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Nonsurgical Treatment and Prevention of Osgood Schlatter Disease

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Abstract. Teenagers are starting to participate in sports in greater numbers due to the recent expansion in the sports business and the spectacular holding of the Olympics in Paris. However, sports injuries during the sports process are also an unavoidable problem, such as tibial tuberosity osteochondritis (OSD), which is a high-incidence disease among adolescent athletes and is troubling many teenagers. The youth population represents the future of a country. Therefore, it is crucial to help them avoid OSD as much as possible and recover from it as soon as possible. This article briefly describes the diagnostic methods and risk factors of OSD, including clinical manifestations and analysis of the advantages and disadvantages of different diagnostic methods such as X-ray, ultrasound, and MRI. The focus is on non-surgical treatment and prevention of OSD, with a particular emphasis on physical therapy (including strength training (core stability training, and lower limb strength training), activity adjustment, stretching, and rehabilitation massage, as well as wearing orthopedic devices) and medication therapy.

Keywords: Osgood Schlatter's disease; Nonsurgical Treatment; Physical Therapy.

1. Introduction

During the growth and development period, Osgood Schlatter's disease (OSD), also known as tibial tuberosity osteochondritis, is more common in teens between the ages of 8 and 12 for females and 12 to 15 for boys. On the other hand, adult instances of OSD have also been reported in domestic literature. As early as 1903, Osgood and Schlatte released independent findings on this condition. According to research, OSD affects one in ten athletes; prevalence estimates range from 6.8% to 33%. Furthermore, only 10% of those with OSD continue to have symptoms throughout adulthood, and the condition's start is unrelated to the amount of activity performed. Additionally, symptoms of OSD may worsen as bones age [1]. Redness, swelling, soreness, and tenderness near the tibial tuberosity are the primary signs of the illness, as well as exacerbation of symptoms during knee joint movements such as kicking, jumping, and braking, and when in contact with hard surfaces (such as basketball, soccer, tennis, volleyball) or kneeling position. As people age, pain will still accompany them. Regardless of whether they continue or engage in physical exercise, regular ossification will be found on the tibial tuberosity through X-ray examination, with only a few and about 10% requiring surgical intervention [2].

With the recent sports craze, more and more teenagers are participating, and the probability of sports injuries is also on the rise. OSD is a highly prevalent sports injury disease among adolescents, this article reviews recent literature to summarize non-surgical prevention and treatment methods for this disease.

2. Diagnosis of OSD

The primary means of diagnosing OSD is by clinical signs and symptoms, which are further supported by radiological studies such as MRIs, ultrasounds, and X-rays that help differentiate OSD from other lesions.

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The condition begins in the lower leg at the point where the tibial tuberosity and anterior patellar ligament meet. In the acute phase, it manifests as soft tissue swelling, which appears blurry around the patellar tendon on X-ray examination. In the later 3-4 months, the soft tissue swelling gradually disappears, but fragmented bone can still be seen. The morphology of the tibial tuberosity tends to be normal, and bone fragmentation may merge with it throughout the chronic phase. However, there is still a chance that the bone fragmentation may shift.

Rotating the thigh 10-20 ° in the sagittal plane of the knee joint can easily identify irregularities in tibial tuberosity and epiphyseal separation, especially in the early stages. In the late stage, it can recognize bone fragmentation. Usually, X-rays can determine three different degrees of damage: Grade I, mild elevation of nodules; Grade II, with clear nodule boundaries; Grade III, nodule fragmentation. However, X-rays have certain limitations, such as only being able to identify bone injuries, while OSD mainly focuses on injuries in the patellar tendon area, which has a low degree of visualization of soft tissue. In the early stages, bone changes may not be accurately identified, and in the later stages, it may not be possible to accurately and reliably identify soft tissue healing and observe inflammation.

Ultrasound has the characteristics of non-invasiveness, reliability, speed, and low cost, and can be used for the OSD diagnosis and monitoring. It is capable of visually seeing patellar tendon injuries, ossification center fragmentation, edema, and potential reactive bursitis symptoms. However, the accuracy of ultrasound examination requires a high level of proficiency from technicians, and it can only provide a small range of views, which may result in the possibility of omissions.

