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REHABILITATION OF SHOULDER INSTABILITY IN JUNIOR HANBALISTS A CHALLENGE FOR PHYSIOTHERAPISTS

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Abstract: This study's relevance stems from the high incidence of injuries among junior handball athletes, particularly instability injuries, which necessitate prolonged recovery periods and extended absences from the team. Forty handball playeres included in the study (LE=20 and LC=20). Both groups underwent initial evaluations regarding pain induced by the injury, daily activity, mobility, and strength. We analyzed the functional balance and had participants complete questionnaires to assess activity limitations due to shoulder injuries and instability, as well as functional impairment. After completing the recuperative program, the control group followed a traditional rehabilitation program, while the experimental group followed the proposed program. LE made important progress analyzed to the LC in terms of functional impairment due to pain and recovery from disability caused by instability injuries, according to post-evaluation results.

Introduction: T. Seil examines the rehabilitation and return to sports for shoulder instability trauma, highlighting that trauma to the capsulolabral glenoid zone will necessitate arthoscopic intervention, has proven to be successful in enabling athletes to resume high-level performance. Rehabilitation primarily aims to improve both the flexibility and the strength of muscles [1]. This progressive training adheres to defined standards to guarantee seamless advancement throughout postoperative rehabilitation. It is necessary to abide by multiple principles. Efficient communication within the medical team is crucial for achieving the best outcomes; rehabilitation protocols should be gradual and tailored to the athlete's advancement. The physiotherapist should prioritize restoring the range of motion and promoting dynamic joint mobility, prioritizing the rotator cuff therapy is necessary before focusing on overall muscular strength improvement in the shoulder. Therapeutic exercises that are progressive and pain-free help to acquire dynamic stability and control of the nerves and muscles during rehabilitation [2]. Thorough comprehension and implementation of these principles can result in accelerated healing and enhanced joint rehabilitation, allowing the athlete to regain their previous level of

performance after an injury [3]. Research on handball trauma mechanisms indicates that most injuries (over 50%) occur due to contact between players. Among these injuries, traumatic injuries are the most frequent, followed by overuse injuries (62% compared to 38%) [4]. Bere T. (2015) found that the 6m line players have the highest rate of injuries, followed by wingers, the first line, and goalkeepers. Rafnsson E.T. (2019) observes that goalkeepers experienced the largest percentage of overuse injuries (67%) and acute injuries (33%), while wingers had an even distribution of overuse and acute injuries. The offensive line was responsible for 36% of injuries caused by overuse and 64% of injuries caused by sudden impact, as stated in reference [5]. Handball's physical nature and varied throwing angles make players susceptible to scapulohumeral joint injuries. Rehabilitation involves strengthening the muscles responsible for joint rotation to support the concentric and eccentric movements during throwing. The rehabilitation program should include throwing motion training and sport-specific regimens. Training should increase shoulder and trunk muscle strength to improve overall physical condition. A holistic rehabilitation and training approach helps players sustain the movements required in handball.
A. Fältström (2022) highlights handball as a contact sport with frequent overhead throwing, leading to a high rate of shoulder injuries [6]. Analisyng risk factors for trauma in young players is crucial, especially in those attending handball-specific schools. This study followed junior handball players aged 15 to 19 over two seasons, monitoring injuries and training/competition efforts weekly [6, 7]. Aim of the study: The goal of this study is to illustrate that following a rehabilitation program for shoulder instability trauma in handball players leads to notable enhancements in pain management, functional balance, and the alleviation of activity limits linked to these injuries and "using a kinetic program will relieve pain, inflammation" [15].

Material-method: The experiment was conducted over 10 months and involved 40 juvenile handball athletes (LE=20 and LM=20). The research assessed the functional impairment and activity limitations that were caused by recurrent discomfort and instability. The following parameters were employed to evaluate disability levels: Pain Assessment: Using the Visual Analog Scale (VAS), participants marked their pain level on a graduated line from 0 (no pain) to 10 cm (maximum pain). Functional Balance of the Shoulder: Evaluated using the constant-Murley method, which assigns points for various shoulder activities and parameters. Participants received a sheet to score indicators like pain, daily activity, mobility, and strength. Lower scores indicated greater shoulder damage (Constant C., Murley A., 1987).

