Experimental study on amniotic epithelial mesenchymal cell transplantation in natural occurring tendinopathy in horses. Ultrasonographic and histological comparison

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Amnion-derived stem cells are considered a promising alternative source for tendon tissue regeneration. Aims of this paper were to illustrate the ultrasound and histological outcomes following the treatment of acute and chronic superficial digital flexor tendon spontaneous lesions in horses with ovine amniotic epithelial cells xenotransplantation.
Six adult horses suffering from unilateral acute (4 cases) and chronic (2 cases) tendinopathy (clinical and ultrasound diagnosis) were enrolled. At baseline, ovine amniotic epithelial cells were grafted, in sterile conditions and under ultrasound control, into the most damaged area. Ultrasound controls were performed at 30, 60, 90, 120, 150 and 180 days after cells implantation; after horse euthanasia (180 days) tendon samples were collected and submitted to histological examination (cellularity, extracellular matrix fiber organization, blood vessels).
At baseline, in the acute cases, the ultrasound exam showed a focal, dishomogeneous, hypo-echoic area into the superficial digital flexor tendon, with loss of the normal fibrillar pattern, while in the chronic cases the damaged tendon area appeared thickened and completely hyper-echoic.
At the final follow-up tendon echotexture was more regular, the cross-sectional area similar to the contralateral limb, and the collagen fibers were oriented in parallel to the longitudinal axis of the tendon both in the acute and chronic cases, suggesting a positive healing response.
These findings were supported by the histological analyses which showed an almost complete restoration of normal tendon architecture with an optimal alignment of tendon fibers.
The present study confirms the excellent clinical outcome after amniotic epithelial cells implantation and shows a very good correlation between the ultrasound findings and the histologic features of tendon samples.

Measuring outcome in research and clinical practice

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An outcome measure is essentially an evaluative tool for assessing the magnitude of some longitudinal change (in impairment, functioning, activities, participation, etc.) in an individual or group. The measured outcome is often a 'latent trait' (such as functional independence, manual dexterity, locomotor capability, etc.), where 'latent' means that it cannot be measured directly but is 'hidden' within the person (who may manifest it through a set of behaviours assessed by a series of questions/items), and 'trait' stands for a hypothetical construct, domain, ability or other.
In order to be useful for their intended purposes, the rating scales and questionnaires measuring 'latent traits' must provide information that allows valid inferences and decisions to be made. Basic classical test theory is still widely used, but this approach neglects a series of standard criteria and practical attributes that need to be considered when evaluating the psychometric properties of a measurement tool, such as the evaluation of how well an item performs in terms of its relevance or usefulness for measuring the underlying construct, the amount of the construct targeted by each question, the possible redundancy of the item relative to other items in the scale, and the appropriateness of the response categories.
The use of an outcome measure is an important aspect of clinical practice, audit and research. Considerable care needs to be taken to ensure that the best possible selection for the task in hand is always performed, and that, wherever possible, the selected measure conforms to modern quality standards for measurement. Rasch analysis represents one of the best methods for studying several key methodological aspects associated with scale development and construct validation. We think that the awareness of this kind of validations can by itself help the final users to critically inspect each outcome measure and the related literature before using it in clinical

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practice, decision making or policy development, and that physicians need to acquire the necessary expertise to be able to select the appropriate tools, administer them thoughtfully, and interpret correctly the results.

Mesenchymal stem cells in osteochondral lesions of the talus

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Introduction

Osteocartilagineous lesions of the ankle (OLT) are defects of the cartilaginous surface and underlying subchondral bone. OLT represent a frequent cause of pain and functional impairment. Due to the limited regenerative capability of the cartilage, surgical treatment is usually necessary. Many techniques have been advocated, with good results. Among them, regenerative techniques should be preferred in order to restore a proper chondral layer: mesenchymal stem cells may be useful to regenerate the osteochondral tissue. Aim of this work is to describe the Rizzoli's experience, at a minimum follow-up of 5 years, with bone marrow derived stem cells transplantation (BMDCT) in OLT.

