

Session: Disease & Treatment – Osteoarthritis

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PLATELET RICH PLASMA FROM UMBILICAL CORD BLOOD WITH CHINESE MEDICINE FORMULA LING ZHI AND SAN-MIAO-SAN IN HYALURONIC GEL FOR ARTICULAR CARTILAGE RETRIEVAL IN RAT OSTEOARTHRITIS MODELZhe Cai ^a, William W. Lu ^{a,b}^aDepartment of Orthopaedics and Traumatology, Li Ka Shing Faculty of Medicine, The University of Hong Kong, Hong Kong^bShenzhen Institutes of Advanced Technology, Chinese Academy of Science, Shenzhen, China

Background: Osteoarthritis (OA) is the most common degenerative joint disease. Umbilical cord blood (UCB) Platelet Rich Plasma (PRP) is an autologous, non-immunogenic concentrate of platelets and a rich source of growth factors. Hyaluronic acid (HA) gel scaffolds function as a delivery vehicle, which augment platelet viability in UCB PRP with the traditional Chinese medicine formulas Ling zhi (LZ) and San-Miao-San (SMS). Our aim is to address this issue and UCB PRP therapy, specifically using the potential therapeutic activities of LZ-SMS, which has been used empirically for the treatment of OA, to promote chondrocyte proliferation and exhibit additive or synergistic immunoregulatory effects for the articular cartilage retrieval at a rodent model of traumatic OA and subsequent cartilage damage.

Subjects and Methods: Selected patients undergoing total knee arthroplasty (TKA) for OA and equal age- and sex-matched healthy controls were recruited and patients' demographic data of age, drugs and Oxford knee scores were recorded. The radiographs of OA knee were evaluated according to the Kellgren and Lawrence system. The biochemical parameters from blood and synovial fluid samples were measured. The validity of the histopathology grading systems was also examined using the Société Française d'Arthroscopie chondroplasty scoring system. Synovial membrane and articular cartilage were obtained from patients undergoing TKA. In the vivo study, the traumatic OA animal model was made by transection of the anterior cruciate ligament (ACL) in Sprague-Dawley rats and resulting in a true instability-induced OA lesion that mimics human traumatic OA. All ACLT treated rats were administered with UCB PRP, UCB PRP HA gel, and UCB PRP with LZ-SMS HA gel, respectively, twice a week for 3 consecutive months, following which the animals were performed micro-CT scan, biochemical parameters detection and histological staining.

Results: We obtained an average PRP concentration of around 1×10^7 platelets/ml. The site of injection was first confirmed using a rat cadaver and verifying with dye. We tagged platelets with the cell tracker indium-111 radioisotope and then used a confocal microscope to view the platelet distributed throughout in the HA gel. We found that human endothelial cells cultured with thrombin activated PRP induced relatively more endothelial cell proliferation compared to control, which demonstrated the potential benefit of PRP to induce cartilage proliferation. In our pilot vivo study, the female Dukin Hartley guinea pigs treated with 100 μ l of PRP HA gel were not found any significant worsening in morphology of cartilage, when compared to the control limb. Furthermore, the treated limb had an increased content of glycosaminoglycan compared to the control limb.

Discussion and Conclusion: The study is to elucidate the *in vivo* immunoregulatory effect of the refined UCB PRP with LZ-SMS on the articular cartilage retrieval in a rodent model of traumatic OA and promotes chondrocyte proliferation *in vitro*, as well as characterizing the clinical features of OA patients. We now wish to investigate further the effect of UCB PRP with LZ-SMS in HA gels on OA cartilage retrieval and chondrocytes proliferation.

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A UNIQUE MULTI-PLANAR EXTERNAL FIXATOR DEVELOPED FOR HIP DISTRACTIONWing Ho Chau ^a, Yuk Sun Cheng ^a, Fuk Tat Mak ^b, Kin Sum Cheung ^a, Ling Qin ^a, Bobby Kin Wah Ng ^a^aDepartment of Orthopaedics & Traumatology, The Chinese University of Hong Kong, Shatin, Hong Kong, China^bDepartment of Electronic Engineering, The Chinese University of Hong Kong, Shatin, Hong Kong, China

Introduction: Legg-Calve-Perthes disease (LCPD) is a form of hip joint disorder, in which avascular necrosis leads to bone softening and fragmentation. It results in deformity of the femoral head and collapse of the functioning hip joint, including subluxation and loss of range of motion. Persistent subluxation would lead to permanent deformity. Hip distraction is used to distract the hip joint in order to

restore the normal anatomy by reducing subluxation and containment of the hip in skeletally immature patient. It is intended that by removing mechanical loading on hip joint, there would improve synovial circulation for better healing. However, the current distractor only allows one direction of movement (i.e. hip flexion). This limitation greatly impairs the mobility of the patients. In our study, a new multi-planar external fixator is designed and tested on cadaveric specimen. It allows two planes of motion (hip flexion/extension and abduction/adduction) without dislocation of bone.

