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CASE SERIES (DESCRIPTIVE)

Effectiveness of a novel strength training protocol to reduce pain and improve functional activity among young badminton players with Osgood-Schlatter disease - a case series

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Background: Osgood-Schlatter disease (OSD) is also known as osteochondrosis or sterile necrosis of the tibial tuberosity. It is mainly caused by tractional inflammation of the bone where the patellar tendon was inserted in the tibial tubercle. It is mainly found in adolescent players aged between 12 and 15 who are exposed to sports that involve repeated jumping, running, rapid changes in direction, and kicking movements. It is a self-limiting condition; the healing period of bradytrophic tissue of a growth plate under traction can last up to 1–2 years. Conservative treatments for OSD are icing, bracing, stretching, strengthening, and activity modification.

Methods: From June 2024 to December 2024, all patients presenting at the badminton academy with OSD were included. Out of 20 patients, 6 Osgood-Schlatter patients were identified. Patients' ages range from 12 to 15, and they are mainly amateur badminton players. All reported pain and swelling in the tibial tubercle, pain during sports performance and stair climbing, and an X-ray that shows OSD. A visual analogue scale (VAS) was used to assess pain during functional movement of badminton, mainly during squats, lunges, and jumping activities.

Results: The VAS score is analysed before intervention in the 1st week and after 5 weeks; post data were taken. During squatting and lunges on the affected side and jumping activity, VAS was measured. The result shows there is a significant reduction in all functional activities after 5 weeks of intervention.

Conclusion: 5 weeks of physical intervention and education helped to reduce pain in squats, lunges, and jumping activity in badminton players with OSD.

Keywords: Osgood-Schlatter disease, badminton, strength training, pain management, young player

Introduction

Osgood-Schlatter disease (OSD) is also known as osteochondrosis or sterile necrosis of the tibial tuberosity. It is mainly caused due to tractional inflammation of the bone where the patellar tendon was inserted in the tibial tubercle. Some literature shows it can happen due to tensile force during the growth period, which directly affects the secondary ossification centre.

Literature review

It is mainly found in adolescent players aged between 12 and 15 who are exposed to sports that involve repeated jumping, running, rapid changes in direction, and kicking movements (1). Due to the traction force, a person feels pain in the knee, which gradually reduces strength, power, and agility and mainly affects the quality of life and sports career. There is not much pathophysiology of how OSD happens, but a few kinds of literature suggest that during jumping, running, and kicking, quadriceps muscles generate excessive tension and become tight, which causes inflammation of the patellar tendon and apophysis of the tibial tuberosity. Gradually the patellar tendon gets detached from the tibial tuberosity. Further progress can cause an avulsion fracture of the tibial tubercle (2).

It is a self-limiting condition; the healing period of bradytrophic tissue of a growth plate under traction can last up to 1–2 years. Conservative treatments for OSD are icing, bracing, stretching, strengthening, and activity modification (3). In patellofemoral pain syndrome, vastus medialis obliques (VMO) activation exercise helps to reduce pain. VMO:VL ratio similar to the sling-based hip adduction exercise. Knee flexion exercises with a knee flexion angle between 0 and 60 degrees were recommended for VMO activation. VMO helps to stabilise the knee; if VMO weakness is there, it can cause improper tracking of the patella (4). During loading and landing, the highest force, VMO, plays a crucial role in stabilising the patella and tracking it properly, minimising load on the tendon by providing medial knee support (5). This case series helps clinicians develop a proper intervention protocol to reduce pain in different functional activities in badminton athletes.

Methodology

The study was done at different badminton academies across Odisha, India. Ethical clearance was taken from the ethical committee of the institute with ethical no. SCI/0025/134AB, and parental informed consent was taken from all the participants. The study is not a clinical trial, so no clinical trial registration was done. The participants were aware of all procedures involved in the study, and written consent was taken for the same. The objective of the study is to assess the effectiveness of a 5-week strength training protocol on pain reduction during functional activities among young badminton players with OSD.

