Grußwort zum ersten CONNECT-Kongress

Bindegewebe in der Sportmedizin

Connective Tissues in Sports Medicine

Interventionsmaßnahmen im interdisziplinären Bereich der Sport- und Rehabilitationsmedizin leisten einen wichtigen Beitrag zur Gesunderhaltung, Diagnostik und Therapie vieler Erkrankungen. Körperliches Training stärkt nicht nur das Herz-Kreislaufsystem, sondern auch den Bewegungsapparat, bestehend aus Skelettmuskulatur und Bindegewebe (Faszien). Andererseits sind es gerade die bindegewebigen Strukturen, die am häufigsten durch sportliche Überlastungsschäden leiden. Nicht nur in der Sportmedizin sondern auch in anderen humanbiologischen Bereichen ist derzeit weltweit eine deutliche Aufbruchsstimmung zu erkennen in Richtung einer gezielten Einbeziehung und Erforschung des muskulären Bindegewebes.

Die Rolle der Faszien

Das 1. Ulmer Symposium zum Thema „Bindegewebe in der Sportmedizin" (CONNECT 2013) thematisierte die Rolle der Faszien aus klinischer, molekularer sowie biomechanischer Sicht, um gezielt den Austausch und Dialog zwischen den Fachbereichen anzuregen. Das CONNECT Symposium spricht Bindegewebsforscher, Sportmediziner, Physiotherapeuten und Trainer gleichermaßen an, um den Transfer von Forschungsergebnissen in die sportliche und therapeutische Praxis zu übertragen. Darüber hinaus verbindet CONNECT grundlagenwissenschaftliche Vorträge mit praxisnahen Workshops, wie Taping, Ultraschall oder Myoreflextherapie, in denen neue sensible Diagnostikgeräte und Techniken der Faszienmanipulation erlernt und ausprobiert werden können.

Die Sektion Sport- und Rehabilitationsmedizin bietet zusätzlich zu ambulanter Versorgung in den Bereichen Kardiologie und Orthopädie ein internistisches Rehabilitationsprogramm, und verschiedene Herzsportgruppen in Ulm und Erbach an, die seit vielen Jahren mit großer Nachfrage und mit viel Erfolg betrieben werden. In Ulm werden olympische Athleten aus den Bereichen Fechten, Rudern und Kanu in Zusammenarbeit mit den nationalen Verbänden sportwissenschaftlich sowie medizinisch im Training und bei Meisterschaften betreut.

Das Team des molekularen Muskellabors beschäftigt sich primär mit dem Einfluss von körperlichem Training auf Prozesse in der Muskulatur, besonders während des Alterungsprozesses. Das Thema „aging" ist ein Forschungsschwerpunkt der medizinischen Fakultät, der wir für die Unterstützung beim Umzug des Labors im vergangenen Jahr herzlich danken.

Die Faszienforschungsgruppe der Division of Neurophysiology der Universität Ulm beschäftigt sich mit den vielfältigen biomechanischen Eigenschaften sowie zellulären Dynamiken des körperweiten Faszinennetzwerkes. Zusammen mit anderen Forschungsgruppen fördert sie eine internationale Vernetzung diesbezüglicher wissenschaftlicher Initiativen.

Bedanken möchten wir uns auch für die großzügige finanzielle Förderung der Deutschen Forschungsgesellschaft (DFG), die unseren CONNECT Kongress in diesem Rahmen ermöglicht.

Jürgen M. Steinacker & Robert Schleip, Ulm

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Referat Nr. 1, Sitzung (2013-04-13 11:00):

Non-Invasive Clinical Measurement of the Viscoelastic Properties of Tendon using Acoustic Wave Transmission

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Background. In isotropic materials, the speed of acoustic wave propagation is governed by the bulk modulus and density. For tendon, which is a structural composite of fluid and collagen, however, there is some anisotropy requiring an adjustment for Poisson's ratio. This paper explores these relationships using data collected, in vivo, on human Achilles tendon and then compares estimates of elastic modulus and hysteresis against published values from in vitro mechanical tests. Methods. Measurements using conventional B-model ultrasound imaging, inverse dynamics and acoustic transmission techniques were used to determine dimensions, loading conditions and longitudinal speed of sound in the Achilles tendon during a series of isometric plantar flexion exercises against body weight. Upper and lower bounds for speed of sound versus tensile stress in the tendon were then modelled and estimates of the elastic modulus and hysteresis of the Achilles tendon derived. Results. Axial speed of sound varied between 1850 and 2090 ms^{-1} with a non-linear, asymptotic dependency on the level of tensile stress (5 - 35 MPa) in the tendon. Estimates derived for the elastic modulus of the Achilles tendon ranged between 1 - 2 GPa. Hysteresis derived from models of the stress-strain relationship, ranged from 3 - 11 %. Discussion. Estimates of elastic modulus agree closely with those previously reported from direct measurements obtained via mechanical tensile tests on major weight bearing tendons in vitro. Hysteresis derived from models of the stress-strain relationship is consistent with direct measures from various mamalian tendon (7 - 10 %) but is lower than previous estimates in human tendon (17 - 26 %). This non-invasive method would appear suitable for monitoring changes in tendon properties during dynamic sporting activities.
References.

