

## Abstracts

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AN\*, Xiao-Chun, Je-Hoon LEE\*, and Seung-Ho HAN, Department of Anatomy, Catholic Institute for Applied Anatomy, College of Medicine, The Catholic University of Korea, Seoul, Korea. **Anatomic study of the localization of motor points and the intramuscular nerve supply to the hamstring muscles.**

Fifty lower limbs from 27 fresh cadavers were dissected to elucidate the anatomical location of the motor point and intramuscular nerve distribution of hamstring muscles. The point where the nerve branch first pierced the muscle belly was defined as the motor point (MP). The intramuscular branches located most proximally and distally were defined as proximal limit (PL) and distal limit (DL) respectively. The MP, PL, and DL were measured along a reference line from the superior medial aspect of the ischial tuberosity to the most proximal aspect of the medial femoral condyle. The MP, PL and DL of long head were located at 41.9, 39.6, and 72.9% of the reference line while for short head at 57.3, 58.9, 80.2%, and for semimembranosus muscle at 62.8, 65.9, and 89.1% of the reference line. The semitendinosus muscle could be divided into two parts according to the intramuscular distribution and for the upper part the data were 20.5, 18.6, and 36.8% while for the lower part were 60.0, 56.6, and 79.1% of the reference line. The results of this research were capable of providing useful guidelines for good practice of selective chemodenervation of hamstring spasticity.

ANANTHARAYA Vinodini N\*, Anu V RANADE\*, Raghuvver C. VASUDEVAN\*, Rekha D. KINI\*, and Nayanatara A. KUMAR\*, Kasturba Medical College, Mangalore, Karnataka, India. **Spermatogenic disturbance induced by testicular torsion and detorsion is significantly prevented by treatment with antioxidant vitamin C in the rat.**

The effect of a testicular torsion leading to the possible loss of a gonad within few hours is well known. Delay in operative intervention remains the dominant factor governing testicular survival. Previous studies have shown that use of antioxidants in the prevention of testicular reperfusion injury following detorsion is conflicting. This study was conducted to know the role of Vitamin C on testicular torsion and detorsion in rats. Male Wistar albino rats were divided as Group I–Group IV. The animals of Group IV were orally pretreated with Vitamin C for 30 days (40 mg/kg bw). The testis was manually rotated 720° clockwise and counter rotated to induce ischemia and reperfusion. The testis was fixed in Bouin's fluid and processed for histopathological examination. There was a significant decrease seen in the standard tubular diameter and the epithelial height in untreated group compared to Normal and Sham controls. However, the animals of Vitamin C treated group, showed a recovery in their standard tubular diameter and epithelial height when compared to their untreated control groups. Therefore this study shows that antioxidant vitamin C can prevent testicular damage as it can block the release of oxygen free radicals.

ANDREWS\*, Kelly, Brion BENNINGER, and Karen RICHARDS, Department of Oral Maxillofacial Surgery, Oregon Health and Science University, Portland, Oregon, Department of Integrative Biosciences, Oregon Health and Science University, Portland, Oregon, Department of Surgery, Oregon Health and Science

University, Portland, Oregon, Department of Periodontal Surgery, Oregon Health and Science University, Portland, Oregon. **Clinical measurements of the hard palate and implications for subepithelial connective tissue grafts with suggestions for palatal nomenclature.**

The objectives of this study were to identify a reliable measuring technique regarding a palatal graft, observing patterns of the neurovascular bundle and identifying morphology of the hard palate. Sub-epithelial connective tissue grafts (SCTG) are performed at an increasing rate to improve aesthetics and oral health. Palatal graft techniques commenced in 1963 and today the SCGT is the most widely accepted technique. The greater palatine nerve and artery (GPN/GPA) are critical neurovascular structures to identify. Their pattern and palate morphology are not well defined. We dissected 34 palates from embalmed human cadavers, implementing a new measuring technique to locate the GPA-GPN bundle, observing patterns and palatal morphology. Electronic digital calipers were used for data collection. Anatomy texts and atlases were analyzed. Results revealed a reliable measuring technique, a common pattern of the bundle and osseous palatal landmarks, which are poorly defined in contemporary texts. Dissections also demonstrated a medial and lateral groove along with a crest in the palatine process of the maxillary bone. The GPA traversed the lateral groove and the GPN traversed the medial groove consistently. The crest was located anteroposteriorly between the grooves. This work suggests a measurement technique, a consistent neurovascular pattern and reconsidering palatal nomenclature.

APAYDIN, Nihal,<sup>1\*</sup> Marios LOUKAS,<sup>2</sup> Richard S. TUBBS,<sup>3</sup> Ali F. ESMER,<sup>1\*</sup> and Murat BOZKURT,<sup>4\*</sup> <sup>1</sup>Department of Anatomy, Ankara University School of Medicine, Ankara, Turkey, <sup>2</sup>Department of Anatomical Sciences, St. George's University, Grenada, West Indies, <sup>3</sup>Section of Pediatric Neurosurgery, University of Alabama at Birmingham, Birmingham, Alabama, <sup>4</sup>Third Clinic of Orthopaedics and Traumatology, S.B. Diskapi Yildirim Beyazid Research and Education Hospital, Ankara, Turkey. **The course of the inferior gluteal nerve and surgical landmarks for its localization during posterior approaches to the hip.**

The position of the inferior gluteal nerve (IGN) makes it vulnerable to iatrogenic injury during posterior and posterolateral approaches to the hip. Although the posterior approach has been reported to be the most frequently used technique, it is most likely to be associated with damage to the IGN. As there is scant information in the literature regarding the course and the anatomic relationships of the IGN, we aimed to investigate the anatomic course of the IGN and to define anatomical landmarks that can be used by surgeons during posterior approaches to the hip. Thirty-two gluteal regions from adult fixed cadavers were used for this study. A triangular-shaped anatomic area that contains the IGN was defined. This geometric area was formed by connecting the following points: posterior superior iliac spine (PSIS) (apex), ischial tuberosity (IT) and greater trochanter (GT). The closest mean distance between the IGN and the PSIS, IT and the GT was 3.2, 5.4, and 4.8 cm, respectively. In all specimens, the nerve entered the deep surface of the gluteus maximus ~4.8 cm from the apex of the GT and approached the GT as close as 0.8 cm on average. On the basis of our study,

BLITZ, Neal M.\* and David J. ELIOT, Department of Orthopedics and Foot and Ankle Surgery, Kaiser North Bay Consortium Residency Program, Kaiser Permanente Medical Centers, Santa Rosa, California, Department of Anatomy, Touro University California, Vallejo, California. **Anatomical aspects of the gastrocnemius aponeurosis and its muscular bound portion—A cadaveric study.**

Gastrocnemius recession surgery is performed to weaken the gastrocnemius muscle's plantarflexory action on the foot. Recent literature demonstrates that surgeons are targeting the anterior muscular-bound aponeurosis as an anatomical location for this lengthening. The area that is available to divide the aponeurosis ("transection zone") is inferior to the region where the aponeurosis is formed by the separate tendons of the medial and lateral heads of gastrocnemius and superior to the nonmuscular-bound aponeurosis. The dimensions of the transection zone have not been studied previously. The mean proximal-to-distal length of the transection zone was 50 mm (range 7–100 mm). Its mean width was 88 mm (48–119 mm). The mean lengths of the medial and lateral heads that were inferior to the transection zone were 40 and 22 mm, respectively. The zone is often long enough for surgeons to make the transection within the zone; a more distal incision will free a greater amount of muscle from its plantarflexory action. An oblique incision that is more distal medially may be appropriate if the transection zone is short, if the transection is far distal in the transection zone, and/or the medial head extends far distal to the lateral head.