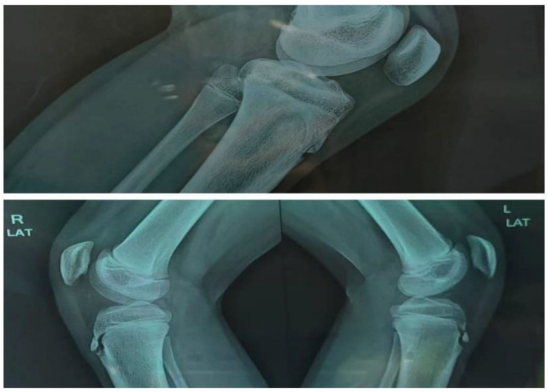

FIGURE 1 | X-ray of Osgood-Schlatter disease (OSD).

Case description

From June 2024 to December 2024, all patients presenting at the badminton academy with OSD were included. Regularly, these players perform 3-hour practice sessions of badminton and 2 hours of fitness. Purposive sampling is used to collect a sample. Out of 20 patients, 6 Osgood-Schlatter patients were identified. The selection criteria to collect the sample were exclusion criteria—anterior cruciate ligament sprain, meniscus injury, and VMO strain. Inclusion criteria—Patients' ages range from 12 to 15; they are mainly amateur badminton players, have a visual analogue scale (VAS) score more than three, report pain and swelling in the tibial tubercle, have pain during sports performance and stair climbing, and have an X-ray which shows OSD (**Figure 1**).

Examination

A VAS was used to assess pain during functional movement of badminton, mainly during squats, lunges, and jumping activities. VAS has a very high reliability (6). As pain occurs

TABLE 1 | Descriptive data of players.

Patient no.	Age	Gender	Experience in sports	Side of OSD
1	12	Female	3	Left
2	13	Female	2	Left
3	12	Male	3	Left
4	12	Male	2	Right
5	13	Male	3	Right
6	13	Female	3	Right

during functional movement, players face much difficulty performing, which affects their quality of life.

Intervention

A 5-week intervention was given to all patients; a patellar brace was used during the session to offload the patellar tendon during sporting activity and prevent further progression of the disease.

Week	Intervention	Repetition
1	Patient education about OSD and its risk factors and complications Complete rest Cryotherapy	10–15 minutes
2–3	VMO activation with a medicine ball Mini-squat with 3 kg Terminal knee extension with resistance band Eccentric quadriceps - leg lowering with a 2 kg weight cuff on the ankle The patellar tendon was used during the session to reduce the load on the patellar tendon.	10 rep 2 set
4–5	Landing error correction Floor-to-Bosu ball jump 180-degree jump in foam surface Change in direction with the loop band. The patellar tendon was used during the session to reduce the load on the patellar tendon.	10 rep 3 set 1 minutes

Results

The VAS score is analysed before intervention in the 1st week and after 5 weeks, post-data were taken. During squatting and lunges on the affected side and jumping activity, VAS was measured. The result shows there is a significant reduction in all functional activities after 5 weeks of intervention.

Inpatient (**Table 2**; **Figure 2**)

1. VAS in squat pre-6, post-4; lunge pre-7, post-5; jump-pre-6, post-4
2. VAS in squat pre-7, post-5; lunge pre-8, post-5; jump-pre-5, post-3
3. VAS in squat pre-8, post-6; lunge pre-6, post-6; jump-pre-6, post-5
4. VAS in squat pre-7, post-6; lunge pre-7, post-7; jump-pre-7, post-6
5. VAS in squat pre-8, post-5, lunge pre-8, post-8; jump-pre-8, post-6
6. VAS in squat pre-6,post-3; lunge pre-4, post-7; jump-pre-7, post-5

