CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

The clinical and basic aspects of patellofemoral pain has been reviewed. The efficacy of acupuncture has been reviewed and discussed. Previous clinical experimental trials on patellofemoral pain has been summarized and discussed.

2.2 Definition and Epidemiology of patellofemoral pain

Patellofemoral pain is a common symptom, especially in athletic population[1]. It affects large percentage of the athletic population in their normal training and competition[2].

2.2.1 Types of patellofemoral pain

Patellofemoral pain was classified according to its causes. The causes of PF pain include trauma (acute and repetitive), osteochondritis dissecans, synovial plicae, chondromalacia, and patellofemoral malalignment, ligamentous injury,

muscular injury and many other soft tissue damages which occur around knee area.[6]

2.2.2 The relationship between PF pain and Quadriceps muscle

Numerous electromyographic studies have documented an overall decrease in quadriceps muscle activity and an imbalance in vastus medialis and vastus lateralis muscle activity in patients with patellofemoral pain and subluxation.[9]

The decrease in quadriceps muscle activity was found to originate from a reflex inhibition[10]. The stimulus for this inhibitory effect has been found to originate from pain and effusion[11].

2.2.3 Epidemiology

The incidence of patellofemoral pain has been reported to be high in muscular male and female athletes[3]. It had been reported that 30% of patients seen in the sports medicine clinic had patellofemoral pain[4]. In a study of running injuries, it was found that the patellofemoral area was the most frequent site of knee pain[5].

Dr.Timothy's study about " Plyometric training in female athletes" stated that a large number of adolescent female athletes with serious patellofemoral pain was caused by jumping and cutting sports such as soccer, volleyball, and basketball.[24] In a recent study on the incidence of injury in door soccer players, researchers at our

center reported that the incidence of serious knee pain was approximately sixfold higher in female than in male players.[25]

The National Athletic Trainers of American Symposium[26] reported that 18% of girls' injuries were knee-related in a population of 333,149 high school girls, and 10% of boys' injuries were knee-related in a population of 380,783 high school boys. They also reported that 89% of surgeries performed on female basketball players were for knee injuries, and the major symptom was patellofemoral pain. Ferreti et al.[27] reported a fourfold higher incidence of serious knee ligament injuries in female versus male National Championship level volleyball players. Zelisko et al.[28] reported in a 2-year study that the incidence of knee injuries in professional female basketball players was 2.2 times higher than that in professional male basketball players. It was suggested that even though these women were as well trained as their male counterparts, differences in knee injury frequency remained.

Haycock and Gillette[29] reported similar total injury rates for male and female collegiate athletes, although they did indicate that female athletes had higher rates of injury involving the patella and joints. Chandy and Grana[30] reported that significantly more female than male high school athletes had knee injuries that require surgery, and they suggested that "emphasis be placed on functional evaluation and conditioning of the quadriceps and hamstring muscles to prevent these knee injuries."

2.3 Clinical Manifestation and Diagnosis of Patellofemoral Pain caused by Chondromalacia

The common clinical symptoms of patellofemoral pain in athletic population are knee weak and pain, patellar tenderness, tenderness at the edge of patellar, instability, swelling and etc. These symptoms will definitely affect athletes' physical function, such as gait, ambulation support, jumping, stair climbing, squatting, instability, patellar inhibition and tilt tests, presence of effusion, patellar grind and crepitation.[31] Diagnosis of patellofemoral pain caused by chondromalacia was focused on patellar cartilage. Generally patellar chondromalacia was diagnosed by X-ray test and arthroscopic examination. Patellar chondromalacia was classified into 5 grades: Grade 1 chondromalacia was a normal appearance; Grade 2 chondronmalacia was cartilage softening; Grade 3 chondronmalacia was fibrillation; Grade 4 chondronmalacia was cartilage fissuring partial thickness loss; Grade 5 chondronmalacia was characterized by erosion of articular cartilage down to subchondral bone.[31]

2.3.1 Medical History

The frequent medical history of patellofemoral pain is the trauma of soft tissue which is around the patellar. It includes both acute and repetitive trauma, such as patellar chondromalacia, osteochondritis, ligamentous injury and muscular injury.[6] Malalignment has also been shown to result in damage to the patellar articular surface

as well as strain on the peripatellar structures,which can cause pain.[7]

It has been stated that a muscular imbalance between the vastus medialis and vastus lateralis muscles contributes to patellar maltracking.[8] Numerous electromyographic studies have documented an overall decrease in quadriceps muscle activity and an imbalance in vastus medialis and vastus lateralis muscle activity in patients with patellofemoral pain and subluxation.[9]

The decrease in quadriceps muscle activity was found to originate from a reflex inhibition.[10] The stimulus for this inhibitory effect has been found to originate from pain and effusion.[11]

Some patellofemoral pain had history or clinical evidence of patellofemoral dislocation, synovial plicae, or meniscal or ligamentous injury, and history of prior knee trauma or knee surgery.[32] Most studies on patellofemoral pain defined the duration of symptoms from 1 month to 15 years.