Referat Nr. 2, Sitzung (2013-04-13 11:05):

Impedance-Measurement Combined with Sono-Elastography as a Tool for the Examination of Lumbar Fascia

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Introduction: Ultrasound-elasticity imaging has recently attracted attention as a technique which directly reveals the physical property of fascial tissues and makes it possible to quantify changes in, for example, tissue hardness due to disease. As manual myofascial treatments often claim to change the tissue's properties, this device can also be used to assess changes in thickness as well as stiffness before and after manipulation. Electrical impedance is a parameter which can be used to determine the amount of water within human tissue. Measuring with various frequencies and considering the physical aspects of impedance it is also possible to differentiate between intra- and extracellular water. Purpose/Aim: In order to characterize tissue properties we apply ultrasound and impedance measurements before and after a short manual treatment of the lumbar region with Rolfing®-techniques. Materials and Methods: The erector-spinae-region between the 2 nd and 4 th lumbar vertebra of 59 subjects was treated for 3 - 5 minutes in a Rolfing-way, until the practitioner felt the tissue becoming softer. Measurements were taken before and after the treatment, in order to compare electrical resistance, reactance and phase-angle, as well as the histogram of the ultrasound-elastography. Subjects were asked about their sex, age, body mass index, sport-activity and history of pain. Results: Considering the impedance we show that there is not only a difference of the impedance in sex (female > male) and age (old > young), but the women and the older subjects also showed greater reactions to the treatment. Persons with a higher body mass index also responded more to the treatment. The ultrasound-elastography showed a tendency to softer tissue after the treatment, again more with the women than with men. Conclusions and Discussion: Both measurements in combination yield valid information about the tissue changes during and after manual treatment. Sono-elastography is able to visualize a softening of the lumbar fascia and differentiates the place where this softening happens. The tissue shows different reactions depending on the sex, age, weight, pain and sport-activity of the person. Since there is no data about the normal impedance of different kinds of human tissue, more detailed examinations are necessary to estimate individual variations. Implications: Manual therapists often claim to feel the tissue get softer in a so called "release". This can be shown and evidenced with impedance- and elastography-measurements and provides a quantitative tool for evaluating one's therapeutic effect in tissue manipulation. Both methods also reveal some risk-factors for lumbar restrictions and backpain.

Referat Nr. 3, Sitzung (2013-04-13 11:10):

Modulation of Collagenous Connective Tissue under Ultrasound-Induced Heat

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Background: The therapeutic lengthening or shortening of collagen connective tissue (collagen modulation) using ultrasound-induced temperature increase (42° C) already showed auspicious results in single case reports. Extending heated tendons and muscles has been aim of some studies since 1970 showing consistent results also after a cooling down phase. The present work scrutinizes the question whether, and to what extent an isolated pig tendon in laboratory testing may be extended or also shortened via ultrasound treatment. This method is suggested as an alternative non-invasive therapeutic method to treat ligamentous instability. Implemented as an outpatient treatment it may also mean lower costs compared to surgery treatment, also because the required hardware already exists in most physiotherapy clinics. Methods: The tendon of the flexor digitorum superficialis of the pig was placed in an 37° C isotonic saline solution, fixed in a purpose-built measuring device with a traction of 500 N. Aiming on shortening in the length the tendon was placed in a slightly compressed position. After ultrasound-induced heating of the tendon at 42° C for ten minutes, measures of change in length was both carried out at a load of 500 N. Precedent to application of ultrasound, measurement errors were estimated analogous without applying ultrasound. Results: The results suggest that under experimental conditions, after the deduction of the average measurement error, collagen tissue may be prolonged by an average of 0.43 mm (0,1 %) and may be shortened by 0.22 mm (0,05 %). Data for lengthening were highly scattered, but never below 0.27 mm. Discussion: The study showed that under test conditions, collagen tissue may be both, extended and shortened. Considering the precedent case reports it is quite obvious to interpret the result as a confirmation of the clinical method of ultrasound-induced collagen modulation. However, there are yet no clinical studies as a valid proof of efficacy.

Referat Nr. 4, Sitzung (2013-04-13 11:15):

Effects of Stretching and/or Vibration on the Plantar Fascia

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An increase in flexibility has been described when bending forward after a treatment of the plantar side of the foot. This increase in flexibility is measured by finger-ground-distance (FGD). Our study seeks to determine viscoelastic changes in the plantar structures and the tension of the Achilles tendon. It also aims to document possible fluctuations in the amount of liquids within the tissue. Can a change of the FGD after a treatment of the plantar side of the foot be observed? Do viscoelastic parameters in the plantar structures show changes after application of vibration or stretching? Does the Achilles tendon show a reaction in its tension caused by a treatment of the plantar foot? Are variations of the amount of liquids within the tissue evocable through vibration or stretching? A total of 68 subjects are included in this study, 25 of which belong to the verum group. The remaining subjects form two control groups. Two ways of stimulating the plantar fascia structures were applied on each individual: on one foot a vibration of 8 - 10 Hz was brought passively into the tissue with a Matrix Rhythmus® device. On the other foot the subjects were instructed to apply an active treatment using MELT® balls. Before and after these treatments biomechanical tissue properties were assessed via myometry (MyotonPro®) at the two following points: point 1 in front of the heel pad, point 2 at the center of the sole. Additionally FGD, electrical impedance and the angle between the foot and the longitudinal axis of the fibula were measured. For the statistical evaluation the Wilcoxon test is used. Preliminary results show: vibration led to a highly significant (< 0.01) change in stiffness and creep as well as to a significant (< 0.05) change in decrement at point 1. Stretching shows highly significant changes in stiffness and creep at point 1 and significant changes in stiffness and creep at point 2. The impedance changes significantly through stretching. The Achilles tendon shows a significant relaxation induced by both applications. The FGD decreases highly significantly in the verum and the sham group. Vibration seems to have a more global effect on the viscoelastic qualities of the tissue near the heel, stretching appears to result in an at least temporary draining effect. The decrease of the FGD in our study is not a result of plantar fascia treatment.

