Analgesic effect and safety of single-dose intra-articular magnesium after arthroscopic surgery: a systematic review and meta-analysis

Guang-hua Lei1*, Chao Zeng1, Dong-xing Xie1

1Department of Orthopaedics, Xiangya Hospital, Central South University, Changsha, Hunan Province, China, 410008

* The presenting author

Correspondence to: Guang-hua Lei, MD, PhD, Department of Orthopaedics, Xiangya Hospital, Central South University, #87 Xiangya Road, Changsha, Hunan, China, 410008. E-mail: lgh9640@sina.cn. Tel. 0731-84327326

Objective: To examine the analgesic effect and safety of single-dose intra-articular (IA) magnesium (Mg) after arthroscopic surgery.

Material: Pubmed, Embase and Cochrane library were searched through in January 2016.

Method: Randomized controlled trials (RCTs) that evaluate the effects of single-dose IA in comparisons of (1) Mg versus placebo, (2) Mg versus bupivacaine and (3) Mg plus bupivacaine versus bupivacaine alone after arthroscopic surgery. Additionally, in vitro and in vivo experimental studies of Mg supplementation were also targeted.

Results: A total of eight RCTs and eight experimental studies were included. IA Mg exhibited a significantly lower pain score after arthroscopic surgery when compared with placebo (MD, -0.41, 95% CI, -0.78 to -0.05, p<0.05). Meanwhile, Mg and bupivacaine presented the similar postoperative pain level and time to first analgesic request. Furthermore, statistically significant differences both in pain score (MD, -0.62, 95% CI, -0.81 to -0.42, p<0.05) and time to first analgesic request (MD, 6.25, 95% CI, 5.22 to 7.29, p<0.05) were observed between Mg plus bupivacaine and bupivacaine alone. There was no statistically significant difference between various groups in each separate trial with respect to side effects, and it seemed that none of the witnessed side effects was related to IA injection. Most of the included in vitro studies showed a chondrocyte protective effect of Mg supplementation, with only two exceptions which suggested that high level of Mg might exhibit an opposite effect. There were also two in vivo studies showing a cartilage protective effect of IA Mg.

Discussion: This systematic review and meta-analysis was performed on a total of 8 RCTs (published 2006 to 2015) and 8 in vitro and in vivo experimental studies. The most important finding of the present study is that the administration of single-dose IA Mg at the end of arthroscopic surgery was effective in pain relief without increasing side effects when compared with placebo, and exhibited a comparable analgesic effect in comparison with bupivacaine. In addition, IA Mg could enhance the analgesic effect of bupivacaine. Another important finding is that Mg seemed to possess cartilage or chondrocyte protective effects according to the included experimental studies. Thus, IA Mg should perhaps be considered as an alternative to local anesthetics for pain relief after arthroscopic surgery. However, the optimal concentration and dosage of IA Mg still needs to be further explored.

Conclusions: Single-dose IA Mg at the end of arthroscopic surgery was effective in pain relief
without increasing side effects, and it could also enhance the analgesic effect of bupivacaine. In addition, Mg seemed to exhibit the cartilage or chondrocyte protective effect according to the experimental studies. Perhaps IA Mg should be considered as an alternative to local anesthetics after arthroscopic surgery. However, the optimal concentration and dosage of IA Mg still needs to be further explored.
Autophagy plays a protective role in tumor necrosis factor-α-induced apoptosis of bone marrow-derived mesenchymal stem cells

Yang Rui1, Li Wei-Ping1, Chen Zhong1, Song Bin1, Ou-yang Yi1, Deng Hai-quan1, Hou Jing-yi1, Tan Wei-Quan1, Zhou Yun-feng1.

1Department of Sport Medicine, Sun Yat-Sen Memorial Hospital, 107 Yan Jiang West Road, Guangzhou 510120, China

Background: Bone marrow-derived mesenchymal stem cells (BMSCs) are being broadly investigated for treating numerous inflammatory diseases. However, the low survival rate of BMSCs during the transplantation process has limited their application. Autophagy can maintain cellular homeostasis and protect cells against environmental stresses. Tumor necrosis factor-α (TNF-α) is an important inflammatory cytokine that can induce both autophagy and apoptosis of BMSCs. However, the actual role of autophagy in TNF-α-induced apoptosis of BMSCs remain poorly understood.

Materials: BMSCs were obtained from 10 healthy donors.

Method: In the current study, BMSCs were treated with TNF-α/cycloheximide (CHX), and cell death was examined by Cell Counting Kit-8, Hoechst 33342 staining, and flow cytometric analysis as well as by the level of caspase-3 and caspase-8. Meanwhile, autophagic flux was examined by analyzing the level of microtubule-associated protein light chain 3 B (LC3B)-II and SQSTM1/p62 and by examining the amount of green fluorescent protein-LC3B by fluorescence microscopy. Then, the cell death and autophagic flux of BMSCs were examined after pre- and co-treatment with 3-methyladenine (3-MA, autophagy inhibitor) or rapamycin (Rap, autophagy activator) together with TNF-α/CHX. Moreover, BMSCs pre-treated with lentiviruses encoding short hairpin RNA (shRNA) of beclin-1 (BECN1) were treated with TNF-α/CHX, and then cell death and autophagic flux were detected. We showed that BMSCs treated with TNF-α/CHX presented dramatically elevated autophagic flux and cell death. Furthermore, we showed that 3-MA and shBECN1 treatment accelerated TNF-α/CHX-induced apoptosis but that Rap treatment ameliorated cell death.

Results: We showed that BMSCs treated with TNF-α/CHX dramatically elevated autophagic flux and cell death. Furthermore, we showed that pre- and co-treatment with 3-MA accelerated cell death but that Rap ameliorated TNF-α/CHX-induced apoptosis. Moreover, BMSCs pre-treated with shRNA of BECN1 were more vulnerable to TNF-α/CHX-induced apoptosis compared to the negative control.

Discussion: Our results demonstrate that autophagy protects BMSCs against TNF-α-induced apoptosis.
Conclusion: We demonstrate that enhancing autophagy has a protective effect against TNF-α/CHX-induced apoptosis, but inhibiting autophagy renders cells more susceptible to TNF-α/CHX-induced cell death. These results indicate the protective role of autophagy in BMSCs in the inflammatory environment, and enhancing autophagy may be a promising strategy to improve the survival capacity of BMSCs after transplanting to the inflammatory environment.
In Vitro Rabbit Periosteal Cell Proliferation and Response to Stimulus in Microfluidic Culture System

Alvin Chao-Yu Chen¹, Chih-Hao Chiu¹, Kin Fong LEI²
¹ Chang Gung Memorial Hospital and University College of Medicine; ² Graduate Institute of Medical Mechatronics, Chang Gung University Taiwan, R.O.C.