2.3.2 Physical Examination

Physical examination is the most important way to diagnose patellofemoral pain. Positive knee tests include knee weak and pain, patellar enderness, tenderness at the edge of patellar, instability, swelling and knee pain when ambulation support, jumping, stair climbing, squatting and instability, patellar

inhibition and tilt tests, presence of effusion, patellar grind and crepitation.[33]

Test of resistance, when stretching leg is when the examiner resist the patient to stretch the injured leg, the patient feel knee pain, means the test positive. The test of friction of patellar cartilage is also used to diagnose patellofemoral pain.[34]

2.3.3 X-ray test and Arthroscopic Examination

Diagnosis of patellofemoral pain caused by chondromalacia was focused on patellar cartilage. Generally, patellar chondromalacia was diagnosed by X-ray test and arthroscopic examination. Patellar chondromalacia was classified into 5 grades: Grade 1 chondromalacia was a normal appearance; Grade 2 chondronmalacia was cartilage softening; Grade 3 chondronmalacia was fibrillation; Grade 4 chondronmalacia was cartilage fissuring or partial thickness loss; Grade 5 chondronmalacia was characterized by erosion of articular cartilage down to subchondral bone.[31]

2.3.4 Isokinetic Muscle Testing

The Cybex isokinetic dynamometer (Lumex, Inc., Ronkonkoma, New York) was used to assess peak torque (strength) in the patients at the start and at completion of the therapy program. A standard method was used to test concentric

strength recorded over the whole range of motion at angular velocities of 60 deg/sec and 180 deg/sec. Test sessions consisted of five attempts with the peak torque recorded.[35]

2.3.5 Quadriceps Muscle Activity

The activity of the vastus medialis and vastus lateralis muscles was assessed during closed kinetic exercises using surface EMG electrodes. Silver-silver chloride surface electrodes were placed over the vastus lateralis muscle and the most prominent part of the vastus medialis obloquies muscle. Electrodes were held in place with a soft spandex belt and a VELCRO (VELCRO USA, Inc., Manchester, New Hampshire) buckle. The location of the strap was placed at a set distance above the patella. This location was recorded for repeat testing at the completion of the study. The repeatability of surface EMG electrodes as compared with intramuscular wire electrodes has been proven.

Integrated EMG activity readings were digitized on-line with Bio-Prompt portable EMG computer software (Physical Health Devices, Inc.). This apparatus permits the incorporation of automated gain adjustment throughout a dynamic range of 7 to 1800 V. The band width was 100 to 540 Hz with a 60-Hz notch filter. The automated gain adjustment reportedly facilitates integrated EMG monitoring during closed kinetic exercise. Average integrated EMG activity readings were obtained for the vastus medialis and vastus lateralis muscles during a closed kinetic

exercise, which consisted of step-up and step-down stair activity. Integrated EMG activity readings were recorded during a 3-second period during which a patient would step onto a 10-inch step. The test session consisted of five repetitions. The test was repeated if the patient completed the test either too quickly or too slowly. A similar procedure was performed for the step-down task.[36]

2.4 Therapeutic Modalities of Patellofemoral Pain

The initial treatment of patellofemoral pain traditionally includes quadriceps muscle rehabilitation, which consists of straight leg raises, quadriceps muscle isometrics, and short-arc terminal extension exercises.[37]

2.4.1 Patellar Taping

Braces have been advocated by several authors to improve patellar tracking and to decrease the pain associated with exercises.[38]

Patellar taping, as described by McConnell,[39] is a new technique to facilitate quadriceps muscle rehabilitation in the treatment of patellofemoral pain. The basic concept of taping is passive correction of patellar subluxation, tilt, and rotation to decrease pain during quadriceps muscle rehabilitation.

By enabling a pain-free range of motion, isotonic and isokinetic exercises may be employed for more effective quadriceps muscle strengthening in a functional armotion.

The initial results of a rehabilitation program using patellar taping have been excellent, with a success rate of 92%.[40] However, this initial McConnell study does not contain a control group and lacks objective evidence to support the use of taping.

A prospective randomized study was designed to evaluate the results of a physical therapy program that used patellar taping in a group of patients with patellofemoral pain. These results were compared with results from a similar group of patients who underwent a physical therapy program without patellar taping. The results were analyzed for both subjective pain relief and changes in quadriceps muscle strength and activity. The results of this study indicated that in similar groups of patients with patellofemoral pain, there is no beneficial effect of adding a patellar taping program to a standard physical therapy program.[41]

2.4.2 Surgical Technique

Some of patellofemoral pain caused by serious dislocation, subluxation, synovial plicae or chondromalacia were treated by surgical technique.