Referat Nr. 5, Sitzung (2013-04-13 11:20):

Potential Roles for HIF-1α and TGF-β in the Modulation of Angiogenic Factors in Response to Repetitive Tensile Loading

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Tendon disorders are a significant cause of pain and morbidity amongst athletes, workers and the general public. Tendinopathy is often viewed as the result of failed or inadequate healing response through repetitive overuse. Previous authors have suggested there may be an association between pain and neurovascular changes resulting from tendon overuse in tendinopathy patients. In order to examine the effects of repetitive overuse on the expression of angiogenic genes which regulate neovascularization in tendinopathy, primary human tendon cells were subjected to cyclic strain. By using a Flexcell® Tension System, isolated tendon cells from human hamstring tendons (excess ACL autograft material) were exposed to cyclic tension (1Hz frequency and 10% strain). MTS and tube formation assays were conducted with conditioned media in order to evaluate the proliferative and angiogenic activity of factors released by tenocytes. DMOG and A83-01were used to stabilize HIF-1α and inhibit TGF-β, respectively. RNA samples were isolated at different time points and gene expression was evaluated by conventional qPCR and qPCR array. Western blotting was also conducted to measure the relative amounts of target proteins. Initial experiments showed that cyclic strain of two-dimensional primary tenocyte cell cultures increased the expression of VEGF, bFGF and Cox-2. But, by increasing the time course, VEGF, bFGF and Cox-2 were progressively downregulated. Angiogenic profiling of tendon cells by qPCR array identified a number of other genes (ANGPTL4, FGF-1, TGFα, VEGF-C and SPHK1) that appear to respond to tensile loading in a similar pattern. Upregulation of these factors may be responsible for an observed increase in proliferation and angiogenic activity of HUVEC cells. Our preliminary results show that ANGPTL4 expression was upregulated by HIF-1α and blocked by a TGF-β inhibitor. It seems that the early response of tendon cells to overuse tensile loading leads to an upregulation of angiogenic factors which may play a role in tissue homeostasis following periods of overuse. HIF-1α and TGF-β pathways may be involved in this response and might modulate the expression of ANGPTL4. Future studies will unravel the mechanism and also the function of the ANGPTL4 protein in angiogenesis and matrix remodeling in tendons.

Referat Nr. 6, Sitzung (2013-04-13 11:25):

The Effectiveness of Ultrasound-Induced Modulation of Collagen Tissue on the Carpal Tunnel Syndrome (CTS)

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The carpal tunnel syndrome (CTS) is the most common bottleneck syndrome in a peripheral nerve representing the second most common outpatient surgical procedure. The ultrasound-induced modulation (UI KM) of the flexor retinaculum is a innovative physiotherapeutic method, which aims on the decompression of nervus medianus, analogous to surgical interventions. The thermally induced modulation capacity of collagen connective tissue is used to dilate the retinaculum by traction and thus to increase the space below. The present work scrutinizes the question if UI-KM affects symptoms of CTS and how effective UI-KM may be in the treatment of CTS. Five subjects with CTS diagnose will be examined. Data will be collected before initiation of treatment (T0), one week post- treatment (T1) and 30 days post-treatment (T2), using the "Disabilities of the Arm, Shoulder and Hand" questionnaire (DASH). Additionally a three-time measurement of nerve conduction velocity (NCV) will be carried out for each assessment. The subjects will be treated on 4 days per week, in a time period of maximum two weeks. Retrieved data will be statistically analysed. This study is expected to make a contribution to gaining information about effectiveness of UI KM on symptoms of CTS. Based on practical experience and theoretical considerations it is expected that UI-KM improves the symptoms of CTS at T1 and T2. Nevertheless, due to the small sample size and the lack of a control group and blinding, the effectiveness of the UI-KM on CTS may not be definitely confirmed by this investigation. However, results may indicate tendencies and present convincing evidence for bigger and better objectified investigations. In contrast to established therapies (surgery) this novel method of treatment does not require harming the body surface, and therefore is suggested to be more acceptable for patients. In addition to a significant saving of costs may be achieved. A good potential availability of the treatment is given already (ultrasound equipment in almost every physiotherapy practice).