BRUECKNER, Jennifer K., Douglas GOULD, Geoffrey GUTTMANN, Brian R MACPHERSON, Bruce MALEY, and Don M. GASH\*, Department of Anatomy and Neurobiology, University of Kentucky College of Medicine, Lexington, Kentucky, The Ohio State University College of Medicine, Columbus, Ohio. **Recruiting the next generation of educators through creation of a graduate certificate in anatomical sciences instruction.**

The paucity of faculty qualified to teach anatomy in health professional programs is well documented in the recent literature. The University of Kentucky Educational Research Group developed an incentive in the form of a Graduate Certificate in Anatomical Sciences Instruction to provide a coherent, integrated approach to helping graduate students, postdoctoral scholars, residents, faculty and staff to develop the skills needed in order to effectively teach anatomy. This 12-credit hour Certificate, including a required 3 credit hour supervised practicum experience, provides basic competency in graduate-level anatomical sciences instruction and provides participants with documentation of their abilities. The Certificate is accessible to participants from a wide range of disciplines and backgrounds and provides practical, hands on anatomy coursework and instructional mentoring. The Certificate is intended to improve the job placement for our graduates, to provide recognition for graduate student professional development in teaching-related efforts, as well as additional resources and avenues for teaching assistant development.

BUNTON, Timothy J.\*, Craig W. GOODMURPHY, and Stephanie FREUND\*, Department of Pathology and Anatomy, Eastern Virginia Medical School, Norfolk, Virginia. **The incidence and relationship between the presence of palmaris longus and fibularis tertius.**

Palmaris longus and fibularis tertius are two muscles within the human body that enjoy variable expression in the population. Palmaris longus is thought to be devolving and fibularis tertius evolving. Although the prevalence of these muscles has been studied individually, it has yet to be determined whether their presence or absence is linked. In the course of our study we dissected 49 human cadavers and searched for a correlation between the absences of palmaris longus and fibularis tertius. The palmaris longus muscle was found to be missing in 18% of the total arms studied. Fibularis tertius was missing in 18% of the total legs studied. These results

are similar to previous studies by other investigators. Of the 49 bodies, 18 were missing one or both of the muscles of interest and were used to look for correlations between the absences of the two muscles. Of the bodies missing palmaris longus or fibularis tertius either bilaterally or unilaterally, 20% were also missing the other muscle. These are similar to incidences found in our general study population (18%/18%), and no statistically significant correlation was found ( $P = 0.74$ ), indicating no relationship between the presence or absence of these muscles.

BUNTON, Timothy J.\*, Craig W. GOODMURPHY, and Stephanie FREUND\*, Department of Pathology and Anatomy, Eastern Virginia Medical School, Norfolk, Virginia. **The incidence and relationship between the presence of palmaris longus and fibularis tertius.**

Palmaris longus and fibularis tertius are two muscles within the human body that enjoy variable expression in the population. Palmaris longus is thought to be devolving and fibularis tertius evolving. Although the prevalence of these muscles has been studied individually, it has yet to be determined whether their presence or absence is linked. In the course of our study we dissected 45 human cadavers and searched for a correlation between the absences of palmaris longus and fibularis tertius. The palmaris longus muscle was found to be missing in 16% of the total arms studied. Fibularis tertius was missing in 18% of the total legs studied. These results are similar to previous studies by other investigators. Of the 45 bodies, 16 were missing one or both of the muscles of interest and were used to look for correlations between the absences of the two muscles. Of the bodies missing palmaris longus or fibularis tertius either bilaterally or unilaterally, 22% were also missing the other muscle. Although these are higher incidences of absence than in our general study population (16%/18%), the correlation is statistically insignificant ( $P = 1$ ), indicating no relationship between the presence or absence of these muscles.

CANTELMI, David, Tom A. SCHWEIZER\*, Anne M. AGUR, and Michael D. CUSIMANO\*, Division of Neurosurgery, Department of Surgery, St. Michael's Hospital, University of Toronto, Toronto, Ontario, Canada, Division of Anatomy, Department of Surgery, University of Toronto, Toronto, Ontario, Canada. **The contribution of the cerebellum in the neurocognitive sequelae of posterior fossa tumor treatment.**

**Introduction:** Neurocognitive impairments often occur following treatment of posterior fossa tumors. These impairments have been attributed to supratentorial damage resulting from radiotherapy, despite the fact that nonirradiated patients also present with similar impairments. Other research has suggested that the cerebellum may play a role in cognition. The purpose of this study was to conduct a literature review of the cognitive role of the cerebellum, and link these findings to neurocognitive deficits of posterior fossa tumor patients. **Methods:** A comprehensive literature review was conducted using Medline, PsychInfo, and Web of Science. All relevant studies from 1979 to December 2007 were included. **Results:** The cognitive functions impaired in patients with posterior fossa tumors are consistent with those that have been related to the cerebellum. **Treatments that reduce radiation dose to supratentorial brain areas have only resulted in small improvements in neurocognitive functions, because these treatments do not reduce damage to the cerebellum.** **Conclusion:** Neurocognitive sequelae in posterior fossa tumor patients are determined by a combination of factors including extent of cerebellar damage and the use of radiotherapy. **Future research needs to account for all of these factors to ensure improved outcome for posterior fossa tumor patients.**

CHUNG<sup>1</sup>, In-Hyuk, Kyu-Seok, LEE<sup>2</sup>, Chang-Seok, OH<sup>3</sup>, and Seung Min KIM<sup>4</sup>, <sup>1</sup>Department of Anatomy, Yonsei University College of Medicine, <sup>2</sup>Department of Anatomy, Kwandong University College of Medicine, <sup>3</sup>Department of Anatomy, Samsung Biomedical

KIM, Soo Y., Robert R. BLEAKNEY\*, Tim RINDLISBACHER\*, Erin L. BOYNTON\*, Denyse RICHARDSON\*, and Anne M. AGUR, <sup>1</sup>Division of Anatomy, Department of Surgery, <sup>2</sup>Department of Medicine and Medical Imaging, University of Toronto, Cleveland Clinic Canada, Sports Medicine Institute, Toronto, Canada. **In vivo ultrasonographic investigation of the musculotendinous architecture of supraspinatus in subjects with rotator cuff tears: A pilot study.**

**Introduction:** In vivo ultrasound (US) of supraspinatus (SP) muscle with tendon tears can be used to assess musculotendinous changes. Previous US studies have been qualitative, focusing on fatty-muscle atrophy; quantitative measurements of architectural parameters have not been investigated. **Purpose:** To quantify the in vivo musculotendinous architecture of SP in relaxed and contracted states in subjects with a 1–2 cm full-thickness anterior tendon tear using US. **Methods:** SP was scanned in three subjects (1M/2F), mean age 57 ± 7 years. The shoulder was scanned in neutral and 60° abduction. Fiber bundle length (FBL) and pennation angle (PA) were computed for each architecturally distinct region of SP. Data was compared with age/gender matched subjects without pathology. **Results:** In pathological subjects, fiber bundles of the anterior region of SP shortened 14.7% on contraction into 60° abduction, whereas in controls fiber bundles shortened 31%. Percentages of fiber bundle shortening of the posterior region were similar between the pathological subjects and controls. In pathological subjects, mean PA of the anterior region increased 23.4%, whereas in controls mean PA increased 67.8%. **Conclusion:** The large differences in dynamic changes of architectural parameters in pathological subjects when compared to normal controls suggest that evaluation of both muscle and tendon changes may be important when planning treatment.

KOWALÓWKA\*, Adam, Jerzy, GIELECKI, and Anna, ZURADA, Department of Anatomy, Medical University of Silesia, Poland. **Digital-image analysis of the subclavian artery in human fetuses.**

The left and right subclavian artery (SA) have their different origin. The left SA usually branches straight from the aortic arch and the right from the brachiocephalic trunk. The purpose of the study was morphological and morphometric analysis of the SA during fetal period of development. The study was performed on 70 spontaneously aborted fetuses in the age between 4th and 7th months of gestation. The arteries of fetuses were injected with a mixture of latex and detergent. After fixed in 4% formalin, the SAs have been dissected. The digital-image analysis system DIAS-08 was used for the measurement of the diameter, length and volume. The statistically significant differences were to be found between the right and left SA in the length and volume. The mean left SA length was 6.51 mm for 4th month group, 8.96 mm for 5th, 10.87 mm for 6th and 13.45 mm for 7th month group age. Accordingly, the mean length for the right SA was as follow 5.82 mm (4th), 7.34 mm (5th), 8.83 mm (6th) and 12.74 mm (7th). The precise morphometric knowledge of the SA may be helpful for the analysis of development of the fetuses and their clinical significance may be discussed in the follow studies. (Sponsored by J Gielecki).