Materials, patients and methods

166 patients with OLT were treated with BDMCT, between 2006 and 2008. Among these 166 patients, 105 had pure OLT, 21 had *osteochondritis dissecans* (OCD) and, in 36 cases, an early degenerative joints disease (EDJD) was associated to OLT. Patients with pure OLT (mean age 35,9 years) had a mean lesions size of 2.12 cm²; 15 of them underwent associated procedures to correct malalignment. Patients with osteochondritis dissecans (mean age 18,7 years) had an average lesions' size of 3,10 cm²: in 2 cases, calcaneal osteotomy was performed. In the early degenerative disease, 36 patients, with osteoarthritis stage I and II according Van Dijk, had a mean age of 38,7 years; 2 of them underwent distal tibial osteotomy to correct the malalignment. Patient evaluation included clinical AOFAS score, X-Rays and MRI preoperatively and at different established follow-ups. The bone marrow-derived cells were harvested from posterior iliac crest, concentrated in the operatory room, loaded on a scaffold with platelet-gel and arthroscopically implanted in the same surgical session.

Results

The overall mean preoperative AOFAS score was 60±19. At the final follow-up, the AOFAS score was 82±15. Pure OLT and OCD achieved excellent results at 24 months, with a stable trend: at 60 months, the final AOFAS score was 92±7 and 91±6, respectively. EDJD experienced a lowering trend after 24 months, which tended to a final stable plateau. 3 patients out of 36 failed; 3 cases had low AOFAS score.
The control MRI at serial follow-up showed a good regeneration of the subchondral bone and the cartilaginous tissue. A good filling of the defects, with good integration of the borders, was achieved in more than 90% of the pure OLT and OCD, whereas much lower results were recorded in EDJD. In EDJD, 6 patients had a progression of the degeneration at radiological evaluation.

Discussion and conclusion

The presented technique was able to provide good clinical results in OLT, providing a regenerated tissue which closely approximates the characteristics of the original hyaline cartilage. At 60 months, better results were achieved by pure osteochondral lesions, whereas better improvement between pre-operative and post-operative outcomes were reached by *osteochondritis dissecans*. Regarding practicality of the procedure, the use of bone marrow-derived cells permitted a one-step treatment, with marked reduction in procedure morbidity, duration and costs, overcoming the relevant drawbacks of previous repair techniques.

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All arthroscopic stabilization of acute acromioclavicular joint dislocation with fiberwire and endobutton system

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Introduction

Acromioclavicular (AC) joint dislocation is common in athletes and in contact sports and about 9% of shoulder injuries involve this joint. The majority of these AC lesions can be successfully treated conservatively but high grade dislocation and some cases of type III dislocation need a surgical treatment. Many different operative techniques have been described over the years. The purpose of this study is to evaluate the results of arthroscopic stabilization of AC joint dislocation with TightRope® system.

Materials, patients and methods

Nineteen patients with acute AC dislocation were treated by arthroscopic fixation with TightRope® system. Any associated lesions were repaired. All patients were assessed before surgery (T0), at 3 months (T1), at 6 months (T2) and at 1 year after the surgery (T3) using a visual analogic scale (VAS) and Constant-Murley Score (CMS). All patients were evaluated with X-ray and MRI was performed at final follow-up.

Results

Six AC-joint dislocations involved the right shoulder and thirteen the left shoulder. Ten were type III dislocation, three were type IV and six were type V dislocation. We found a statistically significant reduction of pain ($p< 0.0001$) at T1 compared to the pretreatment scores. The CMS measures showed an improvement between T1, T2 and T3, but the difference was statistically significant only between T1 and T3 ($p= 0.0170$). The postoperative X-Ray of the shoulder showed a good reduction of the AC joint dislocation. We had 4 cases of recurrences.

Discussion and conclusion

Arthroscopic technique for acute AC joint dislocations with the use of the TightRope® device is minimally invasive and it allows an anatomic restoration of the joint. It is a safe and effective procedure ensuring stable AC joint reconstruction and good cosmetic results.

Tissue engineering for tendon and muscle and the potential role of umbilical cord mesenchymal stem cells

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The scientists and the orthopaedic surgeons have a tremendous opportunity to work together towards the better