Referat Nr. 7, Sitzung (2013-04-13 11:30):

Assessment of Tissue Elasticity by ARFI Shear-Wave Ultrasound Elastography and MyotonPro Myometry

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Introduction: Fascia are important not only for the complex interplay of muscle function and neuromuscular transmission of information but also play an important role in the development of myofascial pain. Using a new ultrasound based technology the Acoustic Radiation Force Impulse Virtual Touch Imaging and Quantification (ARFI VTIQ), and the MyotonPro. Both are new and innovative methods for assessing quantitative tissue characteristics like stiffness and elasticity of tissues. They were used in parallel for measurements. The ARFI technology provides a qualitative and quantitative assessment of tissue stiffness using acoustically induced shock pulses. The resulting tissue displacement is analysed as a color-coded elastography profile of the different depth of the tissue. The MyotonPro measurement is an integrated determination of tissues characteristics at a position. The MyotonPro device induces an external mechanical impulse. The resulting damped natural oscillation is recorded by an accelerometer in form of an acceleration graph. Target: Normal value generation of the Thoraculumbar fascia by ARFI VTIQ and Myometry. Methods: The TLF of 95 adult volunteers (60% female, 40% male, with a mean age of 30,9 ± 11,2) were measured at the level of the iliac crest, 2 cm lateral to the posterior median Linea at both sides, and visualized and identified with B-mode ultrasound. The internal callipers of the ultrasound unit have been used to measure the maximal depth of the TLF. With the ARFI VTIQ technique (Siemens Acuson S3000) and Myometry (MyotonPro) the biomechanical properties of the tissue was determined. The ARFI VTIQ measurement is carried out in m/s, and compared with the MyotonPro dynamic stiffness is determined in N/m. Result: The average width of the Thoracolumbar fascia of the left side in women is 2,5 mm (SD = 0,7 range = 1, 1 - 4,8,) and in men 2,6 mm (SD = 0,5; range = 1,9 - 4,3). The TLF of the right side in woman is 2,4 mm (SD = 0,7; range = 1,0 - 4,3); and in men 2,8 mm (SD = 0,6; range = 2,0 - 5,1). The ARFI VTIQ averages of the TLF on the left side in women is 3,3 m/s (SD = 0,5; range = 1,9 - 4,4)and in men 3,4 m/s (SD = 0,5; range 2,2 - 4,2). The ARFI VTIQ averages of the TLF on the right side in women is 3,4 m/s (SD = 0,5; range = 2,1 - 4,3)and in men is 3,5 m/s (SD = 0,5; range 2,7 - 4,5). We found a correlation of the mean width values of the right and left side of the TLF of all probands p = < 0,0001. The mean stiffness values of both correlated as well (p = < 0,0001). The shear-wave derived elasticity data were compared with the Myometry data generated with the MyotonPro.

Referat Nr. 8, Sitzung (2013-04-13 11:35):

Dexamethasone Modulate Substance P and ANGPTL4 Expression in Tendon Cells

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Dexamethasone, as a potent member of the glucocorticoid class, has a range of effects on cell survival, cell signaling and gene expression. Substance P (SP) which is produced by neuronal and non- neuronal cells has various functions. In addition to its role in pain transmission, this neuropeptide has effects on cell growth, angiogenesis, inflammation and tissue remodeling. SP has previously been shown to be correlated to pain levels in tendinopathy, therefore we reasoned that the reduction of symptoms seen in response to corticosteroid injections could be mediated through an effect on SP production or signaling. ANGPTL4 is a secreted protein which involved in angiogenesis and metabolism regulation. Our previous study introduced ANGPTL4 as a mechanoresponsive factor that may modulate angiogenesis in tendon. In this study, we evaluate the effects of dexamethasone on SP and its receptor Neurokinin-1 receptor (NK-1 R) and also ANGPTL4. The isolated tendon cells from human hamstring tendons (excess ACL autograft material) were incubated with different dosages of dexamethasone. Cells were harvested at different time points for RNA extraction and cDNA synthesis. The expression levels of TAC 1 (the gene encoding Substance P protein), NK-1 R and ANGPTL4 were measured using qPCR. The qPCR data show that dexamethasone significantly down-regulated the TAC1 mRNA in a time and concentration-dependent manner, but there was no significant effect on NK-1 R expression. Our results also show that dexamethasone upregulated ANGPTL4 expression; however the upregulation was most pronounced at low doses and short incubation times. Our results suggest an inhibitory effect of dexamethasone on substance P synthesis by tendon cells. Recent findings suggest the role of Substance P in tissue remodeling and tenocyte proliferation in tendon tissue. Therefore inhibition of Substance P by dexamethasone may alter the matrix and cellularity of tendons, as well as nociception and pain. Dexamethasone also modulates ANGPTL4 expression. Previous studies have shown the effects of ANGPTL4 on angiogenesis and metabolism regulation. Modulation of ANGPTL4 by dexamethasone may affect angiogenesis and matrix remodeling in tendon tissue. Further studies are needed to clarify the effects of corticosteroid treatments on tendon cells and matrices.

Referat Nr. 9, Sitzung (2013-04-13 11:40):

Do Calcium Activated Potassium Channels Control Proliferation of Myofibroblasts?