Background: Periosteum and periosteum-derived progenitor cells have demonstrated the potential for stimulative applications in repair of various musculoskeletal tissues. It is a thin, osteogenic tissue that surrounds bone, houses a heterogenous population of stem cells and osteoprogenitors. There is evidence that periosteum-cell derived paracrine factors, specifically vascular endothelial growth factor (VEGF) and bone morphogenetic protein 2 (BMP2), orchestrate autograft healing through host cell recruitment and subsequent tissue elaboration. Methods that can help periosteal cell proliferation have been studied extensively. However, disadvantages of conventional cell analysis are because it can only provide end-point quantification, is time-consuming and labor-intensive and have to sacrifice cell during analysis. Commercialized microfluidic system (xCELLigence) for cell proliferation and real-time cell amount analysis has been proposed in recent years. We hypothesize that rabbit periosteal cells can successfully proliferate inside the microfluidic cell culture system (xCELLigence) and can respond to different stimulus accordingly.

Methods: Rabbit periosteal cells are harvested from the proximal medial area of both the right and left tibiae of 6-month-old New Zealand White (NZW) rabbits. Periosteal cells are then seeds into xCELLigence system for cell proliferation and further analysis. After 24 hours of cell seeding and confirmation of cell adherence, different kinds and concentration of stimulus are added to each well to see their real-time effect to seeded periosteal cells.

Results: Periosteal cells decreased rapidly right after the exposure of anesthetics, analgesics and steroids in the concentration we commonly used during clinical practice. When they are diluted to 50% and 10% concentration separately, the cytotoxicity of different kinds of anesthetics, analgesics and steroids varied.

Conclusion: Rabbit periosteal cells can be successfully proliferated inside xCELLigence system. The response varies when rabbit periosteal cells exposed to different kinds and concentrations of anesthetics, analgesics and steroids.
The Detrimental Gelling Effect of Plate-Rich Plasma when Exposed to Human Tenocytes in Small Diameter Culture Well

Chih-Hao Chiu\textsuperscript{1,2,3}, Alvin Chao-Yu Chen\textsuperscript{1,2}, Kin-Fong Lei\textsuperscript{3}

\textsuperscript{1} Department of Orthopaedic Surgery, Chang Gung Memorial Hospital, Linkou, Taiwan; \textsuperscript{2} Bone and Joint Research Center, Chang Gung Memorial Hospital, Linkou, Taiwan; \textsuperscript{3} Graduate Institute of Medical Mechatronics, Chang Gung University, Taiwan

Background

Tenocytes of chronic rotator cuff tendon tears are not able to synthesize normal fibrocartilaginous extracellular matrix. Biological strategies are proposed to enhance tissue healing. Platelet-rich plasma (PRP) with different growth factors is believed to be helpful for tenocytes proliferation. Tenocytes from different age, gender of patients and passages has different characteristics. The best-fit PRP for each individual is unknown regarding the protocol of preparation, methods of activation, ratio between different growth factors and role of white blood cell. It needs large number of preparation conditions to screen the personalized best-fit PRP. Small diameter culture wells should be used to screen as much PRP preparation as possible at the same time with limited source of tenocytes from each patient. Results of tenocytes interaction with PRP in smaller culture wells may be different when compared with conventional studies using larger diameter culture wells.

Material

Human tenocytes were isolated from edge of torn human rotator cuff tendons when performing arthroscopic rotator cuff repair. First passage of tenocytes of each individual was used in the following experiment.

Method

Tenocytes were seeded in 4 different commonly used culture plates (96 well, 24 well, 12 well and 6 well) with same seeding density (2x10\textsuperscript{4} cells/cm\textsuperscript{2}). PRP was prepared and added inside each well with adjusted volume according to the diameter of each culture well. Cell proliferation was measured by WST-1 assay.

Results

Tenocytes proliferation was increased in 6 and 12 well culture plate when exposed to PRP. However, it was decreased when exposed to the same condition of PRP (well diameter adjusted) in 24 and 96 well culture plate. The culture medium in small culture wells became gel-like material after PRP was added, which may be responsible for decreased tenocytes proliferation.
Discussion

PRP can enhance tenocytes proliferation by the delivery of various growth factors and cytokines from the α-granules contained in platelets. However, the clinical benefit when applying it for augmentation during rotator cuff repair is still controversial. This may be explained by lacking of standardization of preparation protocol for each individual’s best-fit PRP. To test as much preparation conditions at one time, small diameter culture wells should be used to decrease total tenocytes needed at the same experiment because tenocytes over 3 passages will show phenotypic drift, which will hinder the result of PRP research. The gelling effect of PRP was noted when they were tested in small sized culture wells, which might be detrimental to tenocytes proliferation. The phenomenon disappeared when they were tested in large diameter culture well as published articles. Above condition should be noticed when performing PRP experiment in small diameter culture wells.

Conclusion

The detrimental gelling effect to human tenocytes is noted when performing PRP experiment in small diameter culture well. This condition is avoided when using larger diameter culture wells.
CONFIRMED PRESENCE OF BACTERIAL 16S rRNA IN ACHILLES’ TENDON RUPTURE SAMPLES

Chelsea Hopkins¹, Sai-Chuen Fu¹, Kai-Ming Chan¹, Göran Friman², Qin Ling¹, Christer G. Rolf³

¹Department of Orthopaedics and Traumatology, Faculty of Medicine, The Chinese University of Hong Kong, Hong Kong SAR, China, Department of Medical Sciences, Uppsala University, Uppsala, Sweden², Division of Orthopaedics and Biotechnology, Department of Clinical Science, Intervention and Technology, Karolinska Institute, Stockholm, Sweden³

INTRODUCTION: Tendinopathy continues to be a growing concern in the orthopaedic arena, with various theories about its aetiopathogenesis and, given the insidious nature of the disease, it is this information about the early stages of the disease that we lack in order to make significant advancement in the treatment of this disease. Myocarditis is often caused by viruses and bacteria, and it is this microbial involvement that causes degradation of the supportive collagen matrix [1], as well as the activation of nucleotide-binding oligomerization domain (NOD) proteins that can cause cardiac dysfunction, fibrosis and apoptosis [2], similar to features observed in tendinopathy. We previously demonstrated [3] that NOD1 was significantly more prevalent in tendinopathy samples than in healthy samples, as well as demonstrating that in vitro tendon-derived stem cells responded to diaminopimelic acid (DAP; a bacterial NOD antagonist) with a pro-inflammatory response. There have been at least two reported cases of tendinopathy associated with *Borrelia burgdorferi* (Lyme disease) [4,5] and one reported case caused by *Mycobacterium tuberculosis* [6]. We aim to detect the presence of 16S rRNA, a highly conserved gene-coding region in bacteria in human tendinopathy samples.

METHODS: In an ongoing study, 24 Achilles’ tendon rupture samples were collected that displayed evidence of tendinopathic changes (confirmed by MRI) and 24 healthy hamstring samples were collected from ACL reconstruction grafts under sterile conditions (Approved by the Clinical Research Ethics Committee of the authors’ institution; Ref no.: CRE-2013.479). Genomic DNA was extracted from all samples and universal 16S primers (27F and 1492R; Invivogen©) were used to conduct PCR in order to confirm the presence or absence of bacterial 16S rRNA (confirmed by agarose gel electrophoresis). *Escherichia coli* was used as a positive control, while a blank reagent was used as a negative control. The Fisher’s exact test was used to determine whether there were significant differences between the number of 16S rRNA positive cases in the tendinopathy group and the healthy tendon group, as well as the female: male gender distribution differences between the tendinopathy and healthy groups. A t-test was used to determine whether there was a significant difference in ages between the tendinopathy group and the healthy tendon group. p-value<0.05 was considered significant.