KRISHNAN, Subramaniam and Munisamy MAHALINGAM, Department of Anatomy, Faculty of Medicine, University of Malaya, Kuala Lumpur, Malaysia. **Morphometric studies on the hypoglossal canal.**

The hypoglossal canal transmits the hypoglossal nerve, an emissary venous plexus and a dural artery. The nerve can be compressed in the canal due to skull base tumors, schwannomas or ganglion cysts resulting in speech disturbances. In the present investigation, the morphological characteristics and dimensions were evaluated in macerated Asian skulls ( $n = 62$ ). Measurements (in millimeters) were done using calipers and a micrometer screw gauge for evaluating diameters (vertical and horizontal) and a fine wire for measuring canal length. The right internal canal diameter was  $5.29 \pm 0.75$  [range: 3.37–7.41] whereas the external diameter was  $5.45 \pm 0.61$  [range: 3.26–7.60]. On the left side, the internal diameter measured

$5.65 \pm 0.53$  [range: 3.45–6.40] whereas the external diameter was  $6.11 \pm 0.32$  [range: 3.19–7.33]. There was no significant difference between both sides ( $P \leq 0.05$ ). A double canal was seen in 36% and a triple canal was seen in a single skull. The shape of the internal opening was either circular or oval (74%), teardrop (16%) or dumbbell (10%). The canal length measured  $8.33 \pm 1.88$  [range: 6.42–11.26]. The characteristics of the canal direction were variable and could not be quantified. These results form a useful database for the differential diagnosis of speech disturbances.

KRISHNAN, Subramaniam, Department of Anatomy, Faculty of Medicine, University of Malaya, Kuala Lumpur, Malaysia. **The neuroanatomy curriculum: Current trends and future implications in medical education.**

The neuroanatomy curriculum has come under increasing scrutiny because of vast changes in the educational landscape due to contemporary teaching-learning innovations. The purpose of this study was to evaluate variations in the neuroanatomy course in an attempt to establish a core curriculum for general reference. Twenty-two neuro-anatomical curricula from geographically diverse schools and representing different educational formats (traditional, systems-based, problem based or a combination mix) were evaluated blindly to avoid bias. The parameters studied included range of topics, contact hours (lectures, tutorials and laboratory sessions), hands-on demonstrations, clinical correlations, written assignments and assessment modes. The results showed wide variations. The hours ranged from 3 to 33 (lectures), 0 to 15 (tutorials), and 6 to 33 (laboratory sessions). In addition, it was noted that standardized assessment procedures were not adopted for almost a third of the curricula studied where the methods were arbitrary. It was further evident that there were substantial gaps in the knowledge base in some curricula. Also, in several cases, the syllabus did not come with well defined and measurable learning objectives. A core neuroanatomy curriculum has now become a necessity incorporating a combination of didactic teaching methods and including a substantial portion of student-directed learning activities to prepare them for the clinical years ahead.

KRYSKI<sup>1</sup>\*, Diana G., Michael J. WILEY<sup>2</sup>, Jodie JENKINSON<sup>3</sup>\*, Nicholas WOOLRIDGE<sup>3</sup>\*, and Michael CORRIN<sup>3</sup>\*, <sup>1</sup>Graduate student Msc. BMC Program, Biomedical Communications, Institute of Medical Science, Faculty of Medicine, University of Toronto, <sup>2</sup>Department of Surgery, Division of Anatomy, University of Toronto, <sup>3</sup>Biomedical Communications, Institute of Communication and Culture, University of Toronto, Mississauga. **Enhancing medical students' clinical reasoning ability through visualization of spatially complex gross anatomy with a computer-based, three-dimensional model of the pterygopalatine fossa.**

A web-based interactive 3D model of the pterygopalatine fossa (PPF) and related neurovascular structures was developed and evaluated against a comparable 2D model for its effectiveness at enhancing undergraduate anatomy and medical students' spatial and clinical understanding of the PPF. This understanding is crucial to physicians' diagnosis and treatment of disease conditions involving the PPF, such as the perineural spread of tumor. The boundaries of the PPF were isolated within a 3D model of the skull, and neurovascular structures were modeled in Cinema 4D, including the trigeminal ganglion, maxillary division and branches, pterygopalatine ganglion, and maxillary artery and branches. Users can control both the rotational view and opacity of the model layers, toggle between visible nerves, arteries, or both, view structure labels and descriptions as well as nerve pathways on mouse rollover. An identical 2D version of the module was developed (rotation disabled). Volunteer participants in medicine and anatomy were divided into "2D" (control) and "3D" (experimental) groups, completed a knowledge pretest, were exposed to their assigned module, and completed a post-test. The average score between pre- and post-test for each group was compared (funded in part by the Vesalian Scholar Award from the Vesalius Trust for Visual Communication).

LEE, Sat-Byol\*, Jeong-Yong LEE\*, Wu-Chul SONG\*, Ki-Seok KOH\*, and Soon-Heum KIM\*, Department of Anatomy, Department of Plastic and Reconstructive Surgery, School of Medicine, Konkuk University, Seoul, Korea. **Analysis of lower face in Korean—An anthropometric study.**

In human, distinctive change of lower face and lip was showed as human gets older. However, there was no reliable data of lower face of Korean. The purpose of this study is anthropometric analysis of mouth and lower face for aesthetic and reconstructive surgery. The standardized photographs of 2,018 healthy volunteers were investigated. The data were analyzed and compared in three age groups. All results were larger in male than female and the differences were decreased with age. Most lengths were decreased with age, but length of mouth corner and width of lower face were increased with age. The height of lip is less than 10 mm and the lower lip is higher than upper lip. The tangential length of nose-mentum is 60% of lower facial width and the width of mouth is 60% of tangential length of nose-mentum. Most Koreans showed relatively prominent lower face because of mandibular development. The soft-tissue droop of lower face was one of the significant changes of aging. The results elucidated the senile change of the face of Koreans and demonstrated that Korean has relatively more protruded and wide lower face than Caucasian.

LEE, U-Young<sup>1\*</sup>, Mi-Sun LEE<sup>1\*</sup>, Jae-Hoon LEE<sup>1\*</sup>, Yong-Seok NAM<sup>2\*</sup>, and Seung-Ho HAN<sup>1</sup>, <sup>1</sup>Department of Anatomy, Catholic Institute for Applied Anatomy, College of Medicine, The Catholic University of Korea, Seoul, Republic of Korea, <sup>2</sup>Department of Plastic Surgery Research Professor and BK21 project, College of Medicine, Inha University, Incheon, Republic of Korea. **Relative direction and position of recurrent laryngeal nerve for anatomical configuration.**

This study aims to describe the course of the recurrent laryngeal nerve (RLN) using the tracheoesophageal groove (TEG) at the cricothyroid joint as a base line, and the configuration of RLN and inferior thyroid artery (ITA) for careful dissection in thyroid surgery. Sixty-four cadavers were investigated. The angle of RLN from TEG was measured at the cricothyroid joint. The relative position of RLN to ITA was classified. The location of the contacting point of RLN with ITA was measured and converted as an index. The RLN of left side is likely to be found posterior to ITA and course mainly from 0° up to 30° based on TEG near cricothyroid joint while the nerve of right side is likely to be found anterior to ITA in right side and course mainly from 15° up to 30° based on TEG. The contacting point of RLN with ITA locate from the tip of cricoid cartilage at about three tenth of the distance from the tip of cricoid cartilage to sternal notch without reference to individual body size. These findings suggest the area for careful dissection near cricothyroid joint, the configuration of RLN for identifying the nerve.