Subjects and Methods: A 3D bone model is built from the DICOM data of patient's CT scan in computer aided design software. A new external fixator is then designed and optimized in collaboration with surgeons and engineers. This new fixator is fabricated and attached on a 3D bone model for simulating the hip distraction surgery. Finite element model is built to optimize the distractor and strengthen the stress concentrated region. Cadaver tests with a subluxed hip joint model were performed to prove the concept of the design. Reduction of hip joint was achieved and range of motion allowed by the new distractor is recorded.

Results: A fresh frozen cadaver specimen with intact soft tissues was used in the test. With the help of imaging facilities and navigation system, precise pin fixation can be achieved. The hip distractor distracted the hip joint successfully and kept it in proper position. Movements guided by the distractor can be performed smoothly without dislocating the femoral head. 110 degree of flexion and 30 degree of abduction are recorded when fixing the hip distractor on the cadaver specimen. Circumduction is also possible. No obvious dislocation of the femoral head was observed during hip motion. Also, the subluxed femoral head was restored and contained in the acetabulum after distraction.

Discussion and Conclusion: The external fixation is successful and the distractor is fixed securely on the cadaver. After applying the distractor, both up and down, sideways and rotational movement of the thigh are possible. Further optimization and clinical trials are needed before routine clinical applications. We hope that this multi-planar external fixator will reduce patient's inconvenience in the postoperative period and give a better clinical outcome in patients with LCPD.

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NORMATIVE DATA OF KEY AND PULP PINCHES TO GRIP STRENGTH IN HEALTHY TWENTIESNaomi Hanaka ^{a,b}, Hiroshi Satake ^b, Yasushi Naganuma ^b, Masahiro Maruyama ^b, Ryusuke Honma ^b, Daisuke Ishigaki ^a, Michiaki Takagi ^b^aYamagata Saisei Hospital, Yamagata, Japan^bDepartment of Orthopaedic Surgery, Yamagata University Faculty of Medicine, Yamagata, Japan

Introduction: Grip and pinch strengths are commonly evaluated as parameters of hand function. However, the relationship between grip and pinch strengths has not clearly defined. Therefore, we investigated grip strength, pulp pinch, and key pinch in young adults in order to provide basic data.

Methods: The present study included 450 young adults (326 males, 124 females) with a mean age of 24 years (range, 21–29 years), who were recruited between June 2011 and March 2015. The participants were investigated for grip strength, pulp pinch, and key pinch. Grip and pinch strengths were measured once as a single set by using a Smedley dynamometer and pinch meter (Sakai, Japan). We compared strength between the right and left using the paired *t* test. The level of significance was set at $p < .05$. Spearman's correlation coefficient was used to evaluate the correlation between grip and pinch strength, and between key and pulp pinch.

Results: Mean grip strength (right/ left) was 37.5 (12.9–64) kg and 35.0 (11.3–56.6) kg, respectively ($p < 0.01$). Mean pulp pinch strength was 7.0 (3.7–10.3) kg and 6.6 (3.2–10.3) kg ($p < 0.01$). Mean key pinch strength was 8.7 (4.9–10.3) kg and 8.3 (3.9–10.3) kg ($p < 0.01$). Mean key pinch strength was 1.3 (0.9–2.4) times stronger than pulp pinch strength on the right and 1.3 (0.8–2.0) times stronger on the left. The coefficient of correlation between grip and pulp pinch strengths was 0.62 on the right and 0.67 on the left, that between grip and key pinch strengths was 0.73 on the right and 0.73 on the left, and that between key and pulp pinch strengths was 0.69 on the right and 0.69 on the left. Grip strength is correlated more with key pinch strength than with pulp pinch strength.

Discussion: Normative data have been collected world-wide most often for grip strength and less often for pinch strength. There have been few studies of correlation between grip and pulp or key pinch strengths. Key pinch strength is 1.3 times greater than pulp pinch strength in the present study. Grip strength is correlated more with key pinch strength than with palmar pinch strength. We concluded that key pinch was a significant factor impacting hand strength.

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