RESULTS: Eight of the 24 Achilles’ tendinopathy samples were positive for 16S rRNA presence (33.3%; confirmed by gel electrophoresis) while no healthy hamstring tendon samples were positive for 16S rRNA presence. The Fisher’s exact test demonstrated that there were significantly more tendinopathy samples with 16S rRNA presence than in the healthy tendon group (p=0.004). The tendinopathy group was significantly older than the healthy tendon group (p<0.001) and there was no significant difference in gender between the tendinopathy group as compared to the healthy tendon group (p=0.494).

DISCUSSION: We are the first to demonstrate the presence of bacterial 16S rRNA in human Achilles’ tendinopathy. Contamination was avoided through sterile sampling and
experimental techniques, which was confirmed by the negative controls in which 16S rRNA was not detected. The significant difference of ages between the tendinopathy and healthy groups does not affect the presence of 16S rRNA. This study demonstrates that bacterial 16S rRNA is more prevalent in tendinopathy samples; however, a causal relationship between the presence of bacteria and the development of tendinopathy must be confirmed by future animal studies. We also need to determine the bacterial species through DNA sequencing in order to determine whether a diverse number of species are present in tendinopathy, such as B. burgdorferi, M. tuberculosis or even other bacteria such as Propionibacterium acnes (which has been shown to contribute to joint disease) [7], or if the bacteria detected belong to similar families or classes. Only the presence of bacteria in Achilles’ tendinopathy has been studied, and more thorough sampling and experiments are required to assess various other microbes such as viruses that may be present in the Achilles’ tendon, as well as other tendon regions. These results also support our previous study on NOD1, demonstrating that bacteria present in tendinopathy samples may activate NOD1 pro-inflammatory pathways.

SIGNIFICANCE: This study opens up a novel aspect in the aetiopathogenesis of tendinopathy. It serves as a positive basis to expand this study that may lead to greater insight into new diagnostic and treatment options.

Arthroscopic debridement of talar cyst and bone grafting by using OATS: a case report

Noriyuki Kanzaki1, Nobuaki Chinzei1, Ryosuke Kuroda1, Masahiro Kurosaka1

1 Department of Orthopaedic Surgery, Kobe University Graduate School of Medicine
7-5-1 Kusunoki-cho, Chuo-ku, Kobe 650-0017, JAPAN

Background
Bone tumors of the feet are one of the most difficult problems for foot and ankle surgeons and most of them are reported to be benign. Of these, simple bone cysts are rare but reported to have aggressive lesions which may affect any of the talus. Nowadays, arthroscopic approach is considered to be the effective and less invasive treatment for talar cyst. However, careful pre-operative simulation should be done to approach them. Here, we present the arthroscopic debridement with OATS and bone grafting for bone cyst in the medial part of the talus.

Case report
A 65-year-old woman feels her left ankle pain for three years. Her symptom continued and became worse, and she was introduced to our institution. Physical examination revealed tenderness in the medial side of her ankle and she felt it even at rest. She also noticed the symptom increased to whole ankle joint with the long standing and walking. But no apparent inflammatory findings such as swelling and redness were observed in her ankle. The American Orthopaedic Foot and Ankle Society (AOFAS) score was 87 points when she first visit us but was worsened to 77 points. Radiographs showed that no joint space narrowing in her ankle and about 1.5 cm radiolucent zone in her talus. Computed tomography (CT) revealed that 1.8 X 1.0cm cystic lesions in the medial side of her talus. Iso intensity lesion was observed in T1-weighted Magnetic resonance imaging (MRI) and high intensity in T2 MRI. Contrast effect was observed in the edge of the tumor. Therefore, we diagnosed it as a talar cyst and decided to perform the operation of arthroscopic debridement and artificial bone grafting. Under general anesthesia, patient was placed supine position with traction and thigh tourniquet. 2.7mm and 30 degrees perspective arthroscopy was prepared. When we examined her ankle joint, articular cartilage was almost intact in both talar dome and tibial plateau. At the center of the medial talus, we found a 5 × 5mm fibrillation of cartilage where we noticed sinking by probe. Neither obvious peeling nor abnormal mobility of cartilage were observed in her cartilage. After cautering the fibrillation, we stopped arthroscopy and released the spider traction. Next, about 3 cm skin incision was added distally at the medial portal site. After retraction of tibialis anterior inside, we confirmed the boundaries of the trochlea and the neck of talus. Using 8mm recipient of Osteochondral Autograft Transfer System (OATS) (Arthrex, Inc., Florida, USA), we proceeded about 12 mm implantation aiming tumor. After pulling out the cylindrical bone plug, we observed the white tissue that must be the surface of tumor. Therefore, we continued the operation with the insertion of arthroscopy into the
tissue. Tumors were removed using punch, shaver and curette and were submitted to pathology as possible. After washing, we packed firmly the granules of \( \beta \)-tricalcium phosphate (\( \beta \)-TCP) (Nippon paramedics Ltd., Tokyo Japan) as much as possible. Then, we implanted the cylindrical bone plug obtained by OATS with much attention not to mistake the direction of it. Because the fixation of the plug was very good, we decided not to perform screw fixation. We settled non weight bearing period for 2 weeks with short leg splint and started one third partial weight bearing with supporter after that. Full weight bearing was allowed from 6 weeks post-operation. After 5 months post-operation, she came back to her work of caregiver with the 100 points of AOFAS scores.

Discussion

Talar cyst are very rare and Shears E. et al. reported that the percentages of the talus with suspected bone tumors was 0.003\% at their institution. Talar cysts include simple bone cyst, intraosseous ganglion, and aneurysmal bone cyst and we often have difficulty in diagnosing them only by radiographs. However, the advances of diagnostic devices such as CT and MRI and surgical techniques made us possible to provide safe, secure medical treatment with patients. Now, we recognize that arthroscopic procedures can minimize damage to patients and allow them to start rehabilitation and to return to their daily activities much earlier with excellent clinical results. Especially, some articles about the posterior approach for talar cyst by arthroscopy has been reported. However, as for the treatment of the relatively large cyst in the medial lesion of the talus, the curettage with malleolar osteotomy is generally considered. In case of such an open surgery, we must always pay attention not to injure the saphenous vein, tendon and other neurovascular structures with the risk of malleolar non- or malunion. Recently, OATS techniques are widely used for the repair of joint cartilage defect with arthroscopic operation. Although rare, OATS are also reported as a unique hardware removal. In our case, we considered that we could reduce the invasion to the patient by approaching to the talar cyst anteriorly with OATS because the cyst was about 1cm distance from the front of talus.

Conclusion

The arthroscopic debridement with OATS have the potential to be an effective way for approaching to the talar cyst in the medial part of the talus.
Endoscopic Excision of Os Trigonum and Flexor Hallucis Longus Decompression in Dancers and Athletes

Albert Lesmana; Carlo Borbon

Makati Medical Center, Philippines

Background
Posterior ankle pain is a common complaint in dancers especially ballerinas and athletes such as runners, basketball players, or in sports that involve repetitive, forceful, plantar flexion. The most common diagnosis in this specific population is Os Trigonum Syndrome. Due to the close proximity of Flexor Hallucis Longus with an Os Trigonum, majority of these patients present with Flexor Hallucis Longus Tenosynovitis.