LEYNES\*, Peter, Marc DRYER\*, Nicholas WOOLRIDGE\*, David PEARSALL, and Anne AGUR, Biomedical Communications, Institute of Communication and Culture, University of Toronto at Mississauga, Ontario, Division of Anatomy, Institute of Medical Science, University of Toronto, Ontario, Department of Kinesiology and Physical Education, McGill University, Montreal, Quebec, Canada. **High-calibre skating: Comparing skating techniques between low- and high-calibre hockey skaters with anatomically accurate three-dimensional animation.**

There is currently a lack of adequate visualizations for sports kinematics that clearly display the fine detail of motion and relate it to the actions of specific anatomical components. The human body moves in three dimensions and its movements are not easily conveyed in two-dimensional, static images. The main goal of this pro-

ject is to create a three-dimensional animation that demonstrates to hockey players and coaches the main kinematic differences between novice and advanced hockey skaters. The animation focuses on stride width, stride length, degrees of hip and knee flexion and knee abduction. By revealing the actions of specific muscles and joints in achieving these poses, the animation helps athletes to mentally visualize the anatomy involved and to fine-tune their skating technique. Secondly, this project attempts to develop a streamlined work flow for producing anatomically accurate three-dimensional visualizations. The animation is guided by motion capture data of low- and high-caliber skating strides and 3D muscle simulation. Autodesk Maya(TM) was used to model, render, and animate the visualization. Editing and compositing was done in Adobe After Effects(TM). Hockey players and coaches will evaluate the effectiveness of the final animation. This resource is not available for purchase from national publishers/resellers.

LORIAN\*, Adi, Ilan KOREN\*, Mimi EINREICH\*, and Tamar SCHIRMAN\*, Research division of Brainsgate Inc. **Surgical access to the sphenopalatine ganglion via the oral cavity for placement of a stimulating electrode in treatment of ischemic stroke patients.**

The sphenopalatine fossa has a protected position and a complex neurovascular anatomy. The narrow inverted pyramidal shape space is located between the posterior wall of the maxillary antrum and lateral and medial pterygoid plates. The sphenopalatine ganglion, harbored in the fossa, is the source of parasympathetic innervation to the lacrimal, pharyngeal, nasal and palatal glands as well as to the anterior cerebral circulation (via the Medial Cerebral Artery), thus regulating cerebral blood flow in the anterior part of the brain. Our goal was to determine the position of the vital structures of the sphenopalatine fossa and to develop a safe, precise and minimal invasive procedure that allows insertion of an electrode to stimulate the ganglion. We used in this study 66-dry skulls in order to prepare anatomical landmarks for the oral cavity approach and 200 fresh frozen specimens to determine the anatomical relations of the vital structure in the sphenopalatine fossa. The study lead to the development of an innovative surgical technique using custom made surgical instruments that allow insertion of an electrode in the vicinity of the sphenopalatine ganglion.

LOUKAS, Marios and R. Shane Tubbs, Department of Anatomical Sciences, St. George's University, Grenada, West Indies, Department of Cell Biology, University of Alabama at Birmingham, Alabama. **Cardiac anatomy and embryology: Correcting anatomical errors.**

As with many anatomical structures, the heart continues to have inaccurate descriptions of its anatomy in standard anatomical textbooks. Cardiac structures have consistently and inappropriately been considered in the setting of the heart positioned on its apex, with the atria superior to the ventricles. Another example is that standard anatomy and embryology books fail to recognize that the only true interatrial septum is the fossa ovale and that the rims of the fossa ovale represent atrial infolding filled with extracardiac adipose tissue i.e. there is no septum secundum. Similarly, anatomy books include erroneous notions such as the "Torrent-Guasp" theory regarding myocardial bands, a concept which has no foundation in anatomic fact. Another structure that is erroneously included in anatomy textbooks as part of the fibrous skeleton of the heart is the tendon of the infundibulum. In addition, the tubercle of Lower is still described as a structure of the right atrium, which according to our knowledge is not present in human hearts. Lastly, the importance of the collateral blood supply to the heart and its development from preexisting non functional capillaries (arteriogenesis) is neglected in the majority of anatomy textbooks. We review such misconceptions and provide an evidence-based approach at correcting such incorrect literature.

LUFLE<sup>1</sup>, Rebecca S., Tony TANNOURY<sup>2\*</sup>, Jared TOMAN<sup>2</sup>, Joshua J. STEFANIK<sup>1</sup>, Chad W. FARRIS<sup>1</sup>, and Todd M. HOAGLAND<sup>1</sup>, <sup>1</sup>Department of Anatomy and Neurobiology, Boston University School of Medicine, Boston,

the more the time lapse after the onset of the hearing loss, the more the changes and the hardening of the footplate cartilage took place.

**RANADE, Anu V.\*, Raghuvver C. VASUDEVAN\*, Vinodini N. ANANTHARAYA\*, Rekha D. KINI\*, and Nayanatara A KUMAR\*, Role of administration of vitamin E on the histopathological changes in the rat testis following torsion and detorsion. Testicular torsion is a medical emergency, especially in neonatal or adolescent males.**

Testicular atrophy is a common clinical outcome and is a significant urological issue. It is evident from literature that use of antioxidants in the prevention of testicular reperfusion injury following detorsion is conflicting. This study was designed to know the role of Vitamin E on testicular reperfusion injury following detorsion. Male Wistar albino rats were divided into Group I, II, III, and IV. The animals of Group IV were pretreated with 100 mg/kg bw Vitamin E for 30 days. Ischemia was induced manually by rotating the testis 720° clockwise and counter rotated for reperfusion. The testis was fixed in Bouin's fluid and processed for histopathological examination. This study showed a significant decrease in the standard tubular diameter and the epithelial height in Group III compared to Group I and II. However, upon pretreatment with vitamin E (Group IV) the seminiferous tubules in these animals showed a recovery in the standard tubular diameter and epithelial height when compared to their untreated control groups. The results of this study showed that vitamin E can offer better protection as it can block the release of oxygen free radicals from many sources. (Sponsored by Medical Education and Research Trust, Karnataka).

**RASK\*, Ted and Brion BENNINGER, Department of Oral Maxillofacial Surgery, Department of Integrative Biosciences, Department of Surgery, Oregon Health and Science University, Oregon. Using 3D visual anatomy; Visual Human Dissector Pro™ improves navigation of imaging anatomy.**

Does exposure to 3D anatomical images at twice weekly intervals as formal presentations improve students' navigation of imaging anatomy? Many anatomical courses are incorporating radiological anatomy using various image mediums based on 2D imaging. One of the challenging skills for any healthcare provider or anatomist is the ability to recognize and understand the relationships of various anatomical structures on cross-sectional images. Several texts and computer programs demonstrate static 2D cross-sectional anatomy with excessively labeled images. We chose a 3D human anatomy program to better aid orientation and knowledge of anatomy. Using Visual Human Dissector Pro™ on an actual 3D screen (6 ft × 15 ft) designed for Oregon 3D, students received a 15-min informative navigational tour of human anatomical cross-sections which related to corresponding radiology. We applied cognitive load theory throughout the study. Following each tour, students entered the dissection lab and compared CT and MRI cross-sections with the day's dissection in lab. We assessed their knowledge of radiological anatomy, ability to navigate images, and comfort levels. Results revealed both high scores on didactic exams and increased comfort levels when assessing anatomy from images. This suggests, students benefit when exposed to 3D anatomy prior to lab dissection and radiological images.