The patients are placed supine on the operating room table. Examination with the patient under anesthesia is then performed. After standard sterile surgical operation, application of a drape, and arthroscopic diagnosis, a lateral curvilinear incision is made from the lateral distal pole of the patella to the medial tibial tubercle with the knee controlled by a pneumatic tourniquet. This incision is carried down through the infrapatellar fascia with identification of the infrapatellar tendon. Subcutaneous lateral release is performed. The vastus lateralis tendon is identified as it inserts into the superolateral aspect of the patella and is preserved. The releasebegins distally at the tibial tubercle, runs proximal, and parallels the lateral border of the patella to extend just proximal to the superior pole of the patella. The release includes both the capsule and retinaculum but does not include the synovium.

The periosteum and muscles of the anterior compartment are then stripped from the tibia for a depth of approximately 10 mm. Then, using a microsagittal saw, the tibial tubercle is cut at its superior, medial, and lateral borders, with subsequent elevation of the tubercle with an osteotome. Distally, the bone is fractured with the periosteal sleeve remaining intact. The pedicle is then displaced medially to correct the Q angle to 0, and a 1-cm thick bone graft is obtained from the original tibial tubercle location and placed underneath the displaced tubercle.

The tubercle is then overdrilled using a 4.5-mm drill, followed by drilling with a 3.2-mm drill. Then, after taping, a cortical screw, appropriately 4.5 mm in size,

is placed. The knee is then placed through a range of motion to demonstrate normal tracking and good stability of tibial shingle. Distal medical reefing is done if passive subluxation of the patella persists after taking the knee through a range of motion. The distal fascia adjacent to the infrapatellar tendon and inferior patellar periosteum is imbricated in a pants-over-vest fashion. The vastus medialis obloquies muscle is advanced in the direction of its fibres and sutured to the patella with nonabsorbable sutures if complete passive patellar dislocation persists. The wound is then closed in layers over a medium-sized Hemovac drain (Zimmer Inc., Warsaw, Indiana).

Postoperatively, the patient's leg is placed in a brace locked at 20 and partial weightbearing is allowed using crutches. At the 1-week follow-up, the sutures are removed, weightbearing is progressed, and quadriceps muscle isometric exercises are initiated in the brace, with passive range of motion exercises in the brace several times daily. At 6 to 8 weeks, more aggressive strengthening and range of motion may be instituted with gradual return to normal activities. In the later cases, patients used a continuous passive motion machine immediately after surgery for a duration of 1 week.[42]

2.4.3 Physical Therapy

Physical therapy is widely adopted in the treatment of patellofemoral pain. Therapy consisted of an extensive stretching and quadriceps muscle-strengthening program. Quadriceps muscle strengthening involved progressive

isometric, isotonic, and isokinetic exercises.

Patients were encouraged to perform the exercises on a daily basis for approximately 30 minutes.[43]

2.4.4 Patellar Braces

As part of conservative management, patellar braces have been used to decrease pain. Palumbo [44] found that a dynamic patellar brace was effective in reducing symptoms in 93% of 62 patients. This brace is said to exert a medially displacing force to the lateral border of the patella to maintain improved alignment during flexion and extension. Levine and Splain[45] reported that 77% of the patients with patellofemoral pain experienced significant pain relief with an infrapatellar strap. The exact role of bracing is unclear, but bracing may improve abnormalities in the patellofemoral relationship.

2.5 Introduction of Acupuncture Therapy

Acupuncture is a special medical method of traditional Chinese medicine. It was reported that acupuncture therapy has been effective to many kinds of diseases, such as gastritis,[14] haematopoietic dysfunction due to radio-chemotherapy,[15]appendixmass,[16] reaction caused by blood transfusion and fluid in fusion by ear-acupuncture,[17] etc.

2.5.1 History of Acupuncture

Acupuncture therapy has long standing and established in China. Acupuncture has been treated as a efficient and popular therapy since thousands of years ago.

2.5.2 Rationale of Acupuncture

The rationale of acupuncture is to dredge the blocked meridian, so as to heal the disease. The discovery of "human meridian" is regarded as the "Fifth Great Invention of China".

According to Chinese Medicine, meridian is the channel to transport human's vital energy. If the meridian is blocked, it would cause disease.

According to modern science, many studies showed that meridian is "low electrical resistance line" or " recessive sensor", meridian is able to transfer sound, light, electricity and heat. Meridian system is an independent system, but it is closely associated with nerve system and blood vessel system. It has not only effect of transferring electricity but also liquid crystal effect. Meridian system is a body self-controlled and self-adjusted system. Chinese Acupuncture and Moxibustion therapy based in the theory of meridian is the major part of traditional Chinese Medicine. Currently, more and more countries are learning Chinese Acupuncture

technique.

