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# Posterior Ankle Impingement Syndrome (PAIS) in Dancer: Systematic Review and Proposal of a Clinical Protocol

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## Abstract

**Background:** Posterior Ankle Impingement Syndrome (PAIS) is common in dancers; it's characterized by posterior ankle pain during plantar flexion. The hyperplantarflexion of the ankle beyond the physiological joint range, required by the specific movement, and repeated trauma of the hindfoot, are greatest risk factors for the onset of PAIS symptoms.

**Objective:** Despite the common diagnosis of PAIS in dancers, there is no EBM about physiotherapy treatment; the aim of the study was to propose a clinical protocol by postoperative period to return to sport.

**Material and methods:** A systematic review was conducted according to PRISMA Statement; the clinical query was set by PICO model. Key-words used in databases were: ankle; impingement; dancer; rehabilitation; surgery; os-trigonum.

**Results:** Five studies were selected and evaluated by the Newcastle-Ottawa Scale. The systematic review included 141 sports patients, with an average age of 23,6 years, with a minimum of follow-up of 13,6 months and a maximum of 46,1. A strong correlation between dance and the diagnosis of PAIS, predominantly in female sex, was found. Two different physiotherapy approaches, based on fast or protected post-surgical load, were examined.

**Discussion:** This review demonstrated the inefficiency of an exclusively conservative treatment, and the importance of a post-surgical therapeutic protocol. Considering the achieved results from the review and the deficiency of EBM, a proposal of clinical protocol was made.

**Keywords:** PAIS; Ankle; Dancers; Rehabilitation

### Background

PAIS (Posterior Ankle Impingement Syndrome) describes a pathological condition, characterized by posterior ankle pain, increasing in plantar flexion [1]. The condition is generally asymptomatic, but it is reported as conflict syndrome in sports such as dance, rhythmic or artistic gymnastic, due to repeated trauma to the hindfoot, related to excursion in plantar flexion beyond the physiological joint range [2].

PAIS is both caused by bone/soft tissue lesions, and to anatomical variants [3], and, in most cases, becomes symptomatic if associated with repeated mechanical compression on the structures of the ankle joint [4]. The majority of PAIS, in the plantar flexion movement, show a bone conflict due to a protrusion of the talus, referred as the "Stieda Process", while, in the absence of ossification, it is referred to "Os-Trigonum" [5].

The scientific literature does not report relevant epidemiological data on PAIS. However, the important correlation between the onset of the disease and dance has been demonstrated by various studies [6].

Patients with PAIS suffer recurrent and intense posterior ankle pain, often associated with posterior swelling between the lateral malleolus and the Achilles tendon, exacerbated by plantar flexion of the joint (achieved during sport) [7].

Clinical examination includes assessment of strength and range of movement, palpation and provocative movements. If clinical evaluation suggests a presence of posterior impingement, further diagnosis include XR, MRI or CT [8].

Non-surgical interventions are the first-line treatment for patients with PAIS, despite limited evidence of effectiveness. For acute symptoms, a period of rest is recommended and avoid of provocative activities, modification of the activity, anti-inflammatory drugs and ultrasound-guided injections. However, for sports patients (mainly dancers), surgical excision is the only definitive treatment to prevent the recurrence of symptoms and ensure return to sport [9].

Surgical approach involves medial and lateral incision techniques, selected on the basis of patient's condition and surgeon expertise; medial incision is the best choice for FHL tendinitis associated with posterior impingement, or FLA tendinitis in presence of os trigonum, while lateral incision is selected for ankle impingement not complicated by tendinitis or other medial symptoms [10].

Both approaches involve post-operative treatment: physiotherapy with gradual mobilization of the ankle and foot. The indication to load is allowed usually after three weeks, and return to sport is generally gradual and expected after 6-8 weeks, after proprioception exercises, mobility and strengthening recovery [11].

## Material and Methods

A systematic review was conducted through the PRISMA guidelines. The clinical query was set by the PICO model. The inclusion criteria were:

- RCT/Observational studies of the last twenty years, regarding dancers operated for PAIS, aged between ten and thirty years
- Intervention included both rehabilitation protocols and sports return approach
- Comparison were inactive cohorts
- Outcome aimed at the recovery of ROM and single-leg balance during the movement of "relevé".

The research started in July 2020 and ended on September 2020, consulting the following databases: PubMed, Medline, Pedro and Cochrane; keywords entered were: posterior impingement, ankle, rehabilitation, surgery, dancer, os trigonum, PAIS.

A first screening was applied by the analysis of title and abstract; selected articles were read by full text and processed according to inclusion criteria.

Final recruited studies were scored by Newcastle-Ottawa Scale, to assess methodological quality.

## Results

The Flowchart PRSIMA, shows the selection of the studies (Figure1).