MRI is the most accurate diagnostic technique in OSD detection, which can visualize the cartilage status and detect edema before the ossification center tears. In addition, it is crucial for early detection of lesions. Based on this method, Hirano et al. outlined the five phases of OSD: While NMR at stage 0 is normal, people may have specific symptoms; Phase 1 or early stage: radiological investigation revealed no evidence of inflammation; Phase 2, often known as progressive, shows the presence of tearing in the secondary ossification centers; stage 3, or end-stage: thickening of the tendon and total separation of the tibial tuberosity; Stage 4, or the tracking of bone mending and the growth of new bone tissue [3].

3. Risk Factor

3.1. Gender Factors

According to Kujala et al., the average age of those with OSD was 13.1 years, and the male to female incidence rate was 14:1 [4, 5]. The prevalence of OSD was estimated to be about 12.9%. Furthermore, Kaneuchi et al. discovered that the peak age for males is 14 years old (10.3%), whereas the highest age for girls is between 9 and 10 years old (9.2-10.9%). This observation could be explained by the fact that females reach the tibial tuberosity bone maturation stage two years before boys do. Furthermore, some academics believe that women are more likely than males to get OSD at the epiphyseal period, particularly among athletes.

3.2. Types of Sports

Football, basketball, volleyball players, etc. are all high-risk groups for OSD, accounting for 9% - 13%, 20%, and 15% -18% respectively, such as high-frequency lower limb activities and high-intensity impacts in the lower limbs of football players; Basketball requires a lot of jumping and changing directions, and the tibial tuberosity bears significant traction; Volleyball players need frequent jumps and frequent buffering of the patellar tendon [6-8].

3.3. Dynamic Factors during Exercise

The primary cause of OSD is the patellar tendon's constant tension and traction of the tibial tuberosity, which pulls the anterior tibial tuberosity's epiphyseal cartilage firmly. This strain results from repetitive motions, and the patellar tendon transfers the quadriceps femoris contraction force, which exceeds the tibial tuberosity epiphysis stress and tears the cartilage. It eventually transforms into bone tissue and solidifies the ossification center even more.

3.4. Factors Affecting Motor Function

Due to the active antagonistic relationship between the quadriceps and hamstring muscles, attention should be paid to the dysregulation factors between the two. Other important factors include the type of exercise pattern (stretching and changing direction), the increase in muscle mass and strength level during puberty (especially in boys), the decrease in quadriceps flexibility, as well as high RM level exercise and short-term high load exercise. Furthermore, it seems that the rectus muscle, biceps femoris muscle, gastrocnemius muscle, and soleus muscle are under higher strain.

3.5. Environmental Factors

The degree, quantity, and frequency of physical activity are among the training load management-related variables that may contribute to the development of OSD. Other dietary inadequacies and environmental factors, such as low vitamin D levels, particularly in nations with little sunshine and chilly climates. Research has shown that inadequate levels of vitamin D may impact the metabolism of calcium and phosphorus, resulting in inadequate mineralization of bone, particularly in teenagers undergoing growth and development. Vitamin D deficiency can cause bone fragility, which in turn can cause OSD. Vitamin D deficiency manifests in two aspects: firstly, insufficient sunlight exposure. In low temperatures or winter, with short sunlight exposure and indoor sports training facilities, Vitamin D levels in the blood drop as a result of a reduction in vitamin D production in the skin. This phenomenon is quite common. The second is a dietary deficiency, such as a lack of foods rich in vitamin D in the diet, such as fish and egg yolks.

Another important area for the environmental elements that lead to OSD development is the sports field. For instance, a too hard field may increase the impact and stress on the tibial tuberosity and the force applied to the knee joint during sprinting, leaping, and turning motions. Sports equipment plays a significant role as well. For example, unsupportive shoes may put undue strain on the tibial tuberosity when a person runs, jumps, or changes directions. Another thing to consider is too rigid shoes. The impact force that should be absorbed by the shoes during exercise is transmitted to the knee joint, greatly increasing the risk of OSD.