Due to the intense level of their training activities and routines, conservative treatment of their condition requires 3-6 months training cessation or activity modification, which can be frustrating for athletes preparing for a competition.

Based on recent studies, endoscopic excision of Os Trigonum and decompression of Flexor Hallucis Longus result in faster relief of symptoms and return to activities as reflected in Visual Analog Scale (VAS) and American Orthopaedic Foot and Ankle Society (AOFAS) ankle-hindfoot score.

In this paper, we want to share our experience in treating dancers and athletes with Os Trigonum syndrome and Flexor Hallucis Longus Tenosynovitis, which showed an excellent result in a short term period.

Material and Method
This study included 8 ankles of 8 consecutive patients who underwent arthroscopic excision of Os Trigonum and release of Flexor Hallucis Longus by a single surgeon between 2014 and 2015. The primary diagnosis was Posterior Ankle Impingement due to an Os Trigonum and Flexor Hallucis Longus Tenosynovitis. The indication for surgery was persistent posterior ankle pain in daily activities and during training despite conservative measures. Conservative treatment was initially done for a minimum of 6 months which included NSAID medication, stretching and physical exercises. X-ray and MRI examination were taken and showed evidence of Os Trigonum and inflammation of the Flexor Hallucis Longus.

From eight patients that were included in this study, three patients are professional ballet dancers, one patient is an amateur ballroom dancer, two patients are runners and two patients are basketball player. Four patients are male and four patients are female with mean age of 33.6 (19-59). Mean duration of postoperative follow-up was 4.75 months (range, 3-7 months).

Clinical evaluations were performed using the American Orthopaedic Foot and Ankle Society (AOFAS) ankle-hindfoot score and the Visual Analog Scale (VAS) for pain taken pre-operatively and upon follow up. The time to return to sports activities was assessed for each patient.

Operative Technique
Procedure was done with patient in prone position and using standard posterior portals. Endoscopic findings showed presence of Os Trigonum with inflamed synovium and Flexor Hallucis Longus tendon. Excision of Os Trigonum was done and decompression of the Flexor Hallucis Longus was carried out.

Patient was then placed in a splint for 1 week for wound care and then allowed weight bearing as
tolerated and range of movement exercises once skin wound healed.

Results
Average AOFAS ankle hindfoot score increased from 72 (range, 60-86) preoperatively to 91, (range, 85-100) postoperatively, and pain VAS decreased from 7.3 (range, 6-9) to 1.9 (range, 0-5). The mean time the patient was able to return to previous sports activities is 27.5 days (range, 14-58).
Postoperatively, seven of eight patients went back to pre-injury level of activity. One patient had a complication of tarsal tunnel syndrome upon follow up, which required decompression. No other complication was found.

Discussion
The previous study done by Weis, et al. on arthroscopic excision of a symptomatic Os Trigonum of 24 patients with a mean follow-up of 26 months, revealed similar findings with our present study. Moreover the study done by Calder, et al. on 28 elite professional soccer players with an average of 23 months follow-up, had mean length of time to return to training postoperatively of 34 days showed comparable results as to our study wherein patients were able to return to training by 27.5 days.
In our literature review, we noted that the endoscopic method was more favorable compared to the open method in the excision of Os Trigonum. A comparative study done by Guo, et al. on 41 cases of open versus endoscopic excision of a symptomatic Os Trigonum, revealed that the endoscopic group had a significantly shorter mean time to return to previous sports level. However, there is no significant difference in VAS and AOFAS score between two groups.
Limitation of our study is the small number of population and short period of follow up.

Conclusion
Endoscopic excision of a symptomatic Os Trigonum and decompression of the Flexor Hallucis Longus were effective and safe in treating Os Trigonum syndrome and Flexor Hallucis Longus Tenosynovitis. Faster relief of symptoms and earlier return to sports activities by endoscopic surgery is beneficial for professional dancer and athletes.
**Modified Posterior Portals for Hindfoot Arthroscopy**

Jianchao Gui, M.D. Ph.D. Yiqiu Jiang, M.D., Yan Xu, M.D., Haiqi Shen, M.D.

From the Orthopaedic Department, Nanjing First Hospital, Nanjing Medical University, 68 Changle Road, Nanjing 210006, China.

Address correspondence to Jianchao Gui, M.D. Ph.D., Orthopaedic Department, Nanjing First Hospital, Nanjing Medical University, 68 Changle Road, Nanjing 210006, China.

**Purpose:** The purpose of this study was to determine the course and safe distances achieved with our modified coaxial portals for hindfoot arthroscopy and to report the clinical results. **Methods:** Thirty embalmed cadaveric and ten fresh-frozen ankle specimens were used for anatomic measurements and trial operations. The posteromedial portal via the posterior tibial tendon sheath was first established. The posterolateral portal was subsequently created immediately behind the posterior border of the lateral malleolus and anterior to the peroneal tendons using an inside-out technique. The coaxial portals were finally finished with cannulas left in place. A clinical study was conducted with posterior ankle arthroscopy performed on 18 ankles in 15 patients. All patients were evaluated for any complications with an average follow-up of 38 months. **Results:** The posterior tibial nerve, posterior tibial artery and peroneal artery were located at a mean distance of 8.7 mm, 10.1 mm and 12.9 mm respectively from the near edge of the kirschner wire used as a reference to the coaxial portals. The sural nerve and lesser saphenous vein were at a larger distances of 27.6 mm and 28.3 mm, respectively. The mean West Point Score at the time of the latest follow-up was 91.5 points (range, 76-100). There were 9 excellent results, 3 good results and 1 fair result. No patient showed any complication related to the modified coaxial portals. **Conclusions:** The modified coaxial portals appeared to have a safe distance from the neurovascular structures in our anatomic study. Clinically, this technique is safe, effective, and reproducible.
Arthroscopic arthrodesis for ankle arthritis without bone graft

DUAN Xiao-jun*, YANG Liu
Center for Joint Surgery, Southwest Hospital, Third Military Medical University, Chongqing, 400038, China

Background: Ankle arthrodesis is considered by many to be the standard operative treatment for end-stage ankle arthritis. The purpose of this study was to perform the new technique application for ankle joint surface and determine the outcome for the union rates of ankle arthroscopic arthrodesis.

Methods: A total of 68 patients with posttraumatic arthritis, primary osteoarthritis, and rheumatoid arthritis were treated by ankle arthroscopic arthrodesis between May 2007 and December 2012. Our surgical indication was deformity less than 15 °measured by weight-bearing radiographs. Firstly, the remaining articular cartilage was removed with different curettes and shavers. Then the new technique (microfracture) was done at tibiotalar surfaces. Finally the ankle was fixed with two cannulated percutaneous screws. The wound healing, complications, postoperative radiographs, and American Orthopaedic Foot and Ankle Society (AOFAS) score were evaluated.

