treat the horizontally impacted tooth. The location of impacted teeth, the eruption pathway, the relationship with adjacent tissues, and the inclination of the root should be considered to obtain appropriate occlusal relationships and esthetic results.

P-87

Surgico-orthodontic case report on short face patient with deep bite

Un-Bong Baik[1], Sae-Mi Oh[1], Kyung-Dae Kim[2], Jong-Duk Byun[3], Jae-Hong Kim[4], Byung-Jin Sohn[5], Wook Kim[6]

[1]Smilewith Orthodontic Clinic
[2]Seoul NYU Dental Clinic
[3]Nurikum Seoul Dental Clinic
[4]Seoul Top Dental Clinic
[5]Seoul M Dental Clinic
[6]TMD Dental Clinic

Introduction : It is necessary to increase vertical dimension on short face patient with VMD (Vertical Maxillary Deficiency). Bone graft on Lefort I ostetomy site may be one of the options. But, it is not easy to get stability because strong bite force.

Case Summary : 35 years old female visited orthodontic clinic for deep bite, anterior crossbite and mandibular prognathism. Her skeletal Class III with maxillary retrognathism and mandibular prognathism. She showed short face with VMD.
The initial leveling and alignment was done on the lower dentition. After 8 months, deep bite was greately improved and occlusal plane was flattened. During deep bite correction, the lower molars were extruded and lower incisors were intruded. The facial height was also increased. Two jaw surgery was done. The maxillary Le-Fort I osteotomy was done (advancement by 1.5mm, posterior impaction by 3mm). On the mandible, set back was done by 6mm on the left and 7mm on the right. Vertical correction was not necessary because it was solved by pre-operative orthodontic treatment. Her profile was improved greatly and facial height was increased.
At the timing of debonding, overbite and overjet became normal. After 9 years follow up, the occlusion and skeleltal pattern showed good stability.

Conclusion : Deep bite, short face problem was improved during pre-operative orthodontics. It may be one of options to solve vertical problem of surgico-orthodontic patient.

P-88

Long term follow up case report on TMD patient (ICR: Idiopathic Condylar Resorption)

Un-Bong Baik[1], Sae-Mi Oh[1], Kwang-Heung Han[2], Jae-Hong Kim[3], Byung-Jin Sohn[4], Wook Kim[5]

[1]Smilewith Orthodontic Clinic
[2]Seoul H Dental Clinic
[3]Seoul Top Dental Clinic
[4]Seoul M Dental Clinic
[5]TMD Dental Clinic

Introduction : A suspected case of TMD (ICR: Idiopathic Condylar Resorption) at an early age should be treated with great care. ICR causes skeletal Class II, micromandible, open bite, dental Class II and sever overjet. Even if there was no problem at first, it sometimes gets worse in the middle of treatment .

Case Summary : 7 years old female visited orthodontic clinic for anterior crowding. At that time, the skeletal Class II was not so severe and condylar shape had no specific problem. From 11 year-old age, condyle resorption started to be seen, and overjet became severe. The comprehensive orthodontic treatment was postponed and only TMD treatment (splint and physical therapy) was done.
After careful treatment at the TMD clinic, orthodontic treatment was begun at 17 year-old age. The overjet was 11 mm. 2 options (surgery or dental camouflage) were proposed and the patient accepted the latter. The upper right and left bicuspids were extracted and the anterior teeth were retracted. At debonding, molar class II and canine class I relation was achieved and the overjet became 2mm. The patients profile was greatly improved.

Conclusion : ICR occurrs most frequently in puberty. It affects not only the position of mandible but also occlusion. The comprehensive orthodontic treatment should be postponed until through management and evaluation of TMD is done.