Discussion

Patient education helps the patient to understand the risk factors and the treatment plan, which helps to prevent further progression of the disease (7). Cryotherapy constricts blood vessels to reduce blood flow to the affected part, then increases blood flow and minimises swelling and inflammation. It also slows down nerve signals, provides a numbing effect, reduces pain, and reduces muscle spasms by decreasing muscle tension (8). VMO helps offload the patellar tendon during weight bearing and landing because, during landing, more stress is placed on the patellar tendon, and if stress increases on the patellar tendon, then it aggravates OSD. Straight leg lowering exercise helps to strengthen the patellar tendon, which helps to absorb more shock without affecting OSD (4, 9). Landing error can cause maltracking of the patella, so landing correction helps to maintain proper landing technique (10). Balance and landing on the foam surface help to maintain a gradual loading of the ground reaction force (11). With a loop band, changing direction helps to improve the quickness of functional movement required in badminton, along with increased strength in the quadriceps (12). Wearing a patellar tendon brace helps to lower vastus lateralis (VL) activation before landing, which is helpful to reduce the tensile force on the tendon (13). Limitations of this study were that the intervention period was short, and follow-up was not taken.

Results

Table 1 suggests the descriptive data, whereas **Table 2** and **Figure 3** suggest the pre- and post-outcome measures of three functional activities.

Conclusion

5 weeks of physical intervention and education helped to reduce pain in squats, lunges, and jumping activities in players with OSD. A short-term strengthening protocol makes players functionally active while minimising their pain, so it can be used as a clinical practice. The future scope of this study can be done with a larger sample size and compared with other interventions.

Author contribution

We affirm that the submission represents an original work that has not been published. Previously, it was not currently being considered by another journal. Also, we confirm that each author has seen and approved the contents of the submitted manuscript. The work was carried out in

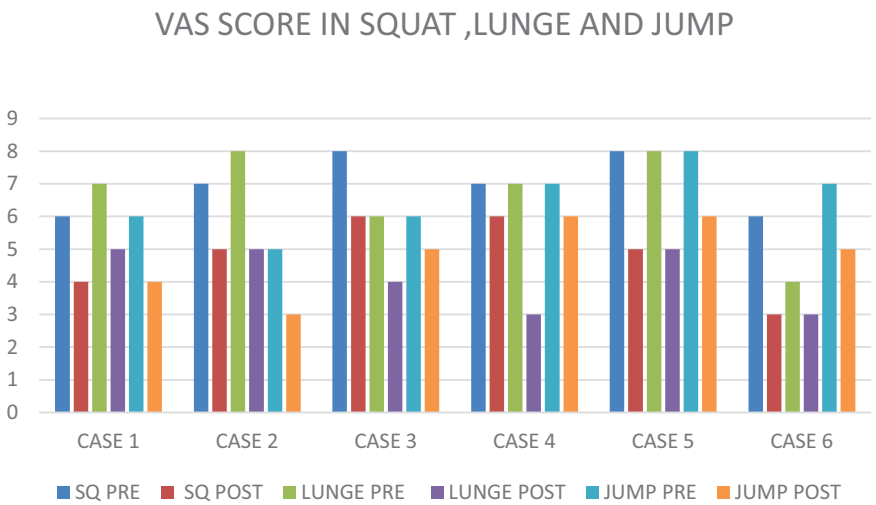

FIGURE 2 | Visual Analogue Scale (VAS) score for functional activity.

FIGURE 3 | Intervention of OSD.

TABLE 2 | Pre and post VAS score of 3 functional activities.

Patient serial no.	VAS in squat pre	VAS in squat post	Mean	VAS in lunge pre	VAS in lunge pre	Mean	VAS in jump pre	VAS in the jump post	Mean
1	6	4	2	7	5	2	6	4	2
2	7	5	2	8	5	3	5	3	2
3	8	6	2	6	4	2	6	5	1
4	7	6	1	7	3	4	7	6	1
5	8	5	3	8	5	3	8	6	2
6	6	3	3	4	3	1	7	5	2

collaboration with all authors. CM and AA designed the study and wrote the protocol, and CM wrote the first draft of the manuscript. AA managed the data collection for the study. All authors read and approved the final manuscript.

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Abbreviations

OSD, Osgood-Schlatter disease
VAS, visual analogue scale
VL, vastus lateralis
VMO, vastus medialis obliques

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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