Results: The average follow-up time was 32 months (range 25-58 months). No bone grafting and a fusion rate of 100% was achieved. The average fusion time was 12.1 weeks. One patient developed superficial infection at two weeks and it was cured by non-surgical treatment. No deep infections, deep venous thrombosis, or revision surgery were observed. Screws had been removed in four patients because of prominence. One patient had fusion in the subtalar joint because of arthritis at 5 years postoperatively. At last follow-up, radiographic signs of developed or progressing arthritis were observed in 9 patients at subtalar joint and in 4 patients at talonavicular joint. At 1-year follow-up, the mean AOFAS ankle/hindfoot score had increased to 84 from a mean preoperative value of 38 (P<0.01).

Conclusions: Arthroscopic arthrodesis provides surgeons with an alternative to traditional open techniques for the management of severe ankle arthritis. Preparation of the joint surface with microfracture has been demonstrated to increase the union rate of arthroscopic ankle arthrodesis, while bone graft and other promoting substance are not necessary to be routinely used.

*Corresponding Author: dxj9@163.com
Combined Posterior and Anterior Ankle Arthroscopy for Treating Posterior and Anterior Ankle Impingement Syndrome

-A non-distraction technique with rapid switching position

Wang Xuesong
Sports medicine service, Beijing Jishuitan hospital, Beijing 100035.

Abstract Purpose: Ankle arthroscopy is an effective technique for treating ankle impingement syndrome. Sometimes it’s difficult to treat with the patients combined with the posterior and anterior lesions. A novel non-distraction technique with rapid switching position was used to treat the patients with posterior and anterior ankle impingement syndrome with combined posterior and anterior arthroscopy. The clinical results were assessed retrospectively. Method 13 consecutive patients with posterior and anterior ankle impingement syndrome were treated with combined posterior and anterior arthroscopy. There were 10 Males and 3 Females. The mean age of the patients was 30.3 years (From 15 to 47 years) .All the patients accepted at least 1 year follow up for clinical subjective scoring, range of motion and complications. Results The mean follow-up time was 15.5 months (From 12 to 22 months) .The mean pre-operative AOFAS score was 70.7±3.9, The mean post-operative was 92.8±4.7. The variant was statistic significantly (P<0.01). All patients reached normal post-operative range of motion of the ankle joint. There was no significant postoperative complication occur. Conclusion The non-distraction technique with rapid switching position which used for treat patients with posterior and anterior ankle impingement syndrome with combined posterior and anterior arthroscopy is an effective and high reproducible method. The extensive lesions of the ankle can be overall assessed and treated by this method.
Simultaneous ankle arthroscopy and hindfoot endoscopy for combined anterior and posterior ankle impingement syndrome in professional athletes

Shinya Miki, Masato Takao, Wataru Miyamoto, Hirotaka Kawano
Department of Orthopaedic Surgery, Teikyo University School of Medicine

Abstract

Background
Both anterior ankle impingement syndrome (AAIS) and posterior ankle impingement syndrome (PAIS) are likely to affect athletes who engage in certain common sports activities, but there has been almost no report which showed the effectiveness of simultaneous surgery for both conditions.

Purpose
To evaluate the clinical outcome of simultaneous low-invasive ankle arthroscopy and hindfoot endoscopy for combined AAIS and PAIS in professional athletes.

Methods
Between October 2009 and October 2011, 12 feet of 9 professional athletes (8 men, 1 woman; mean age, 25 years; range, 19–34 years) with combined AAIS and PAIS underwent simultaneous ankle arthroscopy and hindfoot endoscopy. Radiography, computed tomography, and magnetic resonance imaging were performed. Ultrasound-guided anesthetic injection was administered for diagnosis of PAIS. The active plantar and dorsal flexion angles of the ankle before and after surgery, occurrence of complications, and time to return to competitive sport were evaluated.

Results
All feet had osteophytes in the anterior ankle joint. Os trigonum and a large posterior talar process were found in 8 and 4 feet, respectively. Combined disorders were lateral ankle instability in 6 feet and osteochondral lesion of the talus in 4 feet. Median active plantar and dorsal flexion angles improved significantly from 40° (range, 30–50°) and 10° (range, 5–20°) before surgery to 50° (range, 40–55°) and 15° (range, 10–20°) after surgery, respectively (p<0.01 and p<0.05, respectively). One patient complained of numbness in the vicinity of the sural nerve which resolved spontaneously by 4 weeks after surgery. Median time to returning to competitive sport was 12 weeks (range, 12–15 weeks).

Conclusion
Simultaneous ankle arthroscopy and hindfoot endoscopy for combined AAIS and PAIS enables professional athletes to return to athletic activity.
Anatomic Reconstruction of Anterior Talofibular Ligament with Tibial Tuberosity-Patellar Tendon Autograft for Chronic Lateral Ankle Instability

Can Chen¹, Daqi Xu¹, Xuqiang Qiu¹, Xiong Li¹, Deyi Sun¹, Jin Qu¹, Hongbin Lu¹*

¹ Department of Sports Medicine, Research Center of Sports Medicine, Xiangya Hospital, Central South University, Changsha 410008, People's Republic of China

Background: Reconstruction of anterior talofibular ligament (ATFL) is challenging when the remaining ligamentous tissue is insufficient. Anatomic reconstruction of the ATFL with tibial tuberosity-patellar tendon graft is a good choice that can restore ankle stability, avoid the slow healing of tendon-bone interface as well as preserve joint mechanics and subtalar motion.

Hypothesis: A new technique for anatomically reconstructing the ATFL using a tibial tuberosity-patellar tendon graft will be effective for treating chronic lateral ankle instability (CLAI) induced by single ATFL insufficiency.

Methods: Twenty-one patients with CLAI were found at operation to have single ATFL injury, without healthy ligament margins suitable for suturing. The AFTL was anatomically reconstructed with tibial tuberosity-patellar tendon graft. The American Orthopaedic Foot and Ankle Society Ankle-Hindfoot Score (AHS) and Visual Analog Scale (VAS) were used together to evaluate the clinical results before and after operation. Radiographically, talar tilt angles and anterior drawer were also assessed in pre- and postoperative ankle stress views.

Results: At a mean follow-up of 38±30 months (range, 24-95 months), 100% of patients were completely satisfied with the procedure. Mean AHS values significantly improved from 42.3 ± 4.9 preoperatively to 90.4 ± 6.7 at the latest follow-up. VAS pain scores significantly decreased from 7.3±1.3 to 1.9±1.8 at the latest follow-up. No patients developed arthritic changes beyond grade I on plain radiographs. On stress radiographs, the mean anterior displacement was 6.7±1.2 mm before operation and 3.4±0.6 mm at the latest follow-up. The mean talar tilt angle was 12.3° ±1.1° before the operation and 4.3° ±0.8° at the latest follow-up.