Acupuncture means the use of metal needle to puncture some special points of the body on the meridian lines. The rationale of acupuncture is to dredge the blocked meridian by stimulating the special points, so as to heal the disease. Because special points are meridian's reflection on the surface of the body.[46]

2.5.3 The advantage of Acupuncture

Currently, people are trying to seek for a new therapy which has less side-effects to replace those chemical drugs, and acupuncture is really a suitable substitutional therapy for this. It is the soul of traditional Chinese Medicine. It causes less pain, more efficient and economical, easy to perform, and the equipment is simple. The most important is, needles can reach any parts of the body directly which drugs can not do.[46]

2.5.4 The Role of Acupuncture in the Treatment of Orthopaedic Pain

Acupuncture was also applied in reducing some kinds of pain caused by soft tissue damage or fracture.[21] It was reported that acupuncture had been used to reduce the pain caused by shoulder-frozen, the effective rate was 83.33%.[22]

It has also been reported in some articles, that acupuncture was good in reducing patellofemoral pain. The effective rate was 64%.[23] But they were just clinical observations. There were no statistical significance nor sufficient evidence to support.

2.6 Measurement of Patellofemoral Pain

Since the main outcome of the study is subjective pain, therefore the measurement section played a very important role in this study.

In previous studies, many different methods of evaluating subjective knee pain and knee's physical function were used.

2.6.1 Visual Analog Scale

A visual analog scale was used to assess subjective patellofemoral pain. The questions in the visual analog scale asked patients to characterize their knee pain and relate it to various activities. Answers were based on a 10-point scale. The same visual analog scale was completed at the end of the study period. Final data analysis focused on four areas of the visual analog scale: pain frequency, severity of pain, effect of pain on athletic activities, and the effect of pain on adult daily living activities.[41]

2.6.2 Descriptive Pain Scale

A Descriptive Pain Scale was used to assess subjective pain. The questions in DPS asked patients to characterize their knee pain. Answers were based on an 8-point scale.

Please choose a number according to the scales as follows:

1.No knee pain.

2.Knee pain at present, but can easily be ignored.

3.Knee pain at present, can not be ignored.

4.Knee pain at present, can not be ignored, does not interfere with everyday activity.

5.Knee pain at present, can not be ignored, interfere concentration.

6.Knee pain at present, can not be ignored, interfere some activities, except taking care of basic needs such as eating and toileting.

7.Knee pain at present, can not be ignored, interfere some activities, but rest or bed rest required.

8.Knee pain at present, can not be ignored, interfere basic needs, such as bed rest and eating.

Therefore, each patient can get knee pain's score range from 1-8, and the cutting point of this score is 5. If the score is less than 5, that means the reduction of knee pain, and athletes can go back to practice.[47]

Because the sports population is a special population, they usually go on practising even though they have slight pain or trauma. In cases of serious pain they will stop practising and go to a clinic.

2.6.3 Lysholm Knee Scale

Lysholm Knee Scale takes up symptoms during patients' daily activities. It is a modification of the score presented by Lysholm and Gillquist[48] in 1982. Score 1 is a discrete rating scale in which the patient can achieve a maximum score of 100.

TABLE 2.1-1 Lysholm Knee Scale

Limp (5 points)	
None	5
Slight or periodical	3
Severe and constant	0
Support (5 points)	
None	5
Stick or crutch	2
Weight-bearing impossible	0

TABLE 2.1-2 Lyshom Knee Scale

Locking (15 points)	
No locking and no catching sensations	15
Catching sensation but no locking	10
Locking	
Occasionally	6
Frequently	2
Locked joint on examination	0
Instability (25 points)	
Never giving way	25
Rarely during athletics or other severe exertion	20
Frequently during athletics or other severe exertion (or incapable of participation)	15
Occasionally in daily activities	10
Often in daily activities	5
Every step	0

TABLE 2.1-3 Lyshom Knee Scale

Pain (25 points)	
None	25
Inconstant and slight during severe exertion	20
Marked during severe exertion	15
Marked on or after walking more than 2 kms.	10
Marked on or after walking less than 2 kms.	5
Constant	0
Swelling (10 points)	
None	10
On severe exertion	6
On ordinary exertion	2
Constant	0
Stair-climbing (10 points)	
No problems	10
Slightly impaired	6
One step at a time	2
Impossible	0

TABLE 2.1-4 Lyshom Knee Scale

Squatting (5 points)	
No problems	5
Slightly impaired	4
Not beyond 90	2
Impossible	0

2.6.4 Marshall Scoring Scale

Marshall[49] presented a rating scale in 1977, which covers the symptoms, activity grading, results of a simple functional test, and clinical findings; many of the items are graded in a binary way, i.e., the symptoms are evaluated in an all-or-none fashion, and the maximum score is 50 points.