P-89

Segmental Mini-Bracket Technique in the Correction of Lower Incisor Crowding: an alternative in orthodontic treatment

Marian Almyra Naranjilla

Centro Escolar University, Manila, Philippines

Introduction : A new alternative to treatment using clear mini brackets better described as mini tubes with flat base delivers light forces to align the anterior teeth rapidly without pain. For the movement, super elastic thermal Ni-Ti wires are used to treat malocclusions such as anterior crossbite, anterior incisor crowding,
and residual space closure. The system is minimally invasive and provides patients with better oral hygiene, comfort and aesthetics.

Summary : This case report presents a 12-year-old female with Class I skeletal and dental malocclusion, anterior deep bite and mild lower incisor crowding. The lower incisors tipped lingually after early extraction of deciduous canines intended to resolve severe incisor crowding. The facial profile of the patient was straight as the upper incisors tipped lingually following the inclination of the lower incisors. The upper left lateral incisor eruption was delayed due to an odontoma, which was surgically removed. Clear mini brackets were bonded on the lower teeth from canine to canine and a .010 and .012 thermal Ni-Ti were used. After 8 weeks of treatment, the lower anterior teeth were aligned without any complaint of pain from the patient. Better oral hygiene was observed due to the smaller size and shape of the mini brackets relative to the conventional brackets.

Conclusions : Clear mini brackets may be used to align anterior teeth with mild to moderate crowding rapidly and without pain using segmental mechanics. This is due to the light forces delivered by the small diameter thermal NiTi wires which moved teeth by frontal resorption.

P-90

Management of Class II malocclusion with Twin block and fixed appliance with first premolar extraction

THOMAS MATHEW, VISHWANATH KEDALIYA, JAMES SUNNY

Consultant Orthodontist ,Jerudong Park Medical Centre

Introduction : There are different treatment modalities for correction of skeletal class II malocclusion. The growth modification with functional appliance has been a successful treatment approach for correction of retrognathic mandible. The Fixed orthodontic appliance is often required after the growth modification stage for correction of the incisor proclination and settling of the occlusion. In this case two stage treatment approach with extraction of premolars was required due to the severity of the malocclusion. The extraction of upper first premolar and lower second molar is one acceptable method for space gaining in favourable growth pattern. In this case the lower 1st premolar extraction was done to gain the space. The difficulties of closing the second premolar extraction space by mesialisation of a wider root of first molars was also consideration for opting for first premolar extraction

Summary : The case report documented the treatment of a 12-year–old girl with severe skeletal class II malocclusion with over jet of 9 mm, 100% deep bite and Class II molar, canine and incisor relationships. She had a favourable horizontal growth pattern and at accelerated growth stage.
The functional appliance treatment was initiated using Twin Block appliance with 7mm mandibular advancement for 10 months. The 0.022 Pre-adjusted Edgewise Appliance (MBT) was initiated with extraction of all 1st premolars. After the initial leveling and alignment, retraction of maxillary anterior teeth was done using 0.019 x 0.025 stainless steel arch wire. Class II elastics was used for antero-posterior occlusal correction. Finishing and detailing was done after the space closure. The duration of fixed appliance treatment was 24 months.

Conclusions : A stable harmonious occlusion was achieved after 34 months of two stage treatment along with extraction of all 1st premolars. An upper and lower clear retainer and lower lingual bonded retainer were maintained to retain the stable occlusion.

P-91

Computerized Ultrasonic Axiographic Evaluation of the Condylar Movement in Patients with Internal Derangement of TMJ

Dong-wook Kim, Dae-Young Hwang, Min-Hee Oh, Kyung-Min Lee

Department of Orthodontics, School of Dentistry, Chonnam National University

Objectives : The purpose of this study was to evaluate the condylar movement during lateral excursion in individuals with internal derangement of the temporomandibular joint (TMJ) using ultrasonic axiography.

Material and Methods : Thirty-four patients with internal derangement of the TMJ and 34 participants in the control group were examined. Mandibular functional movement was recorded by ultrasonic axiography. Three-dimensional (3D) condylar movement was measured in the working and balancing condyles. Condylar movements including condylar paths in working and balancing sides, and 3D position of the working and balancing sides were recorded for each patient using an ultrasonic recording device. One-way analysis of variance with Scheffes multiple comparison tests and paired t-test were performed for statistical analysis.