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Background: The calcium-activated K^+ channel, KCa3.1, has an important function in Ca^{2+} signaling for maintaining a negative membrane potential, which provides an electrochemical gradient to drive Ca^{2+} influx. In fibroblasts this channel is up-regulated in a TGF-β dependent manner. The same TGF-β/SMAD signaling is increased in several fibroproliferative diseases, for example in kidney fibrosis (1), or Dupuytren`s disease (2). This pathway is also found to be involved in chronic inflammatory autoimmune diseases, like T-cell mediated colitis or multiple sclerosis. Blockage of KCa 3.1 in fibroblast can suppress myogenesis (3) and in pancreatic cancer cell lines it can stop proliferation (4). Results: The myofibroblast, a specified fibroblast that expresses α smooth muscle actin stress fiber bundles, provides the cell with contractile activity. It can be characterized by markers α SMA, type1collagen, fibronectin/ED-A, and fibrotic markers like PAI-1 or CTGF. The TGF-β/SMAD-dependent proliferation can be modulated for example by Clotrimazol, TRAM-34 (4) or SB-431542 (2). Conclusion: This understanding of the molecular biology of fibroproliferative and chronic inflammatory autoimmune disease can have an impact on the connective tissue research. Therefore a focus on fascia and the knowledge of modulators of fibroproliferative pathways can be beneficial in therapy in the future. References: 1. Grgic I, Kiss E, Kaistha BP, Busch C, Kloss M, Sauter J, Müller A, Kaistha A, Schmidt C, Raman G, Wulff H, Strutz F, Gröne H, Köhler R, Hoyer J: Renal fibrosis is attenuated by targeted disruption of KCa3.1 potassium channel. PNAS 106 (2009) 14518 - 14523. 2. Krause C, Kloen P, ten Dijke P: Elevated transforming growth factor β and mitogen-activated protein kinase pathways mediate fibrotic traits of Dupuytren´s disease fibroblasts. Fibrogenesis & Tissue Repair 4 (2011) 14ff. 3. Pena T L, Chen S H, Konieczny S F, and Rane S G: Ras/MEK/ERK Up-regulation of the Fibroblast KCa Channel FIK Is a Common Mechanism for Basic Fibroblast Growth Factor and Transforming Growth Factor-b Suppression of Myogenesis. J Biol Chem 275 (2000) 13677 - 1368. 4. Jäger H, Dreker T, Buck A, Giehl K, Gress T, Grissmer S: Blockage of Intermediate-Conductance Ca^{2+}-Activated K^+ Channels Inhibit Human Pancreatic Cancer Cell Growth in Vitro. Mol Pharmacol 65 (2004) 630 - 638.

Referat Nr. 10, (2013-04-13):

Effects of Training Status and Exercise on Skeletal Muscle Gene Expression Profiles

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Elucidating the molecular processes responsible for skeletal muscle adaptability in response to exercise is important in order to design effective, individualized training programmes. Gene expression analyses are a useful tool to study the complex signal cascades involved in the response of skeletal muscle to acute exercise and during the regeneration process, leading to physiological and morphological adaptations. Microarray analyses (Affymetrix Human Genome U219 Array) were conducted of skeletal muscle samples (M. vastus lateralis), collected from 8 endurance trained/ET (VO_2max = 67 ml/kg/min) and 8 untrained/UT (VO_2max = 40 ml/kg/min) male study participants at rest, 30 min and 3 h after an acute bout of endurance exercise on a cycle ergometer (1h, 80% VO_2max). Selected transcripts were validated by real-time PCR. Differentially regulated transcripts (≥ 1.5-fold expression difference; $p < 0.05$) were further characterized using functional network analysis (ingenuity pathways analysis). A total of 214 transcripts were differentially regulated at rest between ET and UT. Expression of genes involved in oxidative metabolism was greater in skeletal muscle from endurance trained athletes compared to the untrained group, reflecting the greater proportion of slow muscle fibers in the trained state. The expression of 772 genes was altered by the acute endurance exercise bout (fold change ≥ 1.5; $p < 0.05$). 189 and 268 genes were differentially regulated between ET and UT after 30 min and 3 h, respectively. Results show that the expression of the nuclear hormone receptor (NR) family NR4A subgroup, Nurr77 (NR4A1) and Nor-1 (NR4A3) was significantly induced by the acute cycling bout in both ET and UT. The NR4A family of orphan nuclear receptors regulates the expression of fiber type specific metabolic and structural genes. Nurr77 expression increased 4.3-fold ($p<0.01$) and 3.5-fold ($p < 0.01$) compared to the resting state 30 minutes after exercise in ET and UT, respectively. Nurr77 expression continued to increase in UT at 3 h (6-fold vs. rest, $p < 0.001$), while transcript levels dropped slightly in ET (2.1-fold vs. rest, $p < 0.05$). The highest gene induction in this study was measured for Nor-1 at 3 h post-exercise (ET = 32-fold vs. rest; UT = 52-fold vs. rest, $p < 0.001$). Nor-1 responds to β-adrenergic signaling and reduces myostatin (Mstn) expression. Expression of the β-2 adrenoreceptor (ADRB2) was elevated 2.1-fold vs. rest ($p < 0.01$) in both ET and UT muscle 30 minutes post exercise. Mstn expression was 2.6-fold ($p < 0.01$) higher at rest in UT vs. ET and expression decreased only in UT after exercise (3.1-fold vs. rest UT 3 h, $p < 0.01$).

Referat Nr. 11, (2013-04-13):

Cell-free DNA in Response to Exercise: Do Neutrophils Produce Extracellular Traps?