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understanding of the molecular mechanism of muscle and tendon repair and to conceive new therapeutic paradigms for orthopaedic tissue engineering.
This is particularly important when dealing with muscle lesions, that often partially heal with scar production in presence of lesions of more than 20% of a given muscle, and with tendon lesions, that are subjected to impaired repair depending to age, as advanced age decreased mechanical and biologic potential of tenocyte-like cells. Moreover, the enthesis is a very complex structure made of a functionally graded material; at the direct insertion site the tendon with collagen (col) type I is followed by a transitional region of fibrocartilage with col II and III and bone with col I. On the contrary, in the surgically repaired tendons, no transitional region is recreated and a prevalent fibrovascular scar with col type III is present.
For the muscle, different research approach is applied.
Firtsly, local cell injections of allogeneic muscle satellite cells or muscle derived mesenchymal stem cells (MSC) or bone marrow (BM)-MSC or adipose derived stem cells (ADSCs) have shown positive results, as well as systemic administration of CD133+ myogenic progenitor cells via the circulation. This is justified by the multiple properties of MSC, able to both differentiate and to secrete biologic factors in a paracrine way.
Tissue engineered muscle constructs also have shown promising results, i.e. the combination of myoblast-collagen I, myoblast-hyaluronic acid, BM-MSC- acellular muscle ECM scaffold.
The acellular approach, nevertheless, represents also a valid alternative. Correctly prepared extracellular matrix (ECM) scaffolds (not chemically cross-linked and with minimal residual DNA content) promote the constructive M2 macrophage phenotype and ECM-scaffold derived from tissues rich in HGF (i.e. liver) may be a promising alternative, as HGF is a primary regulator of satellite cell proliferation.
The use of molecules that inhibit the NF-κB pathway or decorin, suramin, relaxin, gamma-IFN and alpha-IFN or the inhibitor of angiotensin II (i.e. angiotensin II receptor blocker Losartan, that modulates TGF- b1) also represent potential future candidates for enhancing muscle repair. At this regards, the combined use of PRP + losartan has shown very interesting results in a recent preclinical work of Huard et al.
For the tendon, the therapeutic horizon is even more complex. Nanostructured scaffold have gained popularity as a future perspective for guiding MSC toward a more organized and efficient tenogenic repair. The use of growth factors as BMP-2, BMP-7, BMP-12 and TGF-beta 3 have obtained, in preclinical animal model, improved structural and mechanical properties of the repaired area, but still scar tissue has been observed. Platelet rich plasma (PRP) is still under investigation for the conflicting clinical evidences, albeit new suggestion come from basic science for a better use of PRP for tendon repair, as the use of PRP without high platelet and WBC concentration. In that, maybe the right question is: which type leukocyte should we discard? Indeed it has been recently demonstrated that neutrophil-depleted, mononuclear cell-enriched (monocytes and lymphocytes) PRP has anabolic effects (increased collagen production). Physical stimuli also may play a role in improving tendon repair, as mechanical stimuli and low frequency pulsed electromagnetic fields (PEMFs). Finally, from the "cellular" point of view, new potential candidates are proposed in literature to be used for increasing tendon repair, as periosteal progenitor cells, induced pluripotent stem cells, adipose stem cells, MSC from rotator cuff and long head of biceps tendon.
In this complex landscape, we propose umbilical cord (UC) as a promising source of cells for muscle and tendon tissue engineering. UC-MSC are emerging candidates for tissue engineering because of unique properties compared to other stem cell types:

- They lie in between embryonic stem cells (ESCs) and adult mesenchymal stem cells (MSCs) on the developmental map
- They share stemness markers of ESCs and MSCs
- They do not induce tumorigenesis
- They are hypoimmunogenic
- Proliferative and fresh cell numbers can be harvested painlessly in abundance from discarded umbilical cords

Emerging clinical applications of UC-MSC are now present in literature as in:

- Cancer (attenuated the growth of multiple cancer cell lines)
- Liver disease (transdifferentiation process, supportive action in increasing the functional recovery of recipient livers, anti-fibrosis)
- Heart (differentiation into cardiomyocyte-like cells; improvement in ejection fraction in a MI rat model)
- Spine (differentiate into Schwann cells capable of supporting neural regeneration and constructing myelin)
- Spinal cord injury in human (intrathecal injection)
- Disc degeneration
- Human: immune mediated disorders, such graft versus host disease (GVHD) and systemic lupus erythematosus (SLE)
- Diabetes (human model).