Results : Significant differences in condylar movement were found between the two groups. In the group with internal derangement of the TMJ, the 3D linear distances of the condylar path in a working condyle were greater than in the control group during lateral excursion of the condylar movement. The speed of balancing condyle in the returning path of lateral excursion was significantly greater in the group with internal derangement than in the control group.

Conclusion : The results of the present study indicate that the internal derangement of TMJ may affect the working and balancing condylar movements during lateral excursion.

P-92

Three-dimensional analysis of facial morphology according to the gender and ages.

Kim Jae hyun[2], Mohammed Alfaifi[1,2], Lim Hee Jin[1,2], Kim Yoonji[1,3], Kook Yoon-Ah[1,2]

[1]Department of Orthodontics, Seoul St. Mary`s Hospital, The Catholic University of Korea
[2]Grauduate school, The Catholic University of Korea, Seoul, Korea
[3]Department of Orthodontics, Graduate School of Clinical Dental Science, The Catholic University of Korea

Objectives : The aim of this study was to determine the age-related changes in the facial morphology during adulthood in healthy Korean population and to evaluate sexual dimorphism for facial features.

Material and Methods : 3D soft tissue photographs of 220 adults (112 men and 108 women) selected from Korean general population were acquired. Subjects had been divided into 6 groups according to their gender and age. 60 landmarks of the Morpheus3D program were traced on all 3D photographs and 30 variables were measured and calculated. Association between gender and age group were assessed by chi-square test. Two-way multivariate analysis of variance (MANOVA) was applied to evaluate the differences between the groups.

Results : All volumetric variables were significantly greater in males than in females ($P < 0.001$), but they had no significant differences according to the age-group. Male groups had greater face volume and a longer and wider face than female groups as well as the nose in men was wider and longer than women. Effect of aging, the elder group had greater lower facial height, nasofrontal angle, and vertical curve of cheek than in the young group. Young group showed less protruded upper and lower lip than that of other groups. Also, the young group had greater mouth height; upper and lower vermilion areas and heights, total perimeter and Cupids bow height than other groups.

Conclusion : This study provides important information that may help in treatment planning for patients undergoing orthodontic treatment or orthognathic and plastic surgery at different age stages.

P-93

Cephalometric annotation using Deep Learning Algorithm

Ji-hye Nam[1], Jeong-eun Park[1], Ui-ryoung Lee[2], Hye-won Kim[1], Won-cheul Choi[1]

[1]Department of Orthodontics,Dental Center,Chung-Ang University Hospital
[2]Department of Oral and Maxillofacial Surgery, Chung-Ang University Hospital

Objectives : Currently, deep learning is being used actively for research in the dental field. We usally use lateral cephalometric, to identify the patient's condition and determine their orthodontic treatment plan. The aim of this study was to evaluate the accuracy of detecting anatomical structures using a newly-developed measurement algorithm applying deep learning on lateral cephalometric.

Material and Methods : The dataset of 100 subjects were used. Through the developed annotation tool, 19 landmarks were manually marked on the cephalography image. After learning the landmark detection task through the deep learning system, we derived the sensitivity, specificity and accuracy of each landmark using an automatic measurement program developed based on the Fully Convolutional Network (FCN).

Results : To estimate the accuracy of the landmark predicted by the developed algorithm, the distance between each landmark coordinate by the algorithm and the actual landmark was measured on the x- and y-axes. The landmark with the smallest error was Sella, and the landmark with the largest error was Gonion.

Conclusion : Through this study, the possibility of cephalography landmarking using Fully Convolutional Network deep learning algorithm was revealed. If a more sophisticated landmarking algorithm is developed by increasing the dataset, it will help to establish an accurate and efficient diagnosis and treatment plan.