**RAVICHANDIRAN Kajeendra<sup>1</sup>, Mayoorendra RAVICHANDIRAN<sup>1</sup>, Karan SINGH<sup>1\*</sup>, Michele OLIVER<sup>3\*</sup>, Nancy MCKEE<sup>1\*</sup>, and Anne AGUR<sup>1</sup>, <sup>1</sup>Division of Anatomy, Department of Surgery, University of Toronto, Toronto, Ontario, Canada, <sup>2</sup>Department of Computer Science, University of Toronto, Toronto, Ontario, Canada, <sup>3</sup>Biological Engineering, University of Guelph, Guelph, Ontario, Canada. Comparison of computation of physiological cross sectional area directly from a 3D computer model and indirectly from equation based methods.**

**Introduction:** Physiological cross-sectional area (PCSA), used for muscle force comparisons, has been calculated by  $PCSA = Volume \cdot \cos(PennationAngle) / Fiber\ Bundle\ Length$ . This calculation is based on idealized whole muscles rather than individual fiber bundles. **Purpose:** To compute PCSA of extensor carpi radialis brevis (ECRB) and pectoralis major (PM) directly from muscle models, constructed from densely digitized fiber bundle (FB) data, and compare with the muscle level equation. **Methods:** Digitized FBs of ECRB (100–150 FBs/muscle;  $n = 8$ ) and PM (700–800 FBs/muscle;  $n = 3$ ) were used to construct 3D models. For the equation, PCSA was calculated using means of all digitized bundles for its parameters. To determine PCSA directly from the model, each FB was represented as a cylinder with a radius half the distance to the closest digitized FB; all FBs'  $CrossSectionalArea \cdot \cos(PennationAngle)$  were summated. **Results:** PCSA methods compared with paired t-test showed no statistical significance ( $P < 0.05$ ) for either muscle. Computationally, PCSA of ECRB was  $6.11 \pm 1.29\ cm^2$  and from equation  $5.73 \pm 1.33\ cm^2$ ; PM  $18.02 \pm 1.69\ cm^2$ ,  $18.23 \pm 2.04\ cm^2$ , respectively. **Conclusion:** Fick (1911) emphasized the importance of including the CSA of all muscle FBs when defining PCSA. Many muscles do not have a single plane where all muscle fiber bundles are found due to varying FB arrangements (Brand, 1981). Use of densely digitized FBs assures inclusivity of FBs and overcomes concerns about sparse fiber bundle parameter measurements.

**RAVICHANDIRAN Mayoorendra<sup>1</sup>, Kajeendra RAVICHANDIRAN<sup>1</sup>, Karan SINGH<sup>1\*</sup>, Michele OLIVER<sup>3\*</sup>, Nancy MCKEE<sup>1\*</sup>, and Anne AGUR<sup>1</sup>, <sup>1</sup>Division of Anatomy, Department of Surgery, University of Toronto, Toronto, Ontario, Canada, <sup>2</sup>Department of Computer Science, University of Toronto, Toronto, Ontario, Canada, <sup>3</sup>Biological Engineering, University of Guelph, Guelph, Ontario, Canada. Use of motion capture to quantify normal and abnormal hand function.**

**Introduction:** Motion capture has been used to define motion spaces of each digit to create more realistic hand animations. This technology may be used clinically to quantify abnormal hand movement. **Purpose:** To explore the possibility of creating a database of normal and abnormal hand movement using motion capture. **Methods:** Ten normal and four subjects with hand pathology were assessed while performing a defined motion drill. A six MX-3+ camera Vicon Motion Capture System at 100 frames/second was used. Eleven retroreflective markers placed on the dorsum of each hand, two on each digit over the interphalangeal joints and one at the wrist were used to track movement while performing the motion drill. The kinematics of hand movements were compared using Maya™. **Results:** Preliminary results suggest that the movements of normal and abnormal hands can be quantified using motion capture. In the abnormal hand, the timing and range of movements of individual digits were altered compared to the movements of the normal contralateral hand. Some subjects with hand problems commented on lack of awareness of how differently the two hands behaved. **Conclusions:** Motion capture could be developed to aid in diagnosis and treatment of hand pathology. Incorporating motion capture into rehabilitation protocols would allow for feedback on performance.

**RAY, Biswabina\*, Brijesh KUMAR\*, and Shahin A. HUNNARGI\*, Department of Anatomy, Kasturba Medical College, Manipal, Karnataka, India. Nonmetrical variations of basioccipital region.**

**Purpose:** Nonmetrical variations of basiocciput are of interest for anatomists and clinicians because they produce clinical symptoms or lead to misinterpretations of radiological images. This is the first report on nonmetrical variations of basiocciput observed in Nepal and first comparative study between Indian and Nepalese variations. **Materials and Methods:** 202 dry human occipital bones (12) and crania (190) belonging to Indian (167) and Nepalese (35) population were examined for nonmetrical variations of basiocciput over a period of 6 years. Variations were divided into hyperostotic and hypoostotic groups. **Results:** Morphological variations observed in this study were precondylar tubercle, third occipital condyle, exostosis on anterior margin of foramen magnum (hyperostotic), basioccipital cleft, fossa navicularis (hypoostotic).

TAN, Yun\*, Waheed M. RANA\*, Jeff WATSON\*, Margaret H. COOPER, John R. MARTIN, III, and Yunxi TAN\*, Department of Surgery, Center for Anatomical Science and Education, Saint Louis University School of Medicine. **An additional approach in preserving the medial and lateral pectoral nerves in modified radical mastectomy.**

Modified radical mastectomy (Patey modification) includes complete removal of the pectoralis minor muscle (Minor) with Rotter's lymph nodes. Both medial and lateral pectoral nerves (MPN, LPN) are preserved to ensure innervation of the pectoralis major muscle (Major). The courses and distributions of LPN and MPN, and their relationships with vessels were studied in 50 cadavers (100 sides). The clavi-manubrial (C5-7) and sternal (C7) branches of LPN innervate different portions of Major. The sternal branch supplies Minor (47%) or even passes through it (14%). The communicating branch from C7 is joined by MPN to form a V or Y shaped loop (71%). Sometimes, the sternal and communicating branches anastomose to form a network (21%). MPN divides into medial and lateral branches. The medial MPN branch divides into branches to innervate Minor and some of them penetrate the muscle to supply the lower portion of Major. The lateral MPN branch wraps around the lateral border of Minor to innervate the lowest portion of Major. On the basis of these observations, surgically splitting the clavicular from the sternal heads of Major will expose the branches of LPN, and cutting the origin of Minor will preserve branches of MPN, all of which may prevent muscle atrophy.

TERRELL, Mark A., Department of Anatomy, Lake Erie College of Osteopathic Medicine, Erie, Pennsylvania. **Podcasting anatomy lectures increases content learning and accessibility.**

An educational research study was conducted to investigate the effect of podcasting anatomy lectures on student learning and class participation. It was hypothesized that podcasting would enable students to obtain missed notes if absent and to review lectures for clarifying difficult concepts to learn; both resulting in higher exam scores. The experimental design consisted of comparing semesters that provided podcasted lectures with a control group, which lacked podcasted lectures. Lecture podcasts were made in the lecture hall using TeleTeaching Tool software that screen captured the computerized PowerPoint lectures synched with audio recordings of the professor's lecture. Students were then provided with links to the University's streaming server to download the podcast files to view and/or listen to the lecture content. Data collection consisted of lecture attendance, exam scores, and student course-evaluations. When lecture podcasting was made available to students, lecture attendance remained similar, the frequency of absent students seeking missed notes decreased, and exam performance and student evaluations increased. These results suggest that providing students with high accessibility to lectures facilitates student autonomy, enhances self-directed learning, and counters excuses for lack of achievement.