Materials and methods/results

We have previously differentiated UC-MSC toward osteogenic, adopogenic and chondrogenic pathway.
We used UC (12 samples) harvested from cesarean birth and a method with minimal manipulation by means of manual fragmentation, culture of fragments (14 days), culture of adherent cells (14-28 days), obtaining a consis-

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tent number of cells at P1-P2 (789673 SD +/-358824). At the FACS (fluorescence-activated cell sorting) cells were positive for some of MSC markers: CD73, CD90,CD105, CD44, CD29; negative for haematopoietic marker CD34; we observed the presence of HLA-ABC, the absence of HLA-DR and additionally a notable presence (40%) of negative double cells for both HLA-ABC and HLA-DR. Telomere lenght analysis at different passages (P1-P5) did not significant differences between the first 5 passages. UC-MSC supernatant exerted immunosuppression of T lymphocyte cultures at 5 days.
We observed the presence of myogenin at immunofluorescence (IF) in cultures of UC-MSC after 3 weeks, in presence of 40 ng/mL fibroblast growth factor (FGF). This was promising for a future potential role of this cell population for muscle repair, analogously to a recent preclinical rat model of Pereira (rat model of tibialis ant. muscle).
For tenoblastic differentiation, UC-MSCs were cultivated for 3 weeks in presence of 5 ng/ml basic fibroblast growth factor (FGF-2) and we observed the presence of scleraxis at IF. Subsequently, in order to increase the tenoblastic lineage of UC-MSC, analogously to the recent work of De Girolamo, UC-MSC were cultivated with 5 ng/ml basic fibroblast growth factor (FGF-2) and with and without the presence of PEMFs 4 hours per day (PEMF generator system IGEA, Carpi, Italy, intensity of the magnetic field = 1.5 mT, frequency = 75 Hz).
Both after 14 and 21 days, we have been able to describe a significant ($p<0.05$) difference in the expression of collagen type I and scleraxis in presence of the PEMFs stimulation when compared to that observed in presence of FGF-2 alone.
In conclusion, UC-MSC from minced UC fragments seems to be potential good candidates for orthopaedic tissue engineering and have several “non-negligible” advantages, because they represent a “Virtually” unlimited cell source and may have few ethical concerns for a future preclinical and clinical application being part of a discarded material (the UC during cesarean birth).
So, a “single-stage off-the-shelf procedure” by means of UC-MSC from minced UC fragments may be hypothesized as a future promising therapeutical approach of muscle and tendon tissue engineering.

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Prevention in gymnastic

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Introduction

Although gymnastics is a sport associated with young participants and frequent high volume, high impact training, there is a paucity of information on injury risk factors and the effectiveness of injury practices. Currently, the International Gymnastics Federation (FIG) has 50 million practitioners of all ages, abilities and cultures that benefit from the wide range of physical activities that the gymnastics offers, in more than 125 Member associations worldwide. This makes it one of the largest sports organizations that contribute to health, fitness and wellness world. Even in the Italian Gymnastics Federation are more than 900 affiliated companies who practice this discipline, with about 70.000 members.
Gymnastics can be traced back at the beginning of time, with a constant evolution and development. The date of the founding of the same Italian Gymnastics Federation is 1896. The practiced gymnastics at the end of 1800 was a form of non-competitive sports activity, with well-controlled movements: practiced gym was therefore what for us, today, is the basis of all physical activities, but also a discipline in its own right that thanks to its various programs contributes to the physical, intellectual and social development of people.

Materials, patients and methods

Gymnastics as a sport has enjoyed a boom in popularity over the last 20 years, which may reflect the increased publicity and television coverage given to the sport at events such as the Olympic Games. Currently in Italy we can count about 1,400 athletes agonists between men and 3,400 in women meanwhile in USA agonists are reported to be about 130,000. It was obviously recognized by the CIO for its function to promote health and for its potential educative. In 2008 the American Orthopaedic Society for Sports Medicine reported that each year, more than 86,000 gymnastics-related injuries were treated in USA hospitals and ambulatory surgery centers, stressing that "gymnasts must consistently prepare for the rigorous physical and emotional toils that the sport requires". "The most common injuries" - AOSSM reported in a newsletter on ww.sportsmed.org – "occur in the ankles, feet, lower back, knees, wrists and hands, often from overuse or simple stress."

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Results

The expert authors (Grant L. J and B R. Wolf) reported that because the upper body is used as a weight-bearing joint in gymnastics, injuries to the shoulder, elbow, and wrist are very common, comparing data with other sports. A wide range of injuries can occur to these joints, but some are more unique (for high frequencies) to gymnasts, including: Superior Labrum, Anterior-Posterior (SLAP) Lesions in the Shoulder Knee strain and ACL tears, Elbow Dislocation, Joints sprains, Achilles Tendon injuries, Low back pain and muscles tears. Adolescence appears to be associated with the highest incidence of injury, which may be partially due to the growth process itself inducing an imbalance between strength and flexibility. There is also evidence that the growth plate cartilage is less resistant to repetitive stress than adult articular cartilage, and that the ligaments of children are stronger than the cartilage and bone to which they are attached.