P-94

Pattern of lip retraction depending on the presence of lip incompetence in Class II subject

MEILING FANG

Department of Orthodontics, The Institute of Craniofacial Deformity, College of Dentistry, Yonsei University

Objectives : The objective of this study was to compare the changes of soft tissues after extraction of 4 first premolars followed by retraction of anterior teeth, depending on the with or without lip incompetent.

Material and Methods : This retrospective study were selected from the adults patients (over 17 years) who had undergone extraction of 4 first premolars, followed by retraction of anterior teeth at the Department of Orthodontics, Yonsei University Dental hospital, between August 2004 and May 2018. The subjects were than divided into two groups, competent group consisted of 25 patients and incompetent group consisted of 23 patients. Lateral cephalograms were taken before and after treatment, and the changes of hard and soft tissues were evaluated.

Results : The ratio of movement between incisors and lips. In the competent group, maxilla is 2.73:1 mandible is 1.42:1. In the incompetent group, maxilla is 2.05:1 mandible is 1.26:1.
The correlation coefficients between movements of maxillary incisal edge and upper lip were 0.414 ($P < 0.05$) in competent group, 0.463 ($P < 0.05$) in incompetent group. The correlation coefficients between movements of mandibular incisal edge and lower lip were 0.402 ($P<0.05$) in competent group, 0.670 ($P<0.01$) in incompetent group.

Conclusion : The result suggests that the presence of lip incompetence affects the changes of lip profile. This study may provide the guidelines to orthodontists in deciding the extraction or non-extraction of the premolar for lip competence treatment. Not only the factors of biximallary, but also the lip incompetent was considered in predicting the postoperative outcomes.

P-95

Evaluation of mandibular position before and after splint therapy using a virtual articulator

Gye-Hyeong Lee[1,7], Hyun Kim[2,7], Eun-Jeong Kim[3,7], Yong-Seung Lee[4,7], Sang-Mi Lee[5,7], Da-Nal Moon[6,7]

[1]21st century Orthodontic Clinic, Yeosu
[2]Kim hyun orthodontic clinic
[3]Cleveland Orthodontic Clinic
[4]LEE Yong Seung Dental Clinic
[5]Star Orthodontic Clinic
[6]Seonigown Orthodontic Clinic
[7]Roth Orthodontic Society

Introduction : When a patient has an unstable occlusion and temporomandibular joint (TMJ), stabilization splint therapy is necessary for an accurate diagnosis. Previous studies have reported that a stabilization splint is much more effective than a bite plane splint or anterior positioning splint. Stabilizing splints cause a fibroses of the retrodiscal tissue of the TMJ, forming a pseudodisc which provides a favorable environment in which the mandibular condyle can be positioned and function reliably.

Discussion : Stabilization splint therapy stabilizes the TMJ, allowing clinicians to evaluate the patients proper TMJ position and thus develop a treatment plan based on the diagnosis. With this therapy, the patients condyle can be located in the uppermost position in the articular fossa with the psuedodisc interposed in the upper part, and thus most of the patients related symptoms are improved. This can be considered as having achieved a functionally stable, reproducible condylar position. After the condyle has been stabilized, diagnosis and a treatment plan should be established. When stabilizing the mandibular condyle with splint therapy, clinicians need to evaluate the sequential changes of the mandibular condyle and confirm that the mandibular condyle is stable.
To accomplish this, dental impressions and model fabrication are needed for the mounting process on the articulator, and a facebow is used to transfer functional and aesthetic components of the patients mouth at every visit of the patient.

Conclusion : Recently, thanks to digital technology, software allows a digital approach to the virtual facebow transfer and virtual mounting on the articulator. The purpose of this presentation is to introduce a novel way to evaluate the mandibular position before and after splint therapy using a single cone-beam computed tomography (CBCT) image and intraoral scans with a virtual articulator.

