

ORIGINAL ARTICLE

Traction apophysitis

EXERCISE IS MEDICINE



Papp Kata¹, Camathias Carlo²

¹ Kantonsspital Aarau, Klinik für Orthopädie und Traumatologie

² Praxis Zeppelin – Orthopädie für Kinder und Jugendliche

Abstract

Overuse injuries are undoubtedly one of the most frequent cause of pain in adolescent athletes which can result in limitation in sport activities and competition, prolonged pain and psychological consequences. We see different forms of this condition regarding the anatomical region at insertion sites of major tendons. Usually we treat conditions of the lower extremities like Osgood-Schlatter or Sinding-Larssen-Johansson disease. We diagnose less frequently overuse injuries of the upper extremities like Little League shoulder or elbow. Commonly they present with pain after activities and limitation in range of motion. Each form has to be treated slightly differently, initially with resting, followed by physical or local therapy. Besides presenting the most important and usual forms of traction apophysitis, we emphasize the aspects

of prevention and point out some ideas regarding training techniques.

Zusammenfassung

Überlastungsschäden sind zweifellos eine der häufigsten Ursachen für Schmerzen bei jugendlichen Sportlern, die zu Einschränkungen bei sportlichen Aktivitäten und Wettkämpfen, anhaltenden Schmerzen und psychischen Folgen führen können. Überlastungsschäden treten vielfach an den Ansatzstellen der wichtigsten Sehnen auf: Darunter zählen wir den Morbus Osgood-Schlatter- oder die Sinding-Larssen-Johansson-Krankheit. Seltener diagnostizieren wir Überlastungsverletzungen der oberen Extremitäten wie die Little-League-Schulter oder den Ellbogen. Die Überlastungen äussern sich in der Regel durch Schmerzen nach Aktivitäten und einer Einschränkung des Bewegungsumfangs. Jede Entität muss separat betrachtet und teilweise auch anders behandelt werden. Schonung, gefolgt von physikalischer oder lokaler Therapie, erweist sich stets als sinnvoller Ansatz. Neben der Darstellung der wichtigsten und häufigsten Formen der Traktionsapophysitis werden die Aspekte der Vorbeugung hervorgehoben und einige Ideen zu Trainingstechniken aufgezeigt.

Introduction

However we are susceptible to think, that more and more children and adolescents take part in organized sports, the 2016 analysis shows diminished activity of Swiss children (6–16 years) compared to 2008: they spend 90% of their days sitting, while they take part in some physical activities approximately 78.6 minutes daily [1]. Nevertheless, we see numerous young athletes with overuse conditions, which limit their everyday activities and can cause psychological distress through pain and limited range of motion. Overuse injuries of the physis typically occur with excessive stress on major tendon insertions, which is common in the growing body. After closure of the growth plates, these conditions are mainly self-limiting. Identifying risk factors is not easy and needs further investigation. Accelerated adolescent growth increases the risk of injury, as the cartilage of the growth plate is more vulnerable for lesions. Repetitive stress can cause physeal widening, early calcification, avulsion fractures, and premature closure [2]. Malalignment, muscle imbalance or weakness, instability, Tanner stage, flexibility, experience and psychological issues can play an important role [3]. Training intensity and the time for recovery are critical beside the fact, that early specialization causes fewer muscle groups to be worked and increased repetition, theoretically increasing the risk of injury and early sport dropout [4]. Younger children (5–12 years) tend to suffer more traumatic injuries, especially of the upper extremities, whilst adolescents (13–17 years) prone to have overuse injuries (54% vs. 49%) [5]. The number of female athletes having overuse conditions seems to be higher than males (63% vs. 42%) [6].

Early recognition of these conditions can help prevent long-lasting limitation in activities and recurring rehabilitation. Although radiological features can be typical (e.g. fragmentation at tendon insertion sites), diagnosis can be made based on the clinical character. It is important to rule out other conditions (e.g. cysts or tumors) when identifying red flags in the patient history or during examination.

Prevention includes reducing the risk factors, most importantly allowing time to rest from practicing and competition [7]. The duration of rest can vary from few weeks to several months depending on diagnosis, sport, and severity of symptoms. Multiple protocols in the physical therapy aim to improve flexibility, strength and balance deficits, which play a major role in prevention. Training protocols should be adapted

to improve technique but avoid repetitive training of only one muscle group by e.g. changing positions on the field or ensuring a sufficient warm-up and cool-down. We should consider delaying specialization to a more developed age, as sports diversification is associated with improved neuromuscular control in young athletes [8].

Here we aim to introduce the most common overuse and traction injuries.