TESCH<sup>1</sup>, Norbert P.\*, Wolfgang PICHLER<sup>2\*</sup>, Hans CLEMENT<sup>2\*</sup>, Angelika SCHWARZ<sup>1\*</sup>, and Andreas H. WEIGLEIN<sup>1</sup>, <sup>1</sup>Institute of Anatomy, <sup>2</sup>Department of Traumatology, Medical University Graz, Austria. **The neurovascular bundle of the extensor compartment of leg in relation to treatment of tibia fractures with the 9-hole and 11-hole less invasive stabilization system.**

The Less Invasive Stabilization System (LISS) has been developed to reduce soft tissue damage and preserve blood supply. Objective of this study was to investigate the risk of lesions of the deep peroneal nerve by LISS-plate in tibia fractures. In twenty female adult legs the length of the tibia was measured and a 9-hole and a-11-hole LISS-plate were placed as described by the manufacturer. After inserting two 0-mm K-wires, the extensor compartment was dissected. The tip of the 11-hole plate touched the bundle in two cases, crossed the bundle between the 10th and 11th hole in three cases, and crossed over the 11th hole in three cases. The tip of the 9-hole plate touched the deep peroneal nerve in six cases, in five

cases the bundle crossed over the 8th hole and in one case the 9th hole. The bundle crossed under the 9th hole in three cases and the 8th hole in one case. In conclusion, the risk of damage to the neurovascular bundle is high. Thus, a larger incision to dissect the neurovascular bundle to minimize this risk should be considered.

THAI, Al<sup>1</sup>, Kajeandra RAVICHANDIRAN<sup>1</sup>, Pirooska L. SZABO<sup>2</sup>, and Anne M. AGUR<sup>1</sup>, <sup>1</sup>Division of Anatomy, Department of Surgery, University of Toronto, Toronto, Ontario, Canada, <sup>2</sup>Department of Physical Therapy, Touro College School of Health Sciences, Bay Shore, New York. **Architecture of the musculotendinous complex of the popliteus muscle: A 3D computer modeling study.**

**Introduction:** There is an ongoing debate in the literature regarding the morphology and attachments of the popliteus muscle (Paraskevas, 2006). However, the architecture of the muscle belly has not been well documented. **Purpose:** To map the three-dimensional architecture and attachment sites of popliteus, and quantify fiber bundle (FB) length, pennation angle (PA) and muscle volume. **Method:** Four formalin embalmed cadaveric specimens ( $76.5 \pm 8.7$  years) were serially dissected and digitized (up to 2000FBs/muscle). This data was modeled (Maya™), and analyzed (SPSS16™). **Results:** The muscle belly consisted of two distinct parts: a quadrangular superficial part composed of parallel FBs attaching proximally to the joint capsule and a deep triangular part forming two intramuscular tendons that blend with the popliteal tendon. The muscle was found attached superior to the tibial soleal line, to tibialis posterior aponeurosis and the joint capsule of the knee. The superficial FB length ( $2.88 \pm 0.69$  cm) was longer than the deep ( $2.42 \pm 0.62$  cm). The deep part ( $16.6 \pm 9.3^\circ$ ) tended to be more pennated than the superficial ( $11.8 \pm 6.3^\circ$ ). Muscle volume varied from 14.4 to 43.3cm<sup>3</sup> with the superficial part comprising about 1/5 of the total muscle volume. **Conclusion:** Architecture of the popliteus muscle belly is more complex than previously reported: two distinct parts were identified based on muscle architecture and attachment sites.

TOSHIYUKI, Saito, M.D., Ph.D., Hanno STEINKE, Ph.D., Tomoe IWABUCHI D.D.S., Toshiyasu KITAYAMA, D.D.S., Yoshiyuki OI, M.D., Ph.D., Takayoshi MIYAKI VMD., Ph.D., and Masahiro ITO M.D., Ph.D., Department of Anesthesia, Nihon University, Dental School, Chiyada-ku, Tokyo, Japan, Department of Anatomy, Tokyo Medical University, Shinjuku-ku, Tokyo, Japan. **Branches of the Posterior Ramus of the Spinal Nerve.**

**Background:** In the needle insertion of epidural and spinal anesthesia, the needle can pass through the longissimus muscle in the dorsum of the human body. During the needle insertion, when the needle touches a nerve in the muscles, the people may experience pain in the back. Obviously the needle should avoid the nerve tract. To provide better anesthetic service, the analysis of the structure and lie of the nerves concerned in that region is inevitable. **Method:** We studied fifteen cadavers in this study. With twelve of the cadavers, we studied the nerve layout of the posterior rami of the spinal nerve near the stem. Three of them were used for the study of transparent specimen, with which we studied the course of the posterior rami inside the longissimus muscle. **Results:** We observed there were three principal branches at the stem of the posterior rami of the spinal nerve, i.e. medial branch, medial branch of the lateral branch (=intermediate?) and lateral branch of the lateral branch just outside of the foramen intervertebrale as Bogduk reported in the lumbar segments. Although the medial branch supplied to the *M. multifidus* and the lateral branch supplied to the *m. iliocostalis*, the intermediate branch supplied to the longissimus muscle. With the transparent specimen, we found that there were structured nerve layouts in the medial and intermediate branch of the posterior ramus inside the muscle. **Discussion:** The medial branch and the intermediate of the posterior rami both cover the region near the spinal column. The both nerves could be misunderstood each other when we dissect from the dorsal direction. **Conclusions:** There were three major branches at the stem of the posterior rami of the spinal nerve. In the upper lumbar segments of the *M. multifidus*, the medial branch and the intermediate branch of the spinal nerve pro-

ogy to facial anthropometry and also definitive data for auricle morphometry in adults. (Sponsored by Scott Lozanoff).

**TURCHIN\* Katie, Monica BRANIGAN\*, and Anne AGUR, Department of Surgery, Department of Family and Community Medicine, Faculty of Medicine, University of Toronto, Toronto, Ontario, Canada. Coping with stress: A comparison between 1st and 2nd year medical students.**

Medical students have reported feeling stress from many causes, including heavy workload, feeling overwhelmed, fear of failure, and strained personal relationships (Moffat, et al., 2004). The purpose of this study is to compare the changes in coping mechanisms and usage of student support services between first and second year medical students. Parnandi (2006) developed an online survey and administered it to the first year medical students. In this study a slightly modified version of the survey was administered to the same group of students, now in second year. Results showed that the major stressor for second year students was personal issues, compared with academics during first year. The Program for Advice and Support of Students was consulted by 4.4% of students, Office of Student Affairs by 10.1% and a Professor/Academy Director/Tutor by 12.2%. Similar to Parnandi's (2006) findings, the most widely used coping strategies were friends outside of medical school (34.4%) and family (22.5%). Students reported improvements in lifestyle in 2nd year: more free time, more sleep and less stress. For student support services to stay in tune with student's need, feedback must be sought on a regular basis and appropriate strategies must be developed to increase awareness of what each resource has to offer.

**TURNER\*, John and Brion BENNINGER, Department of Oral Maxillofacial Surgery, Department of Integrative Biosciences, Department of Surgery, Oregon Health and Science University, Portland, Oregon. The anatomy regarding centric relation and the temporomandibular joint.**

The purpose of this study was to analyze the anatomy of centric relation. Many clinicians believe that maintaining CR is critical in oral pathology treatment. The temporomandibular joint (TMJ) is important because of its essential role in mastication, speech and breathing. The head of the mandible has a position within the TMJ called centric relation that is considered to be the most stable musculoskeletal position of that joint. Definition and morphology of this position have changed or evolved since it was described in the 1920's and remains controversial. Two schools of thought include: a static definition "The head of the mandible positioned most superiorly and anteriorly within the mandibular fossa" and a dynamic definition, which includes "the soft tissue intimate with the joint." We reviewed the most commonly used clinical anatomy and specialist texts to examine the anatomy and clinical significance of centric relation. Our results revealed prosthodontic and oral surgery texts described the topic of centric relation while clinical anatomy texts and atlases gave little attention to centric relation. Considering the importance of TMJ pathology and the anatomical nature of centric relation, our findings suggest it be emphasized with the TMJ in clinical anatomy texts.