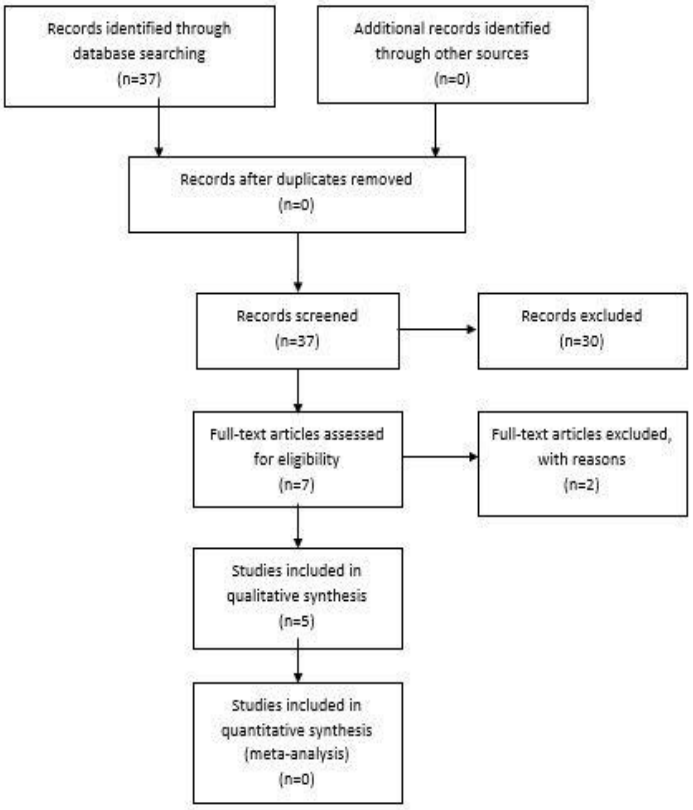


**Figure 1:** Flow diagram by PRISMA Statement.

From all research a total of 37 articles emerged; from a first screening 30 papers were excluded (title and abstract). Two articles were excluded because full text was not accessible; the remaining 5 were included in our review.

Below the five selected studies [4,5,9,12,13]. The two most important emerging general data were: os-trigonum - PAIS related (reported by 121 out of 141 patients) and the correlation between sport practiced and PAIS (110 out of 141 patients were dancers or rhythmic gymnastics and 90%). The average age of patients operated by PAIS was 23 years, the follow-up ranged by 13.6 months to 46.1 ones. Selected studies were then divided on the basis of indication to load in the first phase: partial load and protected load (Table 1).

| Author | Title | Date | Return to sport |
|---|---|---|---|
| [9] | Surgical Outcomes of Os Trigonum Syndrome in Dancers | 2020 | After 6 weeks |
| [5] | Posterior ankle impingement syndrome in athletes: surgical outcomes of a case series | 2019 | After 12 weeks |
| [13] | Management of Posterior Impingement in the Ankle in Athletes and Dancers | 2015 | After 10,5 weeks |
| [12] | Posterior ankle impingement syndrome in football players: Case series of 26 elite athletes | 2016 | After 7 weeks |
| [4] | Posterior ankle impingement syndrome in dancer – a short-term follow up after operative treatment | 2002 | Not reported |

**Table 1:** Bibliographic citations and outcomes of each study [4,5,9,12,13].

### Partial Load

Three articles [4,9,12] opted for partial load, associated with passive mobilization in the first phase (0-2 weeks), proprioceptive by fourth week, balance training between fifth and sixth week.

Clinical analysis was set using pre- and postoperative scales and questionnaires: Veterans RAND 12-Item Health Survey (VR-12), Foot Function Index – Revised (FFI-R), VAS. In all patients an improvement in both pain and functionality was observed.

With regard to the last modality, rapid recovery times have emerged, with a minimum of 6 weeks and a maximum of 7. In spite of a rapid sport reintegration, there were several post-operative complications, compared to those arising through the approach with protected load in the first phase. Declared complications were: nerve damage to sural/tibial, tendinitis, scar damage and hematoma resulting in surgical reopening. The follow-up of the three studies [4,9,12] was respectively 33.4 months [9], 36.5 months [12] and 26.2 months [4].

### Protected Load

The remaining two studies [5,13] of the review, they were set out on the basis of a common parameter, that is, load protection in the first phase, a period in which physiotherapy was focused on PROM, recession of pain and oedema. Partial load was introduced in the third week and, proprioceptive training in the fourth, strengthening of affected muscles towards the sixth week, and re-education to sport movement around eighth week. Clinical outcome analysis is conducted through VAS, AOFAS and VR-12, which showed improvements in both pain and functionality in both studies.

Return to sport was possible no earlier than eleventh week post-rehabilitation, confirming a delay compared to the rehabilitation approach with partial load, but presenting a lower rate of complications and exclusively at the sural nerve, subsequently resolved. Follow-up to these two studies [5,13] was 13.6 months [5] and 46.1 months [13] respectively.