4. Physical therapy methods

Physical therapy for this disease usually involves knee stretching, relaxing the quadriceps muscle to reduce tension, massaging the quadriceps muscle, and performing stretching exercises, combined with ice compress to reduce pain control inflammation, and alleviate local edema. Control activities and reduce stress. It can be combined with relaxation or enhancement training to alleviate symptoms of strength imbalance between the quadriceps and hamstring muscles, achieving a certain balance.

4.1. Stretching Training

The patellar tendon on the tibial tuberosity is subjected to increased stress during OSD stretching and flexibility training when calf muscles such the quadriceps, hamstring, gastrocnemius, and tibialis anterior are tense. The tibial tuberosity might experience less stress when muscles are stretched. Continuous stretching has been shown in studies to relieve discomfort and lessen patellar tendon stress [6]. It may also be used in conjunction with magnetic field treatment or extracorporeal shock wave therapy. When it comes to their medicinal benefits, the former has been shown to successfully reduce tendon pain due to its analgesic properties and ability to restructure and encourage the regeneration of soft tissues. It has been shown that the latter increases bone matrix, improves cartilage, and facilitates bone healing.

4.2. Strength Training

Strength training such as strengthening the quadriceps, hamstring, and hip muscles is crucial for the rehabilitation process of OSD. During the rehabilitation and activity control phase of OSD, muscle atrophy may occur. Muscle function may be restored with strength training. Low-intensity isometric contractions may be employed to lessen the stress on the patellar tendon during the strength training phase in the early phases of physical therapy.As the treatment progresses and symptoms improve, the exercise intensity can be gradually increased, such as lunges and squats. Studies have shown that strength training reduces pressure on the knee joint by strengthening OSD-related muscle groups, especially for running and jumping athletes, and is particularly important for adolescents as their muscle strength may not have fully developed. Therefore, targeted strength training is needed to assist in rehabilitation for adolescents with OSD [9].

In addition, improving core stability is also crucial in strength training. Core stability training can improve the balance and symmetry of athletes' body strength, as well as their balance ability, by enhancing the control and strength level of muscles in the trunk and pelvic areas, thereby reducing abnormal stress on their lower limbs, especially in running, jumping, and emergency stop turning. Enhancing knee joint function during leaping motions is linked to improving core stability, and education on activity modification and progressive knee joint strengthening exercises is probably going to be beneficial.

In OSD injuries, it not only reduces the abnormal stress on the lower limbs of athletes, but also improves their physical control and posture, while enhancing their balance and coordination, and preventing chain injuries in the lower limbs. Leetun et al.'s research shows that insufficient core stability can lead to compensatory actions on the hip, knee, and ankle joints during certain activities, which can increase unnecessary burdens on the lower limbs and increase the probability of lower limb injuries, especially OSD diseases. Core stability training can increase core stability and strength, thereby reducing lower limb compensation and providing a stable and safe power chain for the lower limbs, reducing the risk of OSD [10].

4.3. Pain Management

For individuals with OSD, pain management is particularly important. Pain management does not mean that patients do not feel the stimulation of pain, or feel the pain disappear and become comfortable, but rather that patients can maintain a certain level of exercise ability even during the process of illness, especially adolescents in their growth and development stage. Ice therapy and thermal therapy are commonly used methods, and clinical studies have shown that ice therapy can control inflammation and edema after exercise to assist patients in further and faster recovery [6]. Additionally, knee pads or elastic patches may be used to lessen the strain on the patellar tendon, which helps the knee joint maintain a certain level of stability during movement, lessens discomfort, and partially delays the advancement of illness. Knee joint orthopedic devices can also be used to assist rehabilitation. According to several investigations, the goal of knee joint load-reducing braces is to lessen the strain on the tibial compartment while simultaneously improving quality of life, quadriceps strength, knee proprioceptive sensitivity, and knee gait symmetry.