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Exercise is a proven therapy for the primary and secondary prevention of lifestyle related diseases, including inflammatory and degenerative diseases. On the other hand, immunological reactions in response to acute, intense exercise can trigger thrombotic and cardiovascular complications, which can lead to sudden cardiac death. Excessive training in competitive sports increases the susceptibility to infections and allergies, and can result in chronic fatigue symptoms. The underlying immunological triggers and mechanisms, as well as the complex regulatory balance between pro- and anti-inflammatory mediators are currently largely unknown. High intensity exercise causes a direct, transient rise in circulating cell-free (cf) DNA, a phenomenon also observed in tumor patients and patients suffering from inflammatory diseases. The underlying mechanisms are currently unknown and subject to intense and controversial debate. A tentative explanation is offered by the recently discovered mechanism of active DNA release by neutrophils (neutrophil extracellular traps; NETs). NETs are a matrix, composed of granule proteins and chromatin and serve as a first line defense strategy against invading pathogens. Recent studies have shown that NETs are also present in non-infectious diseases, where they are suspected to cause thrombotic complications, excessive immune reactions and cell damage. Current results from our research groups suggest that high intensity exercise triggers the release of NETs. Furthermore, we show that the active release of NETs in response to exercise in healthy people is effectively counteracted by a concomitant increase in serum DNase activity. The NET model of cfDNA release offers a mechanistic explanation for the complex immunological processes triggered by exercise. Measuring the balance between cfDNA concentration and serum DNase activity as part of a standardized exercise test has the potential to serve a risk marker for patients with immunological and hemostatic malfunctions

Referat Nr. 12, Sitzung (2013-04-14 11:00):

Sacro-Iliac Joint Incompetence in a Sporting Population: Clinical and Radiological Findings

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Injuries to the back represent one sixth of sporting injuries across a variety of sports. This does not include injuries involving the pelvic girdle and its muscle and ligamentous attachments. It has been suggested that 30% of non-specific low back pain may have its origin in the sacro-iliac joint. In the context of sporting activity we have identified a clinical pattern representing mechanical pathology of the sacro-iliac joint, now termed sacro-iliac joint incompetence (SIJI), and matching images with SPECT-CT, a modality seldom applied to low back and buttock pain following acute or overuse trauma to the region (Cusi et al.: 7th Interdisciplinary World Congress on Low Back & Pelvic Pain, 2010). Methods: All patients with a clinical diagnosis of SIJI following the European guidelines for Pelvic Girdle Pain were studied by SPECT/ CT. Patients were followed up by interview at 6 months after therapy (directed physiotherapy or prolotherapy). For SPECT/CT, patients were injected intravenously with 900 - 1000 MBq of 99m Tc HDMP and planar images obtained followed by SPECT/CT from the level of the lesser trochanters upwards. Images were reported by 2 experienced nuclear medicine physicians. Results: The average age of the 253 patients was 42 years (15 - 71 yrs) with 65% F, 35% M. Average length of history was 3.5 years (6 weeks to 26 years). Trauma was implicated in 84% of cases and post-partum back pain in 9%. Clinical scores for SIJI were an average of 3.4 by the European guidelines. All patients showed SIJ uptake and loss of the normal configuration of joint uptake with ligament uptake. Joint sclerosis was observed in 98.8%. Hamstring enthesopathy was present on the ipsilateral side in 39% and on the opposite side in 61%. Adductor enthesopathy was present on the ipsilateral side in 66% and on the opposite side in 57% with bilateral involvement in 23%. Ipsilateral hip impingement was present in 72%. Extra finding were evicent in 56%. Conclusion: We have confirmed the integrity of SPECT/CT in a large cohort of patients with SIJI with specific treatment of the condition yielding good clinical results, in spite of the average length of the clinical history being 3.5 years. The SPECT/CT findings (metabolic changes at the relevant bone-ligamentous interface) and the clinical progress of patients confirm the validity of the self-bracing mechanism proposed by Vleeming and Lee (1998).

Referat Nr. 13, Sitzung (2013-04-14 11:05):

Myoreflextherapy – More than Physiotherapy in Professional Sports

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Myoreflextherapy is practiced since 1991. Her basics are embryology, functional anatomy, neuroorthopaedics, a myofascial model, biochemistry, psychotraumatology, sportmedicine and traditional Chinese medicine. By increasing the manual pressure at the muscle-tendon-bone-transition, neuromuscular reactions and reactions in the connecting tissue are triggered. Myoreflextherapy means an immediate spontaneous regulation of tension in the muscle or rather in the muscle system and with that, it means decompression of joints and soft tissue structures. By physics can be shown, that the axis and vectors of the locomotor system's effective powers flow into the same points/spots concurrent with the traditional acupuncture points/meridians. So, a discipline, obliged neither to the western orthodox medicine, nor to the medical traditions of the east, confirms the acupuncture points – based on the functional kinetic geometry of the musculoskeletal system. Its success is rather based on the fact that its periphery at the same time is access for central and higher instances of motoricity and also of information processing in general. In a vertical network complex movements involve whole chains of muscle elements. This regulation system can be built into muscle loops and muscle chains. It is used in the German Bundesligas of football and icehockey by some physiotherapists and players. Since a personal treatment Klinsmann is convinced by the effectiveness of this therapy. Dr. Mosetter is now the medical consultant of the american football team. Myoreflextherapy helps to prevent injuries and leads to an earlier come back after trauma. There are not only myofascial techniques, there are also metabolic advices to rise the power and Leistungsfähigkeit. The knowledge has an effect on the performance of the training. I use this therapy on all patients and the Judoka of a regional Bundesliga team. Studies of the benefit are still running.