Conclusion: Anatomic reconstruction of the ATFL using tibial tuberosity-patellar tendon graft allows bone-bone healing in talus and tendon-tendon healing in fibula rather than requiring tendon-bone healing, and provides satisfactory clinical outcomes for treating CLAI.
All-arthroscopic anatomical reconstruction of anterior talofibular ligament using semitendinosus autografts

Bin Song, Weiping Li, Rui Yang, Zhong Chen, Jingyi Hou, Weiquan Tan
Sports medicine department of Sun Yat-Sen memorial hospital, Sun Yat-Sen University
No.107 on Yanjiangxi Road, Yuexiu District, 510120, Guangzhou, Guangdong, China

Abstract
Purpose To show a new technique of all-arthroscopic anatomical anterior talofibular ligament reconstruction (ATFL) using semitendinosus autografts and fixed with double suture anchor for chronic ATFL rupture.
METHODS From January 2013 to February 2014, 12 patients (9 male and 3 female), underwent an arthroscopic anatomic reconstruction of the ATFL for chronic ATFL rupture with double suture anchors in tibia. Their ages ranged from 18 to 32 giving a mean age of 26 years. The American Orthopaedic Foot and Ankle Society (AOFAS) score was administered to assess the functional status; clinical examination and conventional radiographs were performed in all patients.
Results 12 patients were followed up for an average of 19.3 months (13-26 months). The mean AOFAS score was 93.25 (range 80-100) at the last follow-up(P= ,T= ). Postoperative AOFAS scores were graded as excellent and good in all patients. One patient undergone transient sural neuritis for about three months. No other complications, such as nerve injury, recurrent instability or infection, was encountered.
Conclusion The new technique, which involves all-arthroscopic anatomic reconstruction of the ATFL using the semitendinosus tendon and fixed with double suture anchors in tibia, is a viable option for treating chronic ATFL rupture with satisfactory clinical outcomes. Prospective randomized controlled trials are needed.
Clinical Relevance The technique, all-arthroscopic anatomic reconstruction of the ATFL using the semitendinosus tendon achived a satisfied outcome, can be used as a good candidate for the ATFL lesion.
Key words Ankle instability; Sprain; Arthroscopy; Ligament reconstruction
Percutaneous Repair of Achilles Tendon Rupture Under ultrasound Surveillance as Effective Method of Treatment in Patients with Other Diseases

Mikolaj Wrobel, Andrzej Mioduszewski, Juliusz Sroczynski, Robert Swierczynski, Jacek Mazek

Ortopedika - Centre for Specialized Surgery, Warsaw, Poland

Background: Open repair of torn Achilles tendon is a standard procedure, however complications may occur due to extensive approach, especially in older patients with general conditions. Different systems for minimally invasive procedures were also introduced but the risk of damaging sural nerve was pointed out.

Aims: We developed percutaneous repair of Achilles tendon rupture under ultrasound surveillance and assessed safety and results of the procedure.

Methods: Since May 2011 until September 2015 we performed 14 procedures. The tendons were repaired with Ethibond suture loop passed through the tendon below and above rupture through the skin with elastic needle under direct ultrasound visualization. We analyzed results of patients with minimally 3 months follow up. Some of patients were also burden with diabetes, cardiac diseases, psychiatric disorders and thrombocytopenia. We qualified for treatment only acute ruptures (up to 10 days), with relative contraindications for open procedures.

Results: We assessed function of repaired tendon in clinical examination and ultrasound exam 6 weeks and three months after surgery. Also AOFAS score was used. 13 of 14 patients healed tendon and returned to their activities. In one case conversion to open surgery was necessary as patient experienced another trauma in postoperative period. Another patient reported persisting pain due to suture conflict with soft tissues. Release of the suture was necessary six months after surgery. There was no sural nerve entrapment nor skin healing problems. AOFAS score raised from 57.8 to 92.8 three months after surgery.

Conclusions: Percutaneous repair of Achilles tendon rupture under ultrasound surveillance is minimally invasive and effective method of treatment of acute ruptures. It is safe and allows to avoid both sural nerve entrapment and skin healing problems. However, it requires some experience with ultrasound diagnostics.
Arthroscopic Treatment for Chronic Achilles Tendon Rupture on High Demand Patients

Nuno Corte-Real, Miguel Silva, Patrícia Wircker, Francisco Pinto
(Hospital Dr. José de Almeida, Cascais, Portugal)

Background: Chronic Achilles Tendon Rupture (CATR) results in symptomatic insufficiency of the Achilles tendon with evident impairment in ankle function.

Surgery is required and an open procedure is usually performed. There is some experience with arthroscopic transfer of Flexor Hallucis Longus (ATFHL) but most authors recommended this technique only on low demanding patients.

The purpose of this paper is to present our early experience using ATFHL on athletic patients.

Material and Methods: We did ATFHL on five non-professional athletes (three runners, one recreational footballer and one surfer), one neglected ruptures and four re-ruptures. All patients were male and the main age was 31 years old (range 23 to 40 years old). The patients we evaluated after a mean follow-up of 21 months (range 8 to 34 months) using the AOFAS score for hindfoot/ankle.

Results: The mean pre-operative AOFAS score was 63 (range 49 to 79) and a mean post-operative AOFAS score was 99 (range 97 to 100). All patients were able to do single foot heel rise and return to sports at the same level.

One patient had transient hypoesthesia of tibial nerve. No other complications where registered.

Discussion: CATR can be solved with ATFHL. However most author only recommend this type of procedure for low demanding patients. For the athletic population, the usual solution is an extensive approach with some kind of plasty of the remnant tendon or other aggressive techniques with the inherent morbidity and risk of soft tissue complications.

We present a small group of recreational athletes in which the ATFHL had a good result, avoiding the risk of a more extensive surgery, with a remarkable functional rehabilitation.

Conclusion: Our experience, although relatively short in term and in numbers, made us believe that the ATFHL may play a role in a treatment of CATR, not only on low demand patients but also in the athletic population, with overall advantage comparing with the open procedures.
The X-ray Changes after Ankle Sprain in Juvenile Patients

Tatsuya Takahashi1, Akihiro Tsuchiya1, Izumi Kanisawa1, etc.
1Funabashi Orthopaedic Hospital Sport Medicine Center, Japan

Background: Ankle sprain is one of the most common sports related injuries. Most cases remain no trouble in playing sports after the injury. However if instability remains it will be a cause of osteochondral lesion of talus or ankle osteoarthritis. The purpose of this study was to investigate the ankle X-ray changes of the patients who had experienced ankle sprain in their youth.

Methods: 10 to 15 years old patients who sprained an ankle and visit our clinic from April 2005 to March 2006 were included in this study. 221 patients 223 ankle were involved. 47 patients 48 ankles revisit the clinic with another ankle sprain and were able to evaluate follow up X-ray. Mean time between first visit and follow up X-ray were 1216 days. The presence of an ossicle of the fibular tip, osteoarthritic changings, free body and osteochondral lesion of talus were evaluated retrospectively. Patient were divided into two groups which had ossicle of the fibular tip (group O), and which had no ossicle (group N) according to follow up X-ray. We analyzed the incidence of concomitant X-ray findings in each groups.

Results: In 33 patients 34 ankles (21.5%) X-ray at first visit showed an ossicle of the fibular tip. 7 patients 7 ankles were assigned to group O and 40 patients 41 ankles to group N according to follow up X-ray. In group O the X-ray showed anterior osteophyte in 4 patients 4 ankles (57.1%), free body in 1 patient 1 ankle (14.3%) and no osteochondral lesion of talus (0%). In group N the X-ray showed anterior osteophyte in 8 patients 8 ankles (19.5%), free body in 3 patient 3 ankles (7.3%) and osteochondral lesion of talus in 1 patient 1 ankle (2.4%). There were significantly high incidence of anterior osteophyte in group O (p=0.03).