**UPADHYAYA\*, Prashant K. and Alan T. RICHARDS, Department of General Surgery, Creighton University Medical Center, Department of Head and Neck Surgery, University of Nebraska Medical Center, Nebraska. Circumferential compression of trachea and esophagus by hypertrophied tubercles of Zuckerkandl.**

Tubercles of Zuckerkandl (TZ) are posterolateral projections of the lateral thyroid lobe present in upto 75 % of normal thyroid glands. They range in size from a micro nodule to projection greater than 1 cm (Grade 3). We present our experience of thyroidectomy in six patients with bilateral enlargement of TZ causing circumferential compression of the trachea and esophagus. Five of the patients were morbidly obese (BMI 39.16 + 7.2). Four patients had varying

degrees of retrosternal extension, pressure symptoms and hypothyroidism. Type of surgery included Total (2), Subtotal (3) and near total (1) thyroidectomy. Average weight of the specimen was 135.16 + 83.4 g, greatest dimension of each lobe measured ~6.75 + 1.4 centimeters. RLN was not visualized in three cases and was found to be entering the TZ substance in one. No major complications (Hyperparathyroidism, RLN injury) were encountered. No patient had recurrent symptoms on follow-up (2-60 months duration). Obese patients with enlarged goiters and Mediastinal extension may have an increased incidence of severely hypertrophied TZ. Thyroid surgery appears safe in this population. Possibility of variation in anatomy of the RLN and parathyroid glands in relation to the TZ should be kept in mind.

**UZ, Aysun<sup>1\*</sup>, Nihal APAYDIN<sup>1\*</sup>, Marios LOUKAS<sup>2</sup>, Richard S. TUBBS<sup>3</sup>, and Simel KENDIR<sup>1\*</sup>, <sup>1</sup>Department of Anatomy, Ankara University School of Medicine, Ankara, Turkey, <sup>2</sup>Department of Anatomical Sciences, St. George's University, Grenada, West Indies, <sup>3</sup>Section of Pediatric Neurosurgery, University of Alabama at Birmingham, Birmingham, Alabama. Vascularization of the fibularis longus and brevis muscles with emphasis on fibular graft harvesting.**

Necrosis of the fibularis longus and brevis muscles after fibular osteocutaneous flap harvest or fibular grafts is a common problem experienced by orthopedic and plastic and reconstructive surgeons. The fibularis longus (FL) and fibularis brevis (FB) muscles are known to be supplied primarily by the anterior tibial artery (ATA) and the fibular artery (FA). However, the exact localization of these vascular pedicles is not to found in the extant literature. Therefore, the aim of this study was to investigate the exact location of the vascular pedicles for the FL and FB and to describe the points of penetration of these vessels through the posterior and anterior intermuscular septa. Sixteen adult cadavers underwent latex injection of the popliteal artery bilaterally. Following dissection, the distances between the apex of the head of the fibula and each of these vascular pedicles and the points where these arteries pierced the intermuscular septa and the length of the vascular pedicles were measured. In all cases, a single artery coursing in the lateral compartment of the leg was identified. This artery was a branch of the ATA and supplied the proximal and middle thirds of these muscles. The distance between the origin of this artery and the apex of the fibular head was on average 8.7 cm. The mean length of this artery was 10.6 cm and the average number of branches was 4.2. In all specimens, the FA supplied the distal portion of the fibular muscles. In 16.7 % of the specimens, the distal portion of the fibular muscles was also supplied by branches arising from the posterior tibial artery. Knowledge of the exact points of the vascular pedicles to the fibularis muscles will aid surgeons in fibular osteocutaneous flap harvest or fibular grafts and minimize tissue necrosis. Conservation of the main branch of the ATA coursing in the lateral compartment of the leg is imperative to preserve the blood supply to the fibularis muscles.

**VOGT\*, Keith M., Courtney Y. KAUH\*, David M. HOLDER\*, and Robert M. DEPHILIP, Division of Anatomy, The Ohio State University, College of Medicine, Columbus, Ohio. Experimental and clinical imaging of a retroesophageal right subclavian artery.**

Cadaver dissection by medical students of a 79-year-old male revealed a retroesophageal right subclavian artery arising from the aortic arch distal to the left subclavian artery and passing posterior to the esophagus and trachea. The right common carotid artery branched directly from the aortic arch and passed anterior to the trachea, while the left common carotid and left subclavian arteries were in their normal positions. To further study this common anatomical variation (0.2-2% occurrence), the aortic arch and its branches were filled with radiopaque contrast medium and images obtained with a portable fluoroscope. In an AP view, the right subclavian artery and the right common carotid artery were superimposed, suggesting a normal brachiocephalic trunk. However, the course of the variant artery was evident on oblique images taken at 30 degrees or greater from normal. Review of this patient's medical records revealed axial computed tomography images of the chest

YAKEISHI\*, Akira, Tsuyoshi SAGA\*, Kei-ichiro NAKAMURA\*, and Koh-ichi YAMAKI\*, Department of Anatomy, Kurume University School of Medicine, Kurume, Japan. **Ultrastructure of submandibular glands and expression of aquaporin-5 in Sjögren's syndrome mice after administration of cevimeline.**

Cevimeline was orally administered to Sjögren's syndrome model mice (SS model mice) and the ultrastructural changes of acinar cells of submandibular glands were monitored. As well, the localization of aquaporin-5 (AQP-5), a water channel existing mainly in cell membranes, was examined immunohistochemically. Ultrastructurally, a remarkable reduction of secretory granules was seen in cevimeline treated submandibular acinar cells. There was an increase of the rough endoplasmic reticulum and an expansion of intercellular spaces in acinar cells. Condensing vacuoles of the Golgi apparatus were also observed. As well, it appeared that salivary production was promoted secondarily. In normal mice AQP-5 was localized in apical and lateral plasma membrane of submandibular acinar cells. In SS model mice, localization was disordered in parts of the cytoplasm as well as in apical plasma membrane. After cevimeline administration, AQP-5 was mostly found in the cell apical membrane of acinar cells of SS model mice, suggesting improved localization of AQP-5. These results clearly showed that cevimeline induces saliva secretion and production in SS model mice. It was also demonstrated that the location of AQP-5 is temporarily normalized by the administration of cevimeline. (Sponsored by M. Miura).

YAMAGUCHI\*, Kumiko<sup>1</sup>, Tomoyuki MOCHIZUKI<sup>2\*</sup>, and Keiichi AKITA<sup>1\*</sup>, <sup>1</sup>Unit of Clinical Anatomy, Tokyo Medical and Dental University, Japan, <sup>2</sup>Department of Orthopedic surgery, Tokyo Medical and Dental University, Japan. **Is the superior glenohumeral ligament a true ligament?**

Three ligaments are known to stabilize the glenohumeral joint: superior glenohumeral ligament (SGHL), middle glenohumeral ligament (MGHL), and inferior glenohumeral ligament (IGHL). Here, we compared the histological structure of these three ligaments. Five shoulders of three cadavers were dissected. From each shoulder, three blocks containing SGHL, MGHL and IGHL were embedded in paraffin. Serial sections were stained, and Types 1 and 3 anti-collagen antibodies were applied to identify the fibers. MGHL and IGHL consisted of parallel compact fibers. They were stained dark with anti-type 1 and 3 collagen antibodies. Connective tissue observed between long head of the biceps tendon (LHB) and tendon of subscapularis (SSC) was intermingled with compact and less compact fibers. These fibers stained dark only with the anti-type 3 collagen antibody. This area was thought to contain SGHL and CHL based on the macroscopic observation, however, the border between them was unclear. SGHL is thought to be a part of CHL which has extended into the space between LHB and SSC. From the histological study, MGHL and IGHL showed a typical ligament structure, however, SGHL did not have a typical ligament structure. SGHL turned out to be connective tissue which extended from CHL. (Sponsored by Tatsuo Sato).