TABLE 2.2-1 Marshall Scoring Scale

Pain	0=Yes 1=No
Swelling	0=Yes 1=No
Stair difficult	0=Yes 1=No
Clicking/numbness	0=Yes 1=No

TABLE 2.2-2 Marshall Scoring Scale

Giving way	0=Regularly upon daily activities
	1=With stress upon daily activities
	2=With stress only
	4=Normal, none
Return to sports/work	0=No return
	1=Return to difficult
	2=Return to original with limitations
	3=Full return
Functional tests	
Duck walk	0=Cannot perform
	1=Can perform but with discomfort
	2=Can perform
Run in place	0=Cannot
	1=Can
Jump on one leg	0=Cannot perform
	1=Can perform but

TABLE 2.2-3 Marshall Scoring Scale

Half squat	0=Cannot 1=Can
Full squat	0=Cannot 1=Can
Specific knee examinations	
Tenderness	0=Yes 1=No
Joint effusion	0=Yes 1=No
Swelling (soft tissue)	0=Yes 1=No
Crepitations	0=Yes 1=No
Muscle power	0=very weak 1=Diminished flexion and extension 2=Diminished flexion or extension 3=Normal
Thigh sizes	0=> 2 cm difference 1=Limited flexion and extension 2=Limited flexion or extension

TABLE 2.2-4 Marshall Scoring Scale

Stability	
LCL	0=Gross instability
	2=Instability in flexion and extension
	3=moderate instability in flexion
	4=Mild instability in flexion
	5=Normal
MCL	0=Gross instability
	2=Instability in flexion and extension
	3=moderate instability in flexion
	4=Mild instability in flexion
	5=Normal
ACL	0=Severe in neutral and rotation (Pivot shift, Jerk test)
	2=Severe in neutral

TABLE 2.2-5 Marshall Scoring Scale

	3=Moderate jog
	4=Slight jog
	5=Normal
PCL	0=Severe in neutral and rotation
	2=Severe in neutral
	3=Moderate jog
	4=Slight jog
	5=Normal

2.6.5 Activity Scale

The activity scale [47] is graded from 0 to 10 and covers activities in daily life and recreational and competitive sports. Activity levels 5-10 can be achieved only if the patient takes part in recreational or competitive sports. Significant difference in scores at different activity levels were obtained.

TABLE 2.3-1 Activity Score

10. Competitive sports	
	Soccer- national and international elite
9. Competitive sports	
	Soccer, lower divisions
	Ice hockey
	Wrestling
8. Competitive sports	
	Bandy.
	Squash or badminton
	Athletics (jumping, etc.)
	Downhill skiing
7. Competitive sports	
	Tennis
	Athletics(running)
	Motocross, speedway
	Handball
	Basketball
Recreational sports	
	Soccer
	Bandy and ice hockey

TABLE 2.3-2 Activity Score

	Squash
	Athletics(jumping)
	Cross-country track findings both
	recreational and competitive
6. Recreational sports	
	Tennis and badminton
	Handball
	Basketball
	Jogging, at least five times per week
5. Work	
	Heavy labour (building, forestry)
Competitive sports	
	Cycling
	Cross-country skiing
Recreational sports	
	Jogging on uneven ground at least twice weekly
4. Work	
Moderately heavy labour	
	(truck driving, heavy domestic work)

TABLE 2.3-3 Activity Score

Recreational sports	
	Cycling
	Cross-country skiing
	Jogging on even ground at least twice weekly
3. Work	
Light labour (nursing)	
Competitive and recreational sports	
	Swimming
	Walking in forest possible
2. Work	
Light labour	
	Walking on uneven ground possible but
	impossible to walk in forest
1. Work	
	Sedentary work
	Walking on even ground possible
0. Sick leave or disability pension because of	
	knee problems

2.6.6 A clinical procedure for assessment of severity of knee pain.

We describe a clinical procedure for assessing knee pain: 10 standardised movements of the knee are made (4 active and 6 passive), and the subject's behaviourial response to each is scored by the assessor on a 0-3 scale. The total score is the Pain Index of the Knee (PIK). We report investigations of repeatability, inter-assessor agreement, and validity of components of the PIK compared with VAS ratings by the subject. We conclude from these results and from our experience of the PIK in practice that it is useful both clinically and for research purposes. It is a simple and efficient procedure for pain measurement in terms of behaviourial response, with good reliability and validity, at least at low and medium levels of pain.[50]

2.6.7 Pain-related limitation in activities of daily living in patients with chronic orificial pain: psychometric properties of a disability index.

Pain-related limitations in activities of daily living are presented for 272 patients reporting orificial pain of the temporomandibular region using the seven-item Pain Disability Index. Results showed that the factor structure for orificial pain patients differed a little from the factor structure for outpatients visiting chronic pain clinic settings. Analysis of pain diagnostic subgroups showed that patients suffering myogenous complaints had higher scores for four of seven daily-living activities that involved pain-related limitations than patients suffering discal disorders.