4.4. Activity Adjustment

Activity adjustment is also a necessary and crucial means of physical therapy, especially for developing adolescents. High-impact workouts (such as sprinting, leaping, making abrupt stops, or changing directions) must be controlled in order to release the patellar tendon's strain on the tibial tuberosity, encourage the healing of the injury, and preserve activity control for a period of six to eight weeks. Low-intensity exercise rehabilitation is progressively carried out under the supervision of a physical therapist, often via nonimpact activities like swimming. Research indicates that the goal of activity modification is to prevent the atrophy of muscles and stiffness of joints brought on by total inactivity, while also promoting bone healing and managing the strain at the tibial tuberosity and patellar tendon [6]. Therefore, activity adjustment is key to ensuring knee joint function and movement ability in OSD patients during the rehabilitation process.

For the physical therapy rehabilitation of OSD patients, the prescription is not limited. Based on the patient's health and evaluations of knee joint mobility, muscular strength, and balancing ability, a customized rehabilitation program should be designed.At the same time, the recovery ability and inflammation control ability of each person should be adjusted promptly to ensure the combination of multiple methods and personalized training, to achieve the goal of rehabilitation.

5. Medication and other treatment methods

The current drug treatments include aspirin, NSAID tenoxicam, NSAID naproxen, NSAIDs diflunisal and naproxen, dexamethasone, lidocaine, Anabolic steroids, GAGPS, etc.

Painkillers such acetaminophen, ibuprofen, naproxen, flurbiprofen, or ketoprofen are now advised for their ability to reduce inflammation, alleviate pain, and encourage the manufacture of prostaglandins. Although they don't lessen the duration of OSD, nonsteroidal anti-inflammatory medications (NSAIDs) seem to improve symptoms [11]. In addition, NSAIDs administered through penetration have a lower success rate and may lead to subcutaneous fat tissue atrophy, skin stripe formation, and even tendon rupture in some cases [12-16]. All the above symptoms are caused by tendon degeneration due to reduced blood supply and changes in collagen synthesis. This should be completely avoided.

6. Injection of leukocyte rich platelet rich plasma (LR-PRP)

There is a growing body of data indicating that LR-PRP treatment is effective in treating OSD. This therapy reduces the length of time patients need to receive treatment by encouraging the damaged tissues' ability to heal themselves. It does this by using high concentrations of growth factors, such as PDGF, VEGF, TGF-β, etc., and white blood cells to control inflammation and encourage the release of growth factors and immune regulation in the injured area to promote soft tissue repair. Injecting 1-1.5 mL of LR-PRP into the tibial tuberosity region while supine is the standard therapy approach. For a period of two weeks, insert the needle into the patient's most sensitive area—the tibial tuberosity. After injection, control the amount of physical activity and combine it with other non-surgical treatment methods for a total of 6 weeks. After 6 weeks, the patient can resume complete physical activity.

7. Conclusion

The mainstream diagnostic method for OSD in the current adolescent population is an MRI examination, which has many risk factors for the disease. In clinical practice, some high-risk factors can be effectively avoided, such as increasing vitamin D intake and choosing appropriate equipment and venues. In terms of treatment, individualized treatment plans are followed, and physical therapy is gradually carried out with multiple measures and adjustments. The mainstream methods include stretching and massage combined with strength training for lower limbs and core stability, and activity adjustments to achieve the best rehabilitation cycle. To lower pain and manage inflammation, medication treatment is separated into two categories: nonsteroidal anti-inflammatory medications and pain relievers. LR-PRP therapy is currently a popular treatment with fast results, combined with physical therapy methods. Regardless of the method of rehabilitation, the goal is to minimize muscle atrophy as much as possible, maximize the patient's experience during the rehabilitation process, reduce pain, and shorten the course of the disease as much as possible, so that the adolescent population can return to optimal exercise as soon as possible. For OSD, the current treatment methods are not comprehensive enough, with few rehabilitation methods and insufficient evidence-based support. In the future, people should further explore the diversity of treatment methods and the optimal injection volume and formula of LR-PRP and organically combine various treatment methods to contribute to the disease control and rehabilitation of adolescent OSD and make effective contributions to the sports industry.

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