YANG<sup>1\*</sup> Hun-Mu, Da-Hye KIM<sup>1\*</sup>, Jong-Tae PARK<sup>2\*</sup>, Kyung-Seok HU<sup>1\*</sup>, Heung-Joong KIM<sup>2\*</sup>, Christian FONTAINE<sup>3</sup>, and Hee-Jin KIM<sup>1\*</sup>, <sup>1</sup>Division in Anatomy and Developmental Biology, Department of Oral Biology, Oral Science Research Center, Human Identification Research Center, Brain Korea 21 Project, Yonsei University College of Dentistry, Seoul, Korea, <sup>2</sup>Department of Oral Anatomy, College of Dentistry, Chosun University, Gwangju, Korea, <sup>3</sup>Department of Anatomy, Faculty of Medicine, Lille II University, Lille, France. **Functional analysis of the masticatory system of the dog with relation to the human.**

The aim of this study is to identify the species characteristics of the dog mastication compared to the human by analyzing 10 landmarks on the heads from seven beagle dogs. The masticatory unit of the

dog was relatively located posterior than the human. The predominance of horizontally-oriented fibers of the temporalis was shown, despite vertical mandibular movement. The biomechanics of the coronoid process and the temporalis revealed backwardly-rotating the coronoid process not superiorly-elevating like the human. The masseter was also obliquely oriented and the temporalis was observed in distinct two-layers. In the dogs, the higher coronoid process compared to the condyle was observed; the vertical difference of them was larger than the human. It appeared the temporalis performs stronger action than masseter and corresponded with marked horizontally-acting of the temporalis. These morphologies indicate the mastication of the dog needs strengthened horizontal stability and it was taken by the cervical muscles attached backwardly to the skull. Thickened temporalis is adapted in feeding. The dentition was longer and farther from the condyle and the pterygoid muscles were not well developed than the human, indicating unfavorable lateral movement. These findings were consistent with evolutionary tendency, feeding without using hands and narrow skull. [Sponsored by Grant No. KRF-2007-314-E00003 from the Korean Research Foundation Grant by the Korean Government (MOEHRD)].

YUE Bin<sup>1\*</sup>, Dai-Soon KWAK<sup>1\*</sup>, Moon-Kyu KIM<sup>2\*</sup>, and Seung-Ho HAN<sup>1</sup>, <sup>1</sup>Department of Anatomy, Catholic Institute for Applied Anatomy, College of Medicine, The Catholic University of Korea, Seoul, Korea, <sup>2</sup>Department of Neurosurgery, Kangdong Sacred Heart Hospital, Hallym University, Seoul, Korea. **Morphometric analysis of trajectory for C2 crossing laminar screws.**

C2 crossing laminar screw fixation was described as a method for upper cervical rigid fixation with minimal chance of vertebral artery injury. However, this technique still has the potential possibility of neurologic injuries or laminar fractures from breakthrough of the inner or outer cortex of the laminar because of the incorrect screw trajectory. With increasingly used in clinical work, many cadaveric morphometric studies concerning the size, length and potential limitations of the translaminar screw's applications were performed. However, to the author's best knowledge, there are few reports mentioned about the morphometric analysis of the screw trajectory. We designed this study aiming at providing valid guidelines for correct trajectory of C2 crossing laminar screw fixation. We used 60 specimens (3D reconstruction models, female: 30, Male: 30) from Digital Korean human model. The location of entry point was decided at the most posterior and superior point in the basis of split spinal process. Safety region was determined by computational method (Mimics, Materialise, Belgium) for the proper angles of the screw trajectory in the axial plane. In superior view, the trajectory's minimum safe angle for the inner laminar cortex was  $34.0^\circ \pm 4.4^\circ$ , the maximum safe angle for the outer cortex at the 1/2 laminar length is  $54.1^\circ \pm 6.6^\circ$  from mid-sagittal plane. And the recommended angle for correct trajectory was range  $43^\circ$ - $46^\circ$ . (To pass 2/3 length of laminar, 90% safety ratio).

YUEN Chris<sup>1</sup>, Anne AGUR<sup>2</sup>, and Nancy MCKEE<sup>2\*</sup>, <sup>1</sup>Department of Exercise Science, University of Toronto, Toronto, Ontario, Canada, <sup>2</sup>Department of Surgery, University of Toronto, Toronto, Ontario, Canada. **Muscle architecture of the gastrocnemius and soleus in boys with Duchenne Muscular Dystrophy.**

**Purpose:** To quantify and visually compare in vivo ultrasound (US) changes in pennation angles (PA), fibre bundle length (FBL) and muscle thickness (MT) of the medial (MG) and lateral (LG) Gastrocnemius, and posterior Soleus (PS) in Duchenne Muscular Dystrophy (DMD) and in controls. **Methods:** Thirty-six boys (5-15 years) were recruited (18 DMD/18 Control). Architectural measurements were quantified from US images in relaxed and maximally contracted states. A 6-level qualitative rating scale was used to describe the appearance of images and cross-referenced with two clinical timed function tests (TFT; walking and stairs). Data was compared using SPSS (t-test and Pearson correlation). **Results:** Only LG (DMD) had significant differences in both FBL (shorter) and PA (greater) compared to controls ( $P \leq 0.05$ ). MG (DMD) and PS

(DMD) had significantly greater PA and FBL respectively. MT was significantly greater in DMD than in controls at all sites. Ninety-four percent of DMD scans were qualitatively rated as "severe" or "obliterated". Qualitative scores were well correlated with TFTs ( $r = 0.690$  for walking;  $r = 0.809$  for stairs). Conclusion: Architecture of DMD subjects is significantly different than controls. DMD muscles were thicker, had larger change in PA, and significantly different FBL on contraction. US may be a useful clinical tool for monitoring changes in DMD muscle.

ZHANG, Han and Leonard J. CLEARY, Department of Neurobiology and Anatomy, University of Texas Medical School, Houston, Texas. **Production of a series of gross anatomy dissection videos.**

Modifications to our Gross Anatomy course over the last several years have led us to recognize the need for a complete series of dissection videos. To assess feasibility of the project and estimate its cost, we worked with the in-house production team on a single episode. Production of that one video with overdubbed voice track required two weeks at a cost of \$2,000. The high cost encouraged us to produce the entire project ourselves. To provide rapid access for students, we decided to work through the entire series in several stages, rather than perfecting one video before moving on to the next. During the fall of 2007, we completed the first phase by recording the dissection of a single male cadaver and a female pelvis. To keep up with the pace of the course, the videos were converted into digital video files with minimal editing and posted on the streaming video server. Student response to these videos was very positive (3.6 on a 4-point Likert scale). We are currently implement-

ing the second phase, in which each video is being edited for time and content. In later phases, scripted narrations and didactic annotations (e.g. labels, highlights) will be added.

ZURADA, Anna and Jerzy GIELECKI, Department of Anatomy, Medical University of Silesia, Poland. **3D interactive virtual reality analysis of the middle cerebral artery.**

The middle cerebral artery (MCA) is a main cerebral vessel supplying the basal ganglia, cortical areas responsible for language, higher cognitive functioning, and some descending pathways. The studies were carried out on archived files of angio-CT scan from 115 patients (75 female and 40 male) ranging from 12 to 78 years. Then files were imported into computer data base system. The precise measurements of the geometric (diameter, length, volume), spatial and stereoscopic (direction cosine) parameters of the proximal M1 segment of MCA had been analyzed using a three-dimensional interactive virtual reality (3D-IVR) method. The M1 was analyzed according to symmetry, age and sexual dimorphism. The mean diameter of M1 segment was 2.23 mm<sup>2</sup>, length was 15.62 mm and the volume was 63.92 mm<sup>3</sup>. Diameter and length were higher in men than woman but the differences were not to be found statistically significant. However, the volume shown the statistically significant differences in gender after the direction of cosine, tortous and deviation index of M1 had been analyzed there were no statistical differences according to the age and gender. The geometric, stereotactic and spatial description of the MCA is helpful to neurosurgeons and neuroradiologists during operation of the aneurysms and other vascular procedures.