Discussion and conclusion

Many injury counter measures can be implemented to help reduce the risk of injury in the sport of gymnastics. Effective prevention of gymnastics injuries needs to be based on an understanding of the inherent nature of the sport, its participants and the external environment.
Most gymnastics injuries can be prevented using safety equipment and by following proper training guidelines and the development of a general conditioning strength and/or stretching programme that would help to reduce the risk of injury, especially before resumption of training or after an enforced break due to injury. Education of coaches and gymnasts and coaching techniques and/or behaviours are considered crucial in the prevention of gymnastics injuries. Finally, correct technique in terms of landing strategies and body posture are also considered essential to prevent gymnastics injuries above all after a severe injury in order to improve the “controlling the fall” syndrome. Both epidemiological and biomechanical research support the notion that dismount landings and the associated high impact forces imparted to the musculoskeletal system may contribute to injury in gymnastics.

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Running with or without shoes?

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The marathon race represents a very popular competition (50,063 finishers at 2013 New York City Marathon[1]). Due to its long distance the steps number is very high (~40.000 at ~3Hz the step frequency[2]). During the last decade lit-

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erature has focused on endurance as an important running feature. Many people consider jogging or long distance running as the main form of structured exercise. Some studies showed that 30% of the runners injure themselves[3] specifically in the lower limbs at hip, pelvis, knee, ankle and/or foot. Interestingly, Hasegawa et al.[4] showed that the 70% of 400 runners operated heel contact and these authors concluded their study stating that "the shoes comfort (confidence?) may prompt heel fool contact". Another interesting issue regards the potential relationship between running foot contact, in terms of neutral stance, pronation and supination, and injury. No relationship has been found[5]. Interestingly, nowadays there are different shoes for different body masses: A1 (100÷130 g for ≤55 kg athletes) A2 (180÷230 g for 55÷65 kg athletes) and A3 (250÷330 g for 65÷75 kg athletes). The shoes are increasingly more comfortable and protective, but desensitize the runner during the repeated foot contacts with the ground (typical of long distance running) on slope running as well impairing the necessary body-environment communication found by some authors[6]. Lieberman was the first to investigate the relationship between foot contact features and barefoot/shod running[7]. He showed that subjects changed foot contact type when changing from shod to barefoot running, i.e., from heel strike with double force peak to forefoot strike with single force peak[7]. Curiously, the 1970 Boston Marathon winner already wore with light shoes very similar to the contemporary minimalist ones, i.e., shoes designed to mime barefoot running[8]. Further evidence-based research is still needed, also given the $3.75 million Vibram, the manufacturer of the most known minimalist shoes, i.e., the FiveFingers, had to pay following a class action performed by several marathon runners injured due to FiveFingers use. Several authors have shown positive and negative consequences of minimalist shoes use. For instance, Hryvniak et al. administered by Facebook to 503 runners a simple questionnaire about the use of minimalist shoes showing a huge decrease of injuries after the shoes change[9]. Yet, research about this matter is still young and we still expect many new results.

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Conservative treatment of acromioclavicular joint dislocation

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The best treatment of acromioclavicular (AC) injuries is difficult to find and largely depends on patient characteristics as well as the severity of injury. There seems to be general agreement on the conservative management of types I and II injuries, while types IV, V, and VI are almost always treated surgically. Controversy still exists over the treatment of type III dislocation. In terms of subjective satisfaction, shoulder mobility, strength, and complications,

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conservative treatment of AC dislocations is indicated over surgical management. The potential advantage for surgical treatment is the reduction in residual deformity and pain and keeping shoulder stability; furthermore the degree of deformity does not correlate well with long-term improvements in pain, motion, or strength. The decison to undertake surgical management in type III dislocation depends on the age (young *vs* old) activity (sportsman *vs* no sportsman) and patient's compliance to surgical treatment. Immobilization (for three weeks) in acute dislocation is excellent to control vertical translation but is less relaible to control horizontal translation in supine position. Results of surgical *vs* conservative treatment in type III dislocation are controversial and the available literature refer to old studies. Randomized controlled studies comparing conservative and surgical therapies are needed.