The factor analytical findings indicated that these patients share common pain-related limitations in activities of daily living. These findings are also consistent with previous results indicating greater pain in orificial pain patients diagnosed with pain complaints primarily myogenous in origin than in pain patients having discal disorders.[51]

2.6.8 The minimum clinically important difference in physician-assigned visual analog pain scores.

To determine the minimum clinically important difference in physician-assigned visual analog scale (VAS) pain scores. METHODS: Physicians attending emergency medicine didactic conferences were enrolled in this descriptive study. The subjects sequentially reviewed 11 written scenarios describing patients in moderate to severe pain. The subjects rated their perceptions of each patient's pain on a 100-mm VAS, then contrasted this pain with that of the previous patient scenario. For these contrasts, the subjects chose one of five responses: "much less," "a little less," "about the same," "a little more," or "much more" pain. The minimum clinically important difference was defined as the difference between scores for scenario pairs in which one patient's pain was rated "a little less" or "a little more" severe. RESULTS: There were 230 comparisons by 23 health professionals. Of these, 64 were judged "a little less," and 56 "a little more," painful. These 120 comparisons, with their pain score differences, were used to determine the minimum clinically important difference. Pain judged to be "a little less" or "a little

more" severe was associated with a mean difference in VAS scores of 18 mm (95% CI 16-20 mm), corresponding to a decrement of 23% (95% CI 20-26%) from the more painful scenario. CONCLUSIONS: Pain research outcomes involving a < 18-mm difference, or a 23% decrement in physician-assigned VAS pain scores, although statistically significant, may have little clinical importance.[52]

2.6.9 A new neonatal postoperative pain measurement score.

Initial testing of validity and reliability.

We have developed a neonatal pain assessment tool CRIES. The tool is a ten point scale similar to the APGAR score (Apgar 1953). It is an acronym of five physiological and behaviourial variables previously shown to be associated with neonatal pain. C--Crying; R--Requires i ncreased oxygen administration; I--Increased vital signs; E--Expression; S--Sleeplessness.We have tested CRIES for validity and reliability. This report is the result of that testing. We have found CRIES to be valid, reliable and well accepted by neonatal nurses.[53]

2.6.10 Comparison of a generic and a disease-specific measure of pain and physical function after knee replacement surgery.

Generic and disease-specific health status instruments are commonly used to assess patients' outcomes. The hypothesis is that they measure distinct but complementary aspectsof patients' quality of life was tested using a sample of

patients aged 67 to 99 years who had undergone knee replacement surgery 2 to 7 years previously. Patients' scores on a generic health-related quality-of-life (HRQOL) measure, the SF-36, were compared to those of the Western Ontario and McMaster Universities (WOMAC) Osteoarthritis Index; the WOMAC was developed specifically for patients with lower extremity arthritis, whereas the SF-36 was aimed at all conditions. A stratified sample of 1,750 Medicare beneficiaries was surveyed and an overall response rate of 80.3% achieved, resulting in 1,193 usable surveys (after adjustment or ineligible, incapacitated, and deceased individuals). The distribution of scores on the three dimensions common to both instruments (i.e., pain, physical function, and overall score) showed consistently higher scores on the WOMAC, on a scale of 0 (worst) to 100 (best), than on the SF-36, indicating less disability from arthritis than from other conditions after knee surgery in this elderly population. Statistically significant differences in the number of people with perfectly healthy scores were detected between the instruments; with regard to pain, 32.2% of the sample reported no pain due to arthritis on the WOMAC, compared with only 13.6% reporting no pain due to any conditions on the SF-36. The figures for physical function and overall score were 9.6% versus 1.4%, and 6.9% versus 0.2%, respectively. Examination for discriminant validity showed that the scores on the two scales followed hypothesized patterns: the WOMAC discriminated better among subjects with varying severity of knee problems, whereas the SF-36 discriminated better among subjects with varying levels of self-reported health status and comorbidity. The results of this study support the inclusion of both a generic and a disease-specific HRQOL measure to assess patient outcomes fully.[54]

2.6.11 The Importance of Term- return to sports

A knee performance test[55] is an objective way of measuring performance in controlled sports like activities, whereas a score can be used to assess symptoms in various activities of sports and daily life. The value of the knee function test lies in monitoring rehabilitation. A score is less useful for this purpose because rehabilitation commonly involves restrictions of activity. However, in a situation with no such restriction, the score evaluates knee function " seven days a week," but the performance test evaluates knee function only in a short test situation. Therefore, with no restriction of activity, the score probably gives the better picture of knee function. With this in mind, a function test should not be included in the knee score to evaluate knee pain and knee injury. But the measurement of knee pain or knee injury are often focused on whether patients can return to sports. Because athletes are special population, they have to go back to practise sports activities sometime even they have slightly pain or injuries.[47]

2.7 Review of Patellofemoral Pain in Clinical Trials

Many previous clinical trials have studied about the treatment of patellofemoral pain. Many different therapies were evaluated.