Discussion: A primary care for ankle sprain is controversial. It usually success but some cases result in chronic ankle instability. In this study one fifth of the patients showed ossicle in first visit X-ray. It involves os subfibulare but we think most of the cases are avulsion fragment. It suggests that even miner sprain which patients didn’t consult a doctor could result in avulsion fracture or they consulted but the previous doctor ignored it. In follow up X-ray 12 out of 48 ankles showed anterior osteophyte even they are so young. Especially in the patients with ossicle the incidence were 57.1%.

Conclusion: A primary care for ankle sprain in young patients is very important to prevent secondary osteoarthritis. Further studies to reveal the appropriate primary treatment for ankle sprain are needed.
Development and Validation of a Computational Foot and Ankle Model to Investigate Lateral Ligamentous Strain

Sophia Chui-Wai HA1, Daniel Tik-Pui FONG2, Feng WEI3, Defeng WANG4, Kai-Ming CHAN4

1 Department of Orthopaedics and Traumatology, Prince of Wales Hospital, Faculty of Medicine, The Chinese University of Hong Kong, Hong Kong
2 National Centre for Sport and Exercise Medicine, School of Sport, Exercise and Health Sciences, Loughborough University, Loughborough, Leicestershire, United Kingdom
3 Orthopaedic Biomechanics Laboratories, Departments of Radiology and Mechanical Engineering, Michigan State University, East Lansing, Michigan, United States of America
4 Department of Imaging and Interventional Radiology, Prince of Wales Hospital, Faculty of Medicine, The Chinese University of Hong Kong, Hong Kong

Introduction

Ankle inversion sprain is one of the most frequent injuries sustained in sports (Fong et al., 2007). Understanding the injury mechanisms is a key component of preventing sports injuries (Bahr and Krosshaug, 2005). Computational models of musculoskeletal joints and limbs can provide useful information about joint mechanics (Liacouras and Wayne, 2007). Validated models can be predictive tools to understand normal joint function and serve as clinical tools for predicting and helping to prevent sports injuries (Wei et al., 2011). This study aims to develop and validate a computational model of the foot and ankle to investigate lateral ligamentous strain in various joint motions.

Methods

A male athlete was invited to participate in this extended study (Fong et al., 2009). His mid-femur to the foot segments were CT scanned to obtain detailed joint anatomy. The CT images were imported to MIMICS and meshed as individual solid bodies. These bones were computationally separated and being assembled in SolidWorks according to the anatomical position. Ligaments were represented as linear springs. Ligamentous restraints and motion constraint were applied to the model. Since toe involvement in inversion sprain is minimal, the phalanges were neglected in this model.

Ligament strain of the model was validated against a cadaveric study done by our laboratory. In the cadaver study, specimens were moved from neutral position to a variety of motions: 30° inversion, 20° eversion, 50° plantarflexion, 20° dorsiflexion, 30° internal rotation, and 40° external rotation. Ligament length of the anterior talofibular ligament, calcaneofibular ligament, and posterior talofibular ligament were measured continuously at every 10° by a digital caliper. Sensitivity tests were performed using the computational model by modifying all ligament stiffness values by either increasing 25% or decreasing 25%. Continuous motions in three planes were then simulated with the computational model. Ligament strains in anterior talofibular ligament, calcaneofibular ligament, and posterior talofibular ligament were calculated and compared to those measured in the cadaver tests.

Results

The ligament strains of the model followed similar trends as those of the cadaver study. The strain of anterior talofibular ligament increased during plantarflexion, inversion, and internal rotation. The calcaneofibular ligament strain was under stress in dorsiflexion, inversion, and internal rotation. The posterior talofibular ligament strain was elongated in dorsiflexion, eversion, and external rotation.
Discussion

The computational model was successfully developed and validated against a cadaver study. This computational model will be further used to simulate the subject-specific injury profile in order to estimate the ligament strain during a Grade 1 injury (Fong et al., 2009). Additionally, this model can also be used in evaluation of an intelligent anti-sprain system to determine if it is effective in preventing this particular injury, and thus to further optimize the anti-sprain system.

References

INFERIOR BALANCE STRATEGY IS ASSOCIATED WITH INSUFFICIENT TRAINING EXPERIENCE BUT NOT WITH INJURY HISTORY IN RUGBY PLAYERS

Gary Chow1, 2, Shirley Fong1, Joanne Chung3, Louisa Chung3, Ada Ma3, Duncan Macfarlane1

1Institute of Human Performance, The University of Hong Kong, Pokfulam, Hong Kong; 2Faculty of Liberal Arts and Social Sciences, The Hong Kong Institute of Education, Tai Po, Hong Kong; 3Department of Health and Physical Education, The Hong Kong Institute of Education, Tai Po, Hong Kong

Background: Balance strategy and balance performance of rugby players with a history of injury are important yet under-examined issues. This study aimed (1) to examine the differences in balance strategy and balance performance between amateur rugby players and non-players, and (2) to explore injury- and training-related factors that may affect rugby players’ balance outcomes.

Material and Method: This is a cross-sectional and exploratory study. Forty-five amateur rugby players and 41 healthy active individuals participated in the study voluntarily. Both balance performance and balance strategies were assessed using the sensory organization test (SOT) of the Smart Equitest computerized dynamic posturography machine. Rugby training history and injury history were obtained by interviewing the participants.

Results: Multivariate analysis results revealed that the SOT strategy scores were 1.99–54.90% lower in the rugby group than in the control group (p <0.05), and the SOT condition-specific equilibrium scores were 1.06–14.29% lower in the rugby group than in the control group (p <0.05). After accounting for the effects of age, sex and body mass index, only length of rugby training was independently associated with the SOT condition 6 strategy score, explaining 15.7% of its variance (p = 0.006). In addition, there was no association between SOT condition 6 strategy/equilibrium scores and history of injury among the rugby players (p >0.05).

Discussion: The suboptimal postural control strategies (over-reliance on hip balance strategies) observed in the rugby players might be associated with the specific movement patterns used during rugby matches (e.g., tackles and collisions). However, with increasing training experience, rugby players gradually shifted their balance strategy from a predominantly hip strategy to an ankle strategy. History of injury including lower limb musculoskeletal injuries and mild concussion was not associated with inferior balance strategy or performance among the rugby players. This finding may be attributed to recall bias or spontaneous recovery. Nevertheless, our results may be relevant to the development of rugby-specific injury prevention programs, including balance enhancement training for the less experienced rugby players, to ensure that all players participate in rugby matches safely.