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KACLiR Test in knee instability: what's new?

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Introduction

The anterior cruciate ligament (ACL) provides almost 90% of the stability to the knee joint; 20% of all sport-related knee injuries involves the ACL, the most commonly traumatized structure of the knee. ACL rupture results in knee instability, prohibits the athletes back to sports, and results in their early retirement.
Reparative knee joint surgery is usually followed, in a high percent of patients, by a long period of weakness of leg extensor muscles. It is likely that the strength modulation is the result of many factors such as increased pain sensitivity, the reduction in peripheral receptor input and the effects of disuse and immobility of the muscle tissue.
Evaluation of neuromuscular behaviour is of extreme relevance and interest in the field of rehabilitation in case of injuries or surgery. This should be used as clinical basic data for assisting and programming rehabilitation exercises. Furthermore it should be performed periodically for monitoring the effects of rehabilitation on neuromuscular functions and specific performances. Several test methods and techniques have been used to provide information regarding the relevance of strength and power to various physical pursuits and to monitor progress of rehabilitation from injuries.
Most of the muscular evaluation assessments, after knee surgery, have been performed during isokinetic training with constant speed dynamometers, even though such systems exhibit some limitations. The maximal speed allowed by the isokinetic apparatus is however lower than 25% of the maximal speed achieved during natural leg extension. Consequently, patients were asked to develop a remarkably high muscle strength; however, a high level of muscle tension is strongly influenced by the patient's pain threshold. Therefore, functional dynamic tests requiring very low muscular strength should be used more often in injury rehabilitation of the lower extremities.
However, the assessment of neuromuscular function is not sufficient for covering the large spectrum of biological changes, which occur with injures and after surgery.

Objective

In this respect, the aim of the present research is to introduce a new procedure to determine the real amount of functional recovery after knee joint surgery.
We suggested the KACLiR (Knee Anterior Cruciate Ligament Reconstruction) test, an innovative technique that analyzes a new component in the evaluation of the functional stability of the knee. This method, consisting of

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monitoring the electromyographic activity of the leg muscles during a whole body vibration treatment, evaluates and quantifies the magnitude of muscular power and sEMG activity developed during voluntary movement. Moreover KACLiR test allows the possibility to detect and quantify proprioceptor function and altered neural strategy of motor pool recruitment after injury or surgery.

Materials and methods

Design
We propose to compare the biomechanic performance in the leg extensor test synchronised with sEMG, the Hamstrings/Quadriceps sEMG ratio in jump test and the response in the EMG activity to vibratory stimuli, in the operated and in the uninjured legs.

Subjects
The study included 52 subjects divided into two groups: the experimental group, made of 38 male and female subjects (mean age= 21,4 ± 3,9) who previously underwent unilateral operation of the knee joint resulting from different types of injuries (e.g. anterior, and/or posterior ligament ruptures, meniscectomy, lateral and medial ligament surgery); the control group, made of 14 male and female healthy subjects (mean age = 28 ± 6,14).

Testing procedures
KACLiR test procedure consists of two different testing session: 1) leg extension assessment for mechanical power calculation, a diagnostic technique consisting on monitoring the muscles EMGs activity during free load leg extension and jumps, it is applied to identify strength and imbalance deficit of the operated and non operated legs; 2) whole body vibration (WBV) treatment procedure, a diagnostic technique consisting on monitoring the muscles EMGs activity during vibration and it is used to identify altered neural strategies of motoneuron pool recruitment.
All the subjects performed the KACLiR test, which is composed of four steps: leg extension, squat jump, counter movement jump and EMG/WBVtest.

Results

The results show that during leg extension test, the mechanical power of the operated leg showed a lower value ($P<0.001$) than the contralateral one, while no differences were noted in the sEMG activity. The sEMG activity during vibration treatment was higher in the operated compared to non-operated leg ($P<0.001$). It has been suggested that the reduced motility trigger functional adaptations that are exhibited via the vibration test.