## Discussion

The analysis carried out on the five studies complies with the guidelines for reporting systematic reviews and meta-analyses, reported in the PRISMA Statement.

Methodological key points of the review were: the adherence to international statement; high scores, by Newcastle-Ottawa Scale for all studies, which confirms the high reliability of our review; recent publications; a specific definition of the patients' profile, which allowed a selection of the 141 total patients; the long-term results of the included studies, which provided for a follow-up of a minimum of 13.6 and a maximum of 46.1 months.

Among the points of criticism, it is necessary to declare the absence of RCTs in scientific literature for the rehabilitation of PAIS, which is the reason why the review was only conducted on cohorts. Probably this is a consequence of the complexity to conduct an RCT in this case, since it would not be ethical leave an operated patient untreated. Coming to clinical aspect, at first our review showed strong correlation between dance and diagnosis of PAIS, and the higher incidence of the disease in female sex and in the age between 15 and 30 years [4,5,9,12,13]. Each article [4,5,9,12,13] then revealed the inefficiency of an exclusively conservative treatment in this range of patients, for whom the return to sport is possible only in the case of surgical excision, followed by specific rehabilitation treatment [4,5,9,12,13]. The results of the research then confirmed the EBM deficiency about this rehabilitation: of five articles, only two reported a protocol approach marked by timing and objectives [9,13], the remaining three studies merely list the progression of rehabilitation at its key points [4,5,12].

Specifically, from the analysis of the proposed physiotherapy plans, two very distinct protocol lines emerged, based on the indication of partial or protected load in the first phase. Three articles [4,9,12] opted for partial load re-education already in the first phase (1-15 days), while the remaining two studies [5,13] protected the load up until the third week.

The outcomes obtained through VAS, AOFAS, VR-12 did not show substantial differences between the two approaches. On the contrary, in terms of post-operative complications and rehabilitation times we note the following differences: an approach with partial load [4,9,12] recorded a higher rate of complications, diagnosed in eight patients, compared to three among patients treated with protected load [5,13]; time for return to sports also vary, by 6.5 weeks [4,9,12] to 11 weeks [5,13].

In all studies [4,5,9,12,13] the possibility to practice the same rehabilitation plan for both the medial and lateral surgical incisions, and a general lack of care to surgical scar, clearly emerged. Scar tissue, despite being the cause of post-operative complications of PAIS [9], was not mentioned in any rehabilitation project (Figures 2 and 3).

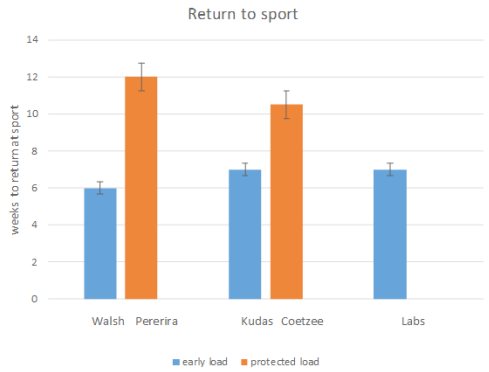


**Figure 2:** Differences in return to sport between selected studies.

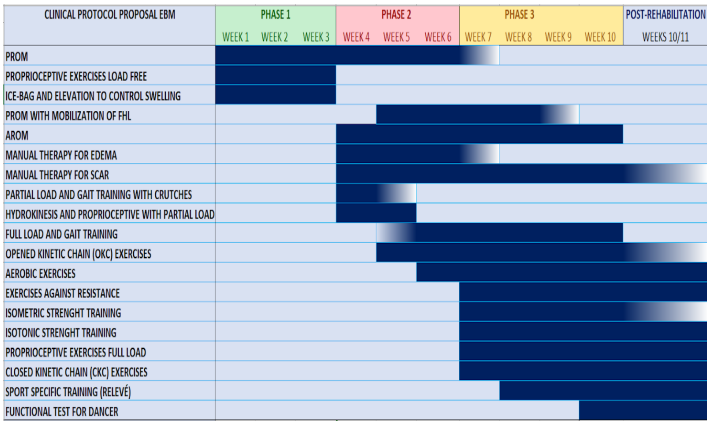


**Figure 3:** Proposal of a clinical protocol for the rehabilitation of PAIS.

In none of the studies mentioned [4,5,9,12-14], hydrokinesitherapy was analysed; as stated by Prins [15], water appears to be the ideal environment for active physiotherapy, since, by exploiting its physical properties, it allows a gradual and effective recovery for patients who have suffered serious injuries or ankle/foot surgery.

In conclusion, the rehabilitation of operated PAIS is far to reach an EBM level; modalities and timing of physiotherapy are, to date, not clear and we can't state a gold standard in this condition management. However, by the results obtained from the review, we carried out a physiotherapy proposal, based on the employment a partial load strategy, combined with exerceise, scar management and manual therapy.

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