Conclusion: The amateur rugby players with a history of injury predominantly relied on a hip, rather than ankle, strategy to maintain standing balance and demonstrated suboptimal balance performance compared to their non-training counterparts. Interestingly, their suboptimal balance strategy was associated with insufficient training experience but not with history of injury.
Precise Patient Selection for Hip Arthroscopy Using Ultrasound-guided Hip Injection

Takuma YAMASAKI1, Susumu HACHISUKA2, Takeshi SHOJI2, Sotaro IZUMI2, Hiroaki MURAKAMI2, Seiichiro NIIMOTO2, Mikiya SAWA2, Kenji MIFUJI2, Yuji YASUNAGA3, Nobuo Adachi2, Mitsuo OCHI2

1Department of artificial joints and biomaterials, Hiroshima university, Japan; 2Department of orthopaedic surgery, Hiroshima university, Japan; 3Hiroshima prefectural rehabilitation center, Japan

Contact address: tacyama@hiroshima-u.ac.jp

Background

Acetabular labral tear (ALT) is considered to be the most frequent pathology as a cause of groin pain. Recently, the technique on diagnosis and arthroscopic treatment for labrum tear has progressed. Satisfactory outcomes of hip arthroscopy were reported. However, failure cases of arthroscopic treatment actually exist, and one of the most concerned problem is patient selection for hip arthroscopy. The purpose of this study is to review the patients who underwent conservative treatment including ultrasound-guided hip injection under the diagnosis of ALT, and to assess the efficacy of the technique of hip injection in order to give a more reliable diagnosis and to reach better operative indication for hip arthroscopy.

Materials and Methods

37 patients with 40 hips (18 men and 19 women) who were diagnosed as ALT, whose groin pain was evaluated using ultrasound-guided hip injection between January 2013 and December 2015, were included in this study. Possible ALT was diagnosed with positive impingement test (flexion and internal rotation), and positive findings on the radial view of MRI. The exclusion criteria included radiographic sign of osteoarthritis of the hip; Tönnis grade 2 or higher and acetabular dysplasia (center-edge angle less than 20°), or other previous history of hip joint pathology. The mean age of the patients at the first consultation was 45 years (17-71 years).

As the procedure of hip injection, HI VISION Avius ultrasound system (Hitachi Aloka Medical, Tokyo, Japan) with a 14-6 MHz linear probe was used. Intra-articular injection was performed using an anterior parasagittal approach with the free hand technique. The needle tip was inserted toward the head-neck junction. On the other hand, extra-articular injection was performed via anterior approach targeting the layer of fascia between iliopsoas tendon and rectus femoris. Not only anterior inferior iliac spine (AIIS) but also iliopsoas tendon and proximal rectus femoris were visualized in the long axis probing. Clinical evaluation was performed with visual-analogue scale (VAS) score and outcomes of the Japanese Orthopedic Association Hip-Disease Evaluation Questionnaire (JHEQ) at pre-injection and at 4 weeks after injection. JHEQ is a validated self-administered questionnaire for QOL of patients with hip disease in the Asian lifestyle, the total score range is 0 (worst) to 84 (best). Additionally, the period between the initial injection and the last injection, frequency of injection, and location of injection (intra-articular space, iliopsoas tendon, proximal rectus femoris) were investigated.

Results
Medians of the VAS score, the total score of the JHEQ, and the pain subscale score of the JHEQ significantly improved after hip injection, and the movement and mental subscale scores of the JHEQ also improved. Conservative treatment including hip injection was effective in 30 hips (75%). The mean period between the initial injection and the last injection was 5 months (range: 1-24 months), the mean times of injection was 4.5 times, and 10 hips out of 30 hips were performed injection of less than 3 times. In 7 hips, injection to iliopsoas tendon or proximal rectus femoris was more effective than that to intra-articular injection. Ten hips (25%) failed conservative treatment and required arthroscopic treatments. In these patients, the mean 2.4 times of injection were performed before surgery.

**Discussion**

Recently, Failure factors of hip arthroscopy have been reported. Not only the etiology but also pathomorphological problem and external-articular pathology is important. Considering the source of groin pain, even if intra-articular pathology is detected by radiograph or MRI, extra-articular pathology could not be ruled out. Various causes of groin pain might be hidden behind obvious pathologies such as ALT. Ultrasound-guided injection could help surgeons to give a more precise diagnosis of the origin of groin pain, which leads to select better operative indication for hip arthroscopy.

**Conclusions**

37 patients with 40 hips who were diagnosed as acetabular labral tear (ALT), whose groin pain was evaluated using ultrasound-guided hip injection were investigated. Conservative treatment including hip injection was effective in 30 hips (75%). In 7 hips out of 30 hips, injection to iliopsoas tendon or proximal rectus femoris was more effective than that to intra-articular injection. Various causes of groin pain may coexist behind obvious pathologies. Ultrasound-guided injection could be useful for precise diagnosis of the cause of groin pain and could lead to better operative indication for hip arthroscopy.
Arthroscopic management for hip acetabular labral tears

-A retrospective study for 300 hip arthroscopy surgery cases

Wang Xuesong
Sports medicine service, Beijing Jishuitan hospital, Beijing 100035

Abstract: Purpose Several studies have recently found an association between acetabular labral tears and the early onset of osteoarthritis. For this reason, treatment of labral tears in young and active patients is crucial for hip preservation. We retrospective reviewed 300 cases for hip acetabular labral tears that treated with hip arthroscopy surgery. The clinical results and image evaluation results were analyzed. Method From Mar 2007 to May 2013, 300 consecutive cases of hip acetabular labral tears were treated with hip arthroscopy surgery, we divided these cases to 4 groups: 1. Acute hip trauma. 2. Acetabular labral tears combined with Femoroacetabular impingement (FAI). 3. Acetabular labral tears combined with bonderary hip dysplasia (CE angle 20°-25°). 4. Acetabular labral tears combined with severe hip dysplasia (CE angle <20°). All the patients were evaluated by clinical examination, X ray film, MRI. The mean follow up time was 3.6 years (2-5 years). Results For Acute hip trauma cases, 36 patients were included. We performed hip arthroscopic surgery including loose body removal and debridement of the labral tears. Two of the patients were treated with internal fixation of the posterior wall fracture of acetabular rim and labral repair under arthroscopic surgery. The mean modified harris score (MOS) was improved significantly from 56.2±4.8 pre-operatively to 95.6±3.7 post-operatively. (P<0.01). For FAI cases, 234 patients were included. All the patients were treated with acetabular rim trimming and osteoplasty of femoral neck and head junction under arthroscopy surgery. 168 patients were treated with labral repair and 66 patients were treated with labral tears debridement. The mean MOS of the labral repair group was significantly improved from 68.3±3.4 pre-operatively to 97.4±2.8 post-operatively. (P<0.01). The mean MOS of the labral debridement group was significantly improved from 65.3±4.8 pre-operatively to and 95.4±4.1. (P<0.01). There was no significant different between the two groups. (P>0.05). For acetabular labral tears combined with bonderary hip dysplasia cases (CE angle 20°-25°), 25 patients were included. All the patients were treated with labral repair under arthroscopy surgery. The mean MOS was improved significantly from 70.1±2.8 pre-operatively to 98.3±4.3 post-operatively. (P<0.01). For acetabular labral tears combined with severe hip dysplasia cases (CE angle <20°), 5 patients were included. All the patients were treated with labral repair under arthroscopy surgery. The mean MOS was not significantly improved from 65.2±4.5 pre-operatively to 67.3±5.1 post-operatively. One 59 years old patients complicated with hip subluxation at 6 months after operation and revised by hip arthroplasty. The postoperative results were poor (P>0.05).

Conclusion Hip arthroscopy surgery seems to be an effective method for treating hip acetabular labral tears cases for patients not combined with severe hip dysplasia. The mid-term results showed good improvement of the clinical evaluation no matter labral repair of debridement but not for the severe hip dysplasia cases.