2.7.1 Patellar Taping in the Treatment of Patellofemoral Pain

The purpose of this study was to evaluate the efficacy of a patellar taping program in the conservative management of patellofemoral pain. Twenty-five patients with patellofemoral pain were randomized into two groups. One group nderwent a standard physical therapy program for patellofemoral pain. The other group underwent the same physical therapy program, but use of a patellar taping technique was added to this program. Results of a subjective visual analog scale and changes in isokinetic strength and electromyographic activity of quadriceps muscle were analyzed. Both the tape and no tape groups experienced a statistically significant decrease in symptoms ($P<0.05$), but no difference in improvement of patellofemoral pain was noted between the groups. Likewise, both groups demonstrated significant improvement in quadriceps muscle isokinetic strength ($P<0.05$) and activity ($P<0.001$), but no difference in improvement was noted between groups. The results of this study suggest no beneficial effect of adding a patellar taping program to a standard physical therapy program in the conservative treatment of patellofemoral pain. Larger prospective studies are warranted to support this opinion.[41]

2.7.2 Knee Brace

A clinical and biomechanical evaluation of a patellofemoral knee brace was conducted to determine subjectively and objectively if the brace was

effective in controlling knee motion and relieving patellofemoral pain symptoms. The subjective results indicated that the patellofemoral brace was able to significantly improve the level of perceived knee stability and decrease the level of pain experienced by all the subjects during their daily living and athletic activities. The objective results showed that the patellofemoral brace had no effect on knee flexion angle during gait or level walking, stair ascent, or stair descent for 2 groups of subjects patellofemoral patients and controls. Joint pain and stability are affected by factors rather than knee flexion angle.[56]

2.7.3 Muscle Function in Patients with Patellofemoral Pain

Muscle function was evaluated in 40 patients with patellofemoral pain syndrome and 20 healthy controls. Patients with patellofemoral pain had a significantly lower knee extensor strength in the most symptomatic knee compared to the least symptomatic knee. Further, the patients had less vertical jumping ability and were weaker in the most symptomatic knee compared to the controls, with the largest difference in eccentric knee extension. There were lower strength and EMG activity, in the patients compared to the controls, in the range closer to full extension and significant differences in muscle activity between the vastus medialis and the rectus femoris muscle. The results can be explained by inhibition selective to knee angles and to the vastus medialis muscle.[57]

2.7.4 Vastus medialis oblique/vastus lateralis muscle activity ratios for selected exercises in persons with and without patellofemoral pain

The purpose of this study was to determine which of selected exercises with and without the feet free to move would enhance vastus medialis oblique muscle (VMO) activity over that of the vastus lateralis muscle (VL) and whether the use of taping would increase VMO activity. Twenty-one subjects without patellofemoral pain (PFP) syndrome and 10 subjects with PFP syndrome, aged 19 to 43 years (X=26, SD=7), participated. Subjects were studied for the normalized, integrated electromyographic (IEMG) activity of their VMO, VL, and adductor magnus muscle (subjects without PFP syndrome) and the VMO/VL ratio using ire electrodes. One exercise demonstrated greater activation of the VMO over the VL when compared with similar exercises in subjects without PFP syndrome. The mean VMO/VL activity ratio for terminal knee extension was 1.2 (SD=0.5) with the hip medially rotated and 1.0 (SD=0.4) with the hip laterally rotated. Although subjects reported that patellar taping decreased pain 94% during the step-down exercise, the VMO/VL ratio was not changed. The results suggest that neither exercises purported to selectively activate VMO activity nor patellar taping improve the VMO/VL ratio over similar exercises.[58]

2.8 Review of Acupuncture in Previous Studies

Acupuncture is a special medical method of traditional Chinese medicine. It was reported that acupuncture therapy had been effective to many kinds of diseases, such as gastritis,[14] haematopoietic dysfunction due to radio-chemotherapy,[15]appendixmass,[16] reaction caused by blood transfusion and fluid in fusion by ear-acupuncture,[17] etc. Acupuncture is more effective to the diseases related with nerve, such as hemiplegia caused by stroke with thread-embeddal in acupoints,[18]parkinson's disease,[19] trigeminal neuralgia[20] and etc. Acupuncture was also applied in reducing some kinds of pain caused by soft tissue damage or fracture.[21] It was reported that acupuncture had been used to reduce the pain caused by shoulder-frozen, the effective rate was 83.33%.[22]

In China, acupuncture is a very popular medical therapy. The advantage of acupuncture is easy to perform. The cost is cheaper than those drugs. But the most important is that acupuncture therapy had special effect to some diseases. Including the reduction of pain caused by soft tissue damage or fracture.