Osgood-Schlatter disease

A chronic apophysitis on the insertion of the patellar tendon at the tibial tuberosity, which is one of the most common traction apophysitis in the growing athlete. It occurs more commonly in females 8 to 13 years and males aged 10 to 15 years without significant differences between them according to recent studies [9]. The diagnostic criteria were identified in a Brazilian cross-sectional study of 956 adolescents as 1) pain with direct pressure on the tibial apophysis, 2) the aforementioned pain before, during, and after physical activities, 3) enlargement or prominence of the tibial apophysis, 4) pain with resisted knee extension and 5) knee pain from jumping [10]. There is broad consensus that surgical treatment is not the most effective treatment [11]. Therapy includes icing, analgesics, physiotherapy (e.g., stretching, strengthening, rest and activity modification) [12]. Jenny Strickland's special program, the Strickland Protocol has excellent results – it emphasizes on gradually stretching the quadriceps muscle and provides strengthening after sufficient lengthening also with a home program [13]. Myofascial treatments could help loosening the shortened muscles, but these techniques have no evidence. In cases of persistent pain despite physiotherapy there is a chance for improvement with bracing, casting or splinting [14].



Figure 1: Left knee of a 12 year old boy with 4 months history of classic pain at the tibial tuberosity, which is fragmented as known in Osgood-Schlatter disease.

Sinding-Larssen-Johansson disease

Overuse condition of the cartilaginous patellar tendon insertion at the distal patella, similar to Osgood-Schlatter disease, but less frequent. It occurs in young athletes between the ages of 10 and 15 years. It can present with swelling and pain, especially after exertion of force. Later it can cause tendon thickening and fragmentation of the lower pole of the patella, sometimes also bursitis [15]. Therapy is similar to that of Osgood-Schlatter: exercises should avoid quadriceps activity. Physiotherapy, local therapy and rest are helpful.

Sever disease

The same inflammatory process as previously seen occurs with Sever disease – this time at the Achilles tendon insertion site of the calcaneal apophysis [7] and concerns more often young boys between the ages of 8 and 12 years [16]. Tenderness is regular on the insertion site of the Achilles tendon, which releases with inactivity and rest. Treatment includes NSAID, ice application, Achilles tendon stretching and activity modification. Heel pads can be helpful initially, bracing is rarely indicated [17].



Figure 2: Right ankle of a 12,5 year old boy with several months of heel pain and limited dorsiflexion of the ankle. Slight fragmentation of the apophysis at the heel is seen, illustrative for Sever disease.

Little League shoulder

Widening of the proximal humeral epiphysis or epiphysiolysis, which follows repetitive rotational and traction stresses associated with overhead throwing [7]. This condition is exemplary in baseball pitchers although it can present in other overhead athletes (rarely seen in tennis players) [18]. Diagnosis is based on the clinic and radiographs, as the widening of the growth plate has to be identified and compared to the

other side. Therapy consists initially cessation of throwing, followed by physiotherapy (rotator cuff strengthening, posterior capsule stretching, core strengthening) and progressive throwing program (starting with short tosses at low velocity with slowly progression of distance and velocity of throws) after sufficient rest (approximately 3 months).

Little League elbow

It is a term often used to describe a variety of physeal and cartilaginous injuries at the pediatric elbow. Overuse conditions in the elbow occur with excess compression or traction forces placed across a joint during sport [7]. Medial side injuries are most common and relate to chronic forces of valgus overload produced during the early and late cocking phases of throwing, producing age dependent injury patterns, such as apophysitis in childhood and epicondylar avulsion fractures in the more mature athlete. Key is prevention like in the previous conditions.

Discussion

Overuse, especially traction apophysitis conditions have some common patterns, but the different anatomical regions should be treated individually. Although treatment instructions often lack scientific evidence, there are successful methods. In a 2017 review article, Arnold et al. [7] gave a standardized approach for analyzing risk factors and treating overuse conditions in a systematic way: the first and most important step is resting, sometimes even immobilizing the affected joint. Limiting training and competition volume especially during peak growth velocity could help prevent overuse injuries. Once the pain has subsided, flexibility and strength can be restored.

All of the references cited below emphasize the importance of further studies of the separate conditions in order to create the best treatment algorithms. Identifying the risk factors can help prevent not only long-lasting activity limitations and chronic pain, but psychological consequences.

The American Academy of Sports Medicine, the American Orthopaedic Society for Sports Medicine, the American Academy of Pediatric Committee on Sports Medicine and Fitness point out the importance of diversity in sports participation and delayed specialization [3]. It is debated, that early specialization can help developing elite-level skills, as the diversified training seems to be more affective in this regard [21].

Practical implications

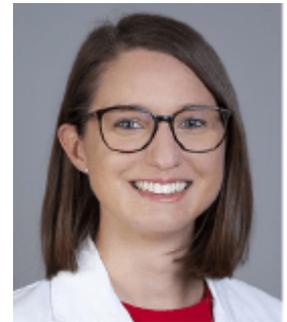
- Traction apophysitis can occur at insertion site of major tendons and causes pain, swelling and limited range of motion.
- Initial treatment should consist of resting and avoiding repetitive microtraumas.
- Prevention in sports should include identifying risk factors and teaching the correct technique.
- Diversity in activities can help avoid fatigue and overuse of certain muscle groups.

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Corresponding author

Kata Papp
Tellstrasse 25, 5001 Aarau
Phone: 079 484 24 84
Email: kata.papp@ksa.ch



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ADOLESCENT SPORT ACTIVITY OVERUSE INJURIES SPORT SPECIALIZATION