P-96

The effect of vertical skeletal pattern on clear orthodontic appliance treatment

Insung Chung, Chungju Hwang

Department of Orthodontics, The Institute of Craniofacial Deformity, College of Dentistry, Yonsei University

Objectives : The purpose of this study was to compare whether the post-treatment results of the removable clear orthodontic appliance will change significantly according to the pre-treatment vertical skeletal pattern of adult patients by using lateral cephalograms.

Material and Methods : In this study, I have analyzed patients who have mild crowding and have been treated by removable clear orthodontic treatment (Invisalign®, Align Technology) by non-extraction. Subjects are divided into two groups according to the mandibular plane angle (to SN), which corresponds to the low angle group (8 males and 21 females, mean age of 26.2 3.8 years) and the high angle group (9 males and 26 females; mean age, 28.6 4.7 years). After that, I compared the skeletal and dental measurements of both pre- (T1) and post-treatment (T2) using lateral cephalograms.

Results : 1. In skeletal measurement, low angle group showed more decrease of anterior facial height and posterior facial height than high angle group ($P<0.001$).
2. In posterior part of dental measurement, the amounts of intrusion in first and second molars were greater in low angle group than high angle group ($P<0.05$).
3. In anterior part of dental measurement, low angle group showed more increase of overbite than high angle group ($P<0.05$), and the distance from tip of mandibular incisor to horizontal reference line was significantly decreased only in low angle group ($P<0.001$).

Conclusion : Clinician should consider about the results that low angle patient, who received a non-extraction treatment using removable clear orthodontic appliance, were likely to experience more intrusion in the molars and consequently have decreased vertical facial height than high angle patient.

P-97

Can the RP model (RM) replace the Plater model (PM) in the Orthodontic Clinic?

Cheol-hyun Moon[1], Yoonkoo Kang[1], Sujung Lee[1], Youngtaek Gong[1], Seunghoon Oh[2]

[1]Department of Orthodontics, Gachon University Gil Dental Hospital
[2]Smile making dental clinic

Objectives : To determine the accuracy of the Rapid prototyping Model (RM) considering the degree of crowding.

Material and Methods : Among the Plaster Model (PM), twenty of maxillary and mandibular models with crowding of more than 8 mm for the maxilla and 6 mm for the mandible (Max.: 12.183.24 mm, Man.: 9.393.37 mm) were scanned with a model scanner. Based on this, 40 RM were fabricated. For the evaluation of reliability, validity and reproducibility, three researchers (R1, R2, R3) measured 18 items in each model. R1 measured twice, R2 and R3 measured once.

Results : Reliability; There was a significant difference ($p < 0.05$) in 4 items in PM and 24 items in RM. Validity; There was a significant difference ($p < 0.05$) in 3 items between PM and RM. Reproducibility; There were significant differences ($p < 0.05$) between researchers in 12 items in the PM and 15 items in RM. There were no items showing a difference of 0.5 mm or more between the researchers and the first and second measurements of the same researcher.

Conclusion : This study was conducted to evaluate the clinical usefulness of the RM. Even though there were statistically significant differences between PM and RM, the RM can be an alternative to the PM even though in crowding case, clinically.

P-98

Analysis of Skeletal and Dentoalveolar factors in Patients with Deep Overbite Malocclusio

Tae Hyun Kim[1,2], Young-Jin Seo[2], Yae-Jin Kim[1,2], Dong-Yul Lee[1,2]

[1]Department of Orthodontics, Korea University Guro Hospital
[2]Department of Orthodontics, Graduate School of Clinical Dentistry, Korea University

Objectives : Overbite is a discrepancy of numerous skeletal and dental factors and it should be viewed as a clinical manifestation of underlying discrepancies. the aim of this study was to investigate the various skeletal and dental factors of deepbite malocclusion, and investigate which factor has the greatest effect.

Material and Methods : Dental and skeletal measurements were made on lateral cephalometric radiographs and study models of 60 patients (F=35,M=25,19Y 4.6Y) with deepbite. Bite groups were divided into two groups; normal group (30 patients) and severe deepbite group (30 patients). These measurements were statistically analyzed. Independent two smaple t-test was performed to investigate statistical significance between two groups ($p< 0.05$). For analysis of contribution, correlation analysis and regression analysis were conducted.