Referat Nr. 14, Sitzung (2013-04-14 11:15):

Aquatic Therapy use in Management of Musculoskeletal Dysfunction: An Effective Rehabilitation Tool

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Aquatic Therapy offers outstanding benefits for pain modulation; musculoskeletal rehabilitation, conditioning and training. It speeds the physical recovery process and improves mental well-being by enabling accelerated rehabilitation in these conditions. Aquatic physical therapy is the fastest growing area of physical therapy and rehabilitation. The benefits have been recognized since Roman times when whirlpools and hot springs were used to promote healing and manage medical aliments. Aquatic therapy (AT) is the evidenced based and skilled practiced of physical therapy in an aquatic environment. AT includes but is not limited to treatment, rehab, prevention, health, wellness and fitness (conditioning) of clients in an aquatic environment. Conditions can be acute, transient or chronic. Hence, Aquatic Therapy exercise is the application of therapeutic exercise that occurs in the medium of water. The concept is simple. The results are real. Water provides buoyancy and viscosity. Buoyancy aids the patient's movement while resisting gravity. Impact is minimal. Viscosity, the thickness of water, produces 3-dimensional resistance to all movement. Simply put, it's a lot harder to exercise in water than on land while, at the same time, water substantially lowers the chances of further injury or pain. The temperature and pressure of the water also assist with circulation and relaxation of muscles. Compression by the water helps to reduce edema, or swelling, in the tissue. Warm water increases circulation to the injured body part. Numerous studies have reported the physiological benefits of aquatic therapy in the management of connective tissue injury and rehabilitation in humans. Exercise in water has the advantage of allowing a patient, unable to perform land-based exercises, to begin exercising sooner than otherwise possible. Aquatic therapy allows early weight bearing by unloading the weight and stress on the joints while providing supportive buoyancy to muscles. In a resistant but supportive aquatic environment the patient's muscular, proprioceptive and endurance activities can be increased according to their individual level of tolerance, confidence and healing. Aquatic therapy offers patients a total exercise program that includes activities for cardiovascular conditioning, flexibility, strength, muscle endurance, muscular relaxation and post exercise recovery methods. Aquatic therapy is an efficient and safe way to treat some diseases and maintain health and wellness. Combining Aquatic Physical Therapy with standard, land-based therapy shortens the disability period.

Referat Nr. 15, Sitzung (2013-04-14 09 11:20):

Myofascial Triggerpoint Release (MTR) Technique in Reducing Chronic Shoulder Pain

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Introduction: Shoulder pain is a common health problem with high prevalence. Previous studies have suggested that myofascial trigger points are strongly associated with musculoskeletal chronic shoulder pain. To deactivate the MTPs, different treatments have been proposed as manual techniques, active exercises and postural corrections. In addition, myofascial trigger-point release (MTR) therapy is often prescribed for treating lower back pain. However, there is a lack of systematic and controlled studies to objectively measure the efficacy of these techniques and especially in terms of muscle stiffness and elasticity. Research question(s)/hypotheses: The general aim of the present study was to assess in a pilot investigation the principle effectiveness of the Myofascial Triggerpoint Release technique in patients with chronic shoulder pain. We hypothesized that MTR technique would decrease pain perception and improve shoulder function by reducing muscle stiffness and increasing muscle elasticity. Methods: On 23 patients, three sites were selected on the more painful trapezius (treated side) and on the opposite trapezius (not-treated side) respectively. A standardized maneuver of myofascial triggerpoint release technique, in four 10 minute sessions over a period of 2 weeks was exclusively applied on the more painful trapezius. Myometry, algometry, analog scales of stress, quality of life, level of suffering and range of movement were assessed before and after intervention. Additionally, a brief pain inventory (BPI) scale was presented pre-, post- and four-weeks post- treatment. Results: A significant decrease in stiffness ($p < 0.01$) and increase in elasticity ($p < 0.001$) was observed post intervention only for the treated side. An increase in pressure and depth (algometer) indicating a significant reduction of pain was observed on the treated and not-treated sides respectively. Scores of BPI scale significantly decreased from 6 ± 1.51 before intervention to $2{,}26 \pm 1.84$ after intervention and to $1{,}64 \pm 1.84$ at 4 weeks after the intervention. A significant decrease of level of suffering and stress scores and significant increase of quality of life and range of movement scores were observed after treatment. Discussion: Our results demonstrated that MTR technique may induce clinically relevant improvements in pain reduction and objective changes in mechanical tissue properties in patients with shoulder chronic pain. Moreover, decrease in stiffness and increase in elasticity only for the treated side indicates a specificity of our intervention in improving shoulder mobility and inducing reorganization of healthy muscle functioning.