Conclusion

The leg extensor test displays a high reproducibility, uses very low external resistance and therefore may provide quantitative evaluation of muscle capacities a few weeks after surgery. The sEMG response to WBV has the advantage to record diffused muscle activation in which it is possible to compare contemporaneously the injured and the healthy leg reflex response to the same stimulus.
The result of our study suggests that KACLiR test, that represents the combination of vibration and sEMG recordings, may detect the impairment after surgery and offers the opportunity to assess the degree of recovery during an habilitation program and/or of a persistent deficit.

Chronic non-specific pain: improving outcomes

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Non specific chronic pain is caused by still unknow mechanisms. For this reason many pain treatments used in physical medicine and rehabilitation do not still have a scientific rationale.
Since the Eric Kandel, Medicine Nobel Prize in 2000, late sixty studies, the modern neurophysiology is using the concepts of central sensitization to explain some of the mechanisms of chronic pain and neuropathic pain. Based on this concepts Prof. Andrew Fischer, NYU, in the late Ninety, describes spinal segmental sensitization (SSS) as possible source of common non specific chronic pain.

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Spinal segmental sensitization (SSS) is a hyperactive state of the spinal cord caused by irritative foci sending nociceptive impulses from a sensitized damaged tissue to dorsal horn neurons. The clinical manifestation of dorsal horn sensitization includes hyperalgesia of the dermatome, pressure pain sensitivity of the sclerotome and myofascial trigger points within the myotomes, which are supplied by the sensitized spinal segment.
Treatment rationale and techniques may evolve from this information, and should be taken into account when dealing with chronic patients with amplified pain responses.
Irritative foci in the form of myofascial trigger points (MTrPs) located within the associated myotomes and tender spots of the segment frequently lead to SSS. The mechanism consists of the nociceptive stimuli generated in the sensitized areas bombarding the dorsal horn of the spinal cord. This causes central nervous system sensitization with resultant hyperalgesia of the dermatome and sclerotome and spreads from the sensory component of the spinal segment to the anterior horn cells, which control the myotome within the territory of the SSS. The importance of SSS is emphasized by the fact that it is consistently associated with musculoskeletal pain. For example, thoracic SSS facilitates and perpetuates abdominal pain and somatovisceral symptoms commonly mimicking GI disorders. The development or amplified activity of MTrPs is one of the clinical manifestations of SSS.
Failure to recognize and diagnose SSS often leads to only temporary pain relief, since multimodal procedures are aimed at treating the peripheral without addressing the segmental dysfunction. This may lead to transient benefit rather than long term relief because peripheral pain and their associated symptoms frequently recur.
Eradication of the sensitized spinal segment assessing and desensitizing (reverses to normal sensitivity) the SSS by blocking the nociceptive impulses from the peripheral pain and prevents afferent bombardment of the dorsal horn. Subsequent treatment in the myotome, sclerotome, neurotome and dermatome of the territory of the sensitized spinal segment leads to long term relief of neuromusculoskeletal pain and dysfunction. Many of the common intervenction for musculoskeletal pain, such as trigger point injections, spinal manipulations, acupuncture, modalities, and others, when used with an SSS overview allow a multimodal treatment, that offers the most effective treatment of chronic musculoskeletal pain.

1. Identification of the immediate cause of pain:
   Ask patient to point with one finger where the most intensive pain is.
   Find the point of maximum tenderness.
   Reproduction (recognition) of pain: press over the maximum tender point and ask: is this the pain you are complaining about?
   Quantify the tenderness (degree of sensitization) by algometer.
2. Diagnosis of sensitized spinal segment (SSS):
   Dermatomal hyperalgesia:
   1. Pain diagram.
   2. Paper clip scratch test (use of sensory diagnostic tracks).
   3. Skin pinch and roll: Test sensitization of subcutaneous tissue.
   4. Dorsal and ventral primary ramus hyperalgesia needs to be diagnosed

   Sclerotomal hyperalgesia:
   1. Palpation for tenderness of spinous vertebral processes.
   2. Palpation for tender spots (TsP) and MTrPs at attachment sites, and enthesopathies.

   Myotomal distribution of:
   1. Trigger points/tender spots by palpation and algometry.
   2. Taut bands by palpation and tissue compliance meter which renders quantified, objective results.
   3. Muscle spasm/reduced stretch range by palpation.
3. Treatment: concentrate on the sensitized spinal segment corresponding to the immediate cause(s) of peripheral pain and the associated spinal segmental nociceptive irritative focus. The multimodal treatment techniques to desensitize the dorsal horn, eliminate the SSS and eradicate the peripheral pain generators.

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