Results : In dental factor, U1-PP, Column angle of U1, Curve of spee were statistically significant. In skeletal factor, gonial angle and LAFH/TAFH were statistically significant. There was no significant difference between Gonial angle and LAFH/TAFH. There was significant difference among Curve of spee, CA U1, U1-PP, which implies greater influences in order on overbite.

Conclusion : Overbite are associated with various dentoalveolar, skeletal factors. In dental factor, exaggerated curve of Spee was the greatest contributing components, in skeletal factor, a decreased gonial angle was the greatest contributing components. This analysis of deepbite components could help clinicians design individualized mechanotherapies based on the underlying cause.

P-99

The effect of impacted mandibular third molars on the axis of the mandibular second molars

Sooin Jung, Hosik Jang, Won Lee, Soonshin Hwang, Chooryung Chung, Kyung-Ho Kim

Department of Orthodontics, Gangnam Severance Dental Hospital, The Institute of Craniofacial Deformity, College of Dentistry, Yonsei University

Objectives : Preventive extraction of third molars is a topic of controversy and whether third molar can aggravate anterior dental crowding is still debatable. Furthermore, quantitative and qualitative analysis of position, angle, and torque of adjacent mandibular second molar is yet insufficient. This study investigated the effect of impacted third molar on the axial angle of adjacent second molars during the post-orthodontic maintenance period.

Material and Methods : Panoramic x-ray was used and 132 quadrants were evaluated. We measured changes in angle of mandibular second molar and angle between mandibular second molar and first molar over 5 years after debonding. Furthermore, the axis of second molar and angular changes in first and second molars depending on age, sex, depth and angle of third molar were analyzed.

Results : Mandibular second molars were tilted distally about 2Ơuntil after 5 years post-treatment in patients with remaining mandibular third molar at the end of treatment. Depth of third molars at the end of treatment was not correlated to change of axis in second molars($p>0.05$). Angle of third molars and distal tilting of third molar had a low positive relationship. Age and sex were not correlated to change of axis in mandibular second molar after 5-years following treatment.

Conclusion : Mandibular second molars were tilted distally until after 5 years post-treatment in patients with remaining mandibular third molar at the end of treatment compared to those without mandibular third molar.

P-100

Full-mouth tooth agenesis patterns in non-syndromic oligodontia patients in Japan

Ayaka Sato, Kazuhito Arai

The Nippon Dental University School of Life Dentistry at Tokyo

Purpose : Oligodontia refers to a severe type of hypodontia that is characterized by agenesis of six or more permanent teeth excluding the third molars, and characterized as wide individual variation. Tooth agenesis pattern has been often evaluated in each quadrant but characteristics of full-mouth tooth agenesis pattern (FMTAP) in patients with non-syndromic oligodontia in orthodontic patients is not well understood. The present study aimed to investigate the prevalence of FMTAP in Japanese orthodontic patients with non-syndromic oligodontia.

Materials and methods : Two orthodontists independently evaluated panoramic radiographs of 92 orthodontic patients with oligodontia (64 females and 28 males, age range, 13-32 years; mean age, 17.5 4.4 years) and recorded the tooth agenesis excluding third molars in each image. Each patients dental status was evaluated for each dental quadrant and four quadrants were combined as FMTAP. Female and male ranking of prevalence of FMTAP was calculated by the pivot table function of Microsoft Office Excel 2013 (Microsoft, Redmond, Wash).

Results : We found 83 patterns of FMTAP. Most frequently observed pattern included agenesis of bilateral maxillary first and second premolars and mandibular second premolars (five patients, 5.4%), followed by first and second premolar agenesis for all the four quadrants (4 patients, 4.3%).

Conclusions : FMTAP in non-syndromic oligodontia in Japanese orthodontic patients was highly variable and commonly observed patterns include premolars.