2.8.1 Clinical Observation on 74 Cases Pain in Waist Treated with tapping along Channels Combined with Acupuncture

Based on the phenomena of needling sensation propagated both along channels and toward affected areas, the authors treated 74 cases of pain in waist

and lower extremities with tapping along channels combined with conventional acupuncture and achieved satisfactory therapeutic effects. Of the total, 37 cases (50%) were cured, 23 cases (31%) obviously improved and 14 cases (19%) improved. The combination therapy can promote systemic and strengthen needling sensation and its propagation to elevate curative effects.[59]

2.8.2 Treatment of 260 Cases of Cerebral Paralysis by Acupuncture

The authors treated 260 cases of cerebral paralysis with acupuncture therapy. The treatment was offered once daily. Simultaneously, conventional acupuncture was also combined in some points. Different needling technique were performed according to the symptoms. One course of treatment consisted of 24 sessions. The results showed 29 cases of cure, 79 of marked effectiveness, 133 of improvement, and 19 of unchange. The total effective rate was 92.7%.[60]

2.8.3 350 Cases of Diabetes treated by Acupuncture

According to diagnosis criteria of diabetes from WHO, 350 patients have been diagnosed as diabetes since 1991, including 178 male patients and 182 female patients. All patients received the treatment of acupuncture once per day. The first duration of treatment is 15 days. All drugs must be stopped during the treatment of acupuncture. Outcome: 260 cases achieved notable effect (Blood sugar is normal or decreased over 50 mg%); 80 cases achieved marked effect (symptom disappeared, Blood sugar

decreased 30-50 mg%); 10 cases had no effect.[61]

2.8.4 Pain from Shoulder-frozen treated with Acupuncture

Eighty-eight patients were randomly divided into acupuncture group and medicine group (as the control). Subjective shoulder pain were evaluated by Visual Analog Scale. All patients were treated by acupuncture therapy combined with massage therapy. After 1 month treatment, 73 cases achieved reduction of pain, 15 cases got no effect. The reduction rate of pain was 83.33%.[22]

2.9 What Will This research Do?

Patellofemoral pain is a common symptom, especially in athletic population. It affects large percentage of the athletic population in their normal training and competition.

Therefore, to improve the treatment of patellofemoral pain is what sports medicine doctors are expecting. Currently, modern sports medicine always focus on developing surgical techniques to heal sports diseases. Surgical operation can certainly achieve good outcome and patient satisfaction, but the operation might exert a greater influence on athletes' normal training and competition, and athlete's sports life would be shortened. To our knowledge, most athletes could not last their sports lives for too long after receiving surgical operation. On the other hand, surgical

treatment cost much more than conservative treatment. Therefore, most athletes and their coaches prefer to receive conservative management to treat their sports diseases.

The conventional conservative management of patellofemoral pain has focused on physical therapy, such as modification of activities, nonsteroidal anti inflammatory medications, and quadriceps muscle strengthening.[12]

Physical therapy is widely adopted in the treatment of patellofemoral pain. Therapy consisted of an extensive stretching and quadriceps muscle-strengthening program. Quadriceps muscle strengthening involved progressive isometric, isotonic, and isokinetic exercises.

Patients were encouraged to perform the exercises on a daily basis for approximately 30 minutes.[43]

As everyone knows, acupuncture therapy is a traditional Chinese Medical therapy. The advantage of acupuncture is easy to perform. The cost is cheaper than drugs. But the most important is that acupuncture therapy had special effect to some diseases, including the reduction of pain caused by soft tissue damage or fracture. It was reported that acupuncture therapy had been effective to many kinds of diseases, such as gastritis,[14]haematopoietic dysfunction due to radio-chemotherapy,[15]appendixmass,[16] reaction caused by blood transfusion and fluid in

fusion by ear-acupuncture,[17] etc. Acupuncture is more effective to the diseases related with nerve, such as hemiplegia caused by stroke mith thread-embeddal in acupoints,[18] parkinson's disease,[19] trigeminal neuralgia[20] and etc.

In China, acupuncture therapy was also widely adopted in sports medicine clinic. Most of Chinese athletes, including those who have won the world champions, used to receive acupuncture therapy. Therefore, acupuncture therapy is an acceptable treatment in terms of athletic population in China.

The author is very interested in the study of acupuncture. In the past four years of clinical practice in sports medicine clinic, we found that acupuncture therapy had achieved good outcome and patient satisfaction, particularly to most of soft tissue injuries.

But the epidemiological researches on acupuncture are insufficient. The effectiveness of acupuncture need to be proven by more scientific evidence. Therefore, more clinical control trials on acupuncture are being expected.

The purpose of this study is to evaluate the efficacy of the acupuncture therapy combined with physical therapy in the conservative treatment of patellofemoral pain caused by patellar chondromalacia, aimed at combining traditional Chinese Medicine and modern medicine together to improve the treatment of sports diseases.