Referat Nr. 16, Sitzung (2013-04-14 11:25):

Isometric Endurance Enhancement after Repeated Profound Continuous Pressure Treatments

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Introduction: Massage can be considered relevant for low back pain but is very demanding for the therapist. A device (MyoDK®) was build to precisely apply monitored pressure using bodyweight and allow prolonged and systematic treatments under standardized protocols. Before testing its efficiency for patients, we aimed to prove its ability to enhance muscular performance in normal subjects on tests considered significant for evaluating low back pain patients. Hypothesis: A repeated treatment of mechanically applied pressure on soft tissues can increase isometric endurance. Methods: 20 national level French hockey players were randomly assigned into a treated (n = 10) and a control group (n = 10) for a 3 month trial. Blinded investigators evaluated performance initially (M0) and at the end of each month (M1, M2, M3) for isometric endurance and push-ups. Isometric endurance was calculated as the average performance on 4 tests: trunk flexors, trunk extensors, hip extensors and chair, in seconds. The treatment group received 3 treatments every month for 3 month of control monitored pressure on trunk and leg muscles for 20 minutes. Statistical analysis used ANOVA with 1 factor (level of significance was set at 0.05 for all tests.) Results: Isometric endurance is significantly increased in the treatment group after 2 months (84.8 ± 25.4 versus 125 ± 18.2, $p < 0.05$) and after 3 months (96.8 ± 21.8 versus 136.9 ± 19.8, $p < 0.05$) Push-up performance was not significantly modified. Discussion: Repeated treatment of mechanically applied pressure on trunk and legs soft tissues has been able to enhance isometric endurance of conditioned athletes, not acutely but after 2 months. Interestingly arms were not treated and the performance did not differ between the 2 groups after treatment. Blinding subjects to the treatments was found to be impossible but athletes are competitors by nature and its unlikely their performance was influenced by psychological factors. Whether improvements rely on soft tissue modifications or neural improvement remains to be determined by futures studies.

Referat Nr. 17, Sitzung (2013-04-14 11:35):

Elasticity Measurements on Agarose-Phantoms – Shear Wave Ultrasound Elastography and Myometry

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Introduction: Elastography measurements to monitor tissue changes have become important in a wide medical application field, for example in breast cancer. A new ultrasound based technology the Acoustic Radiation Force Impulse Virtual Touch Imaging and Quantification (ARFI VTIQ), and a myometry measurement device, the MyotonPro, were tested on agarose phantoms. These two new methods for assessing quantitative tissue characteristics like stiffness and elasticity were used in parallel on agarose phantoms. The ARFI technology provides a qualitative and quantitative assessment of tissue stiffness using acoustically induced shock pulses. The resulting tissue displacement is analysed as a color-coded elastography profile of the different depth of the tissue. The MyotonPro measurement is an integrated determination of tissues characteristics at a position. The MyotonPro device induces an external mechanical impulse. The resulting damped natural oscillation is recorded by an accelerometer in form of an acceleration graph. Target: Test measurements on homogenous and mixed elastography phantoms by ARFI VTIQ and Myometry. Methods: Phantoms were build out of 0,7 to 3 % agarose slices in different combinations including harder inclusions of different shapes. These inclusions had a 10 -mm diameter and were made with 1 % - 3 % agarose. A colored ink was added in the inclusion phantoms to make it visible. For optimizing the B-mode a layer of muscle tissue from pig was inserted in some phantoms. With the ARFI VTIQ technique (Siemens Acuson S3000) and Myometry (MyotonPro) the biomechanical properties of the different phantoms were determined. The ARFI VTIQ measurement is carried out in m/s, and compared with the MyotonPro biomechanical and viscoelastic properties. Result: Experiments are conducted in elastic agarose phantoms. These phantoms can be considered as elastic solids for the low-frequency, shear waves generated. The percentage in agarose choosen was tested in advance to be in the error free measuring range of the MyotonPro device. The experiments presented were realized in agarose phantom in which the shear wave speed was in the range of 1.5 m/s to 8 m/s. It was of special interest how this new ARFI technology measures tissue elasticity at transition phases. And for the Myometry technology we addressed the question which impact an inclusion at a certain depth has for the measurement. Interestingly the stiffness of an adjacent layer projects an artefact of about 2mm into the next layer for the ARFI measurement.

Referat Nr. 18, Sitzung (2013-04-14 11:40):

Possible Applications of Stretching of the Myofascial Units in Warm Water

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Introduction: At the present time more and more attention is paid to the fascia issues, both in the research and practical applications. Thomas Myer's concept of myofascial units continuity, which creates the lines of force transmission in the body applies well for stretching strategies. Most recent data shows fascia elasticity and adaptability with applications to training. However, in living body the fascia is connected with muscules, and while being stretched both tissues should be took into account. Data shows, that relaxed muscules are more able to stretch, thus we need to look for a good environment for relaxation. Body temperature water (33 - 35 degrees Celsius) seems to be optimal environment for stretching of myofascial units. Research hypothesis: Stretching of myofascial units in body temperature water is effective and gives aditional opportunity for sports professionals. Methods: Autor used a literature review, including notes from number of workshops as well as practical experience in working with top level athletes to create a proposal of stretching protocols and itd applications. Results: Presented techniques apply to all major lines of myofascial units thought the body and has applications in all natural movements. Discussion: Practical effects of stretching in the water of body temperature shows promissing results, which may be connected with recently found nature of the fascia and physiology of immersed body. This gives an additional way of application of stretching for athletes as well as a wide field of new research in this area.