Table 1. Shoulder instability kinetic program

STAGE NAME AND DURATION	OBJECTIVES	PROHIBITIONS	PROPOSALS

PHASE I IMMOBILIZATION IN ORTHOSIS the first 4 weeks post-intervention	- Reduction of edema - Reduction of muscle contractions - Pain reduction - Formation of the motivation to take part in the recuperative program	- Active mobilization of the shoulder; - Lifting objects; - Giving up the orthosis in crowded spaces and during sleep	RICE protocol ice massage for 15-20 minutes, passive-assisted mobilization, active-assisted mobilization by a physiotherapist of the distal shoulder joints (elbow, fist, hand), assisted passive mobilization, up to the pain limit, starting from the 2nd postoperative week, abduction in the plane of the scapula, internal rotation up to at 45 degrees in abduction 30 degrees, external rotation 0-25 degrees starting from 30-40 degrees abduction.
PHASE II REHABILITATION MOBILITIES week 4 – 10 post-intervention	Restoring shoulder mobility) Correction of dyskinesias present from the period before the intervention; Maintaining a positive state of mind, building trust in the physiotherapist and the rehabilitation act	- Excessive external rotation - Lifting heavy weights - Lifting objects above the level of the head and towards the back of the head	progressive exercises, applications with ice and the RICE protocol, the orthosis is abandoned, applications are made with kinesiological bands for support, lymphatic drainage, abduction in the plane of the scapula, pendulum (swing) exercises are initiated, initially in low dynamic positions and it is recommended to increase muscle strength with more repetitions (30-50) but with low weights 0, 5 - 3 kg.
PHASE III REHABILITATION OF MUSCLE STRENGTH Week 10 – 14 post-intervention	Increase in muscle strength - Correction of dyskinesias present before the intervention - Regaining muscle strength.	Avoiding stress on the anterior capsule - The resumption of training and the game of handball; - Avoiding effort or functional activities in a plan where mobility and resistance are not recovered.	exercises to regain muscle strength, endurance and neuromuscular control, exercises for the biceps brachii muscle, but also for the pectoral muscles (small and large) using small weights, subscapular rehabilitation is initiated, stretching exercises are introduced. Exercises to regain muscle strength, endurance, and neuromuscular control Exercises for the biceps brachii muscle, but also the pectoral muscles (small and large) using small weights Subscapular rehabilitation is initiated Stretching exercises are introduced
PHASE IV REHABILITATION OF PROPRIOCEPTION Week 14 – 18 postoperatively	Improvement of neuro-proprioceptive control; - Maintaining the results obtained; - Increase of general resistance.	- Physical exercises targeting the triceps muscle; - The resumption of sports activities involving throwing is allowed after the completion of 4 months at the intervention; - Avoiding joint overload and overuse.	Isotonic exercises if the patient does not compensate for movements and does not complain of pain Muscle strengthening exercises Overhead exercises if mobility and strength below 90 degrees elevation are good Shoulder stretching and muscle strength exercises Pull-ups as long as the elbow does not flex more than 90 degrees.
PHASE V RE-EDUCATION OF HANDBALL SPECIFIC MOVEMENTS week 18 – 24	- Full body training to reach the level of performance you had before accident;	- Non-observance of the principle of gradualness in the dosage of exercises and effort; - Overtraining; - Failure to observe rest and rehabilitation periods.	Specifically designed exercises for the sport of handball, with an emphasis on tossing exercises, moving from small objects to larger ones Specific techniques to improve throwing by performing exercises that develop strength in the shoulder joint

- Maintaining motivation and focus to complete the rehabilitation program.	The pace and intensity at which work is done in this phase are specific to intense training periods and competitive periods.

The kinetic program was implemented in stages of one lesson from monday to friday, with an effective work time of twenty hours per month. Each kinetic stage will be represented by Phases I, II, and III. Effective labor time will be twenty-four hours per month, with six sessions per week in Phases IV and V.The kinetic regimen was implemented for an average of ninty-four hours, as well as thirty-six hours of handball-specific exercise. The average recuperative duration was twenty-four weeks. The first three phases will be dedicated a total of fourteen weeks, during which rehabilitation will be conducted five times per week, resulting in a total of seventy hours of medical rehabilitation. In the last two phases, are allocated ten weeks of kinetic rehabilitation, which will consist of a program that lasts 1 hour six times a week. This will result in sixty hours of kin etic rehabilitation and handball-specific exercises. The kinetic program will consist of 130 hours of physical therapy [8].

Results: The athletes in the LE have made significant progress in terms of their VAS score, as evidenced by the evolving pain score in the LE and LC. The LE scored substantially lower on the final pain assessment than the LC (P = 0.00036). Initially, the LE had a Visual Analog Scale (VAS) average of 8.12 ± 1.48, which decreased to 0.68 ± 0.80 by the final evaluation. In contrast, the LC had an initial VAS average of 8.24 ± 1.45, which reduced to 3.24 ± 2.37 at the end of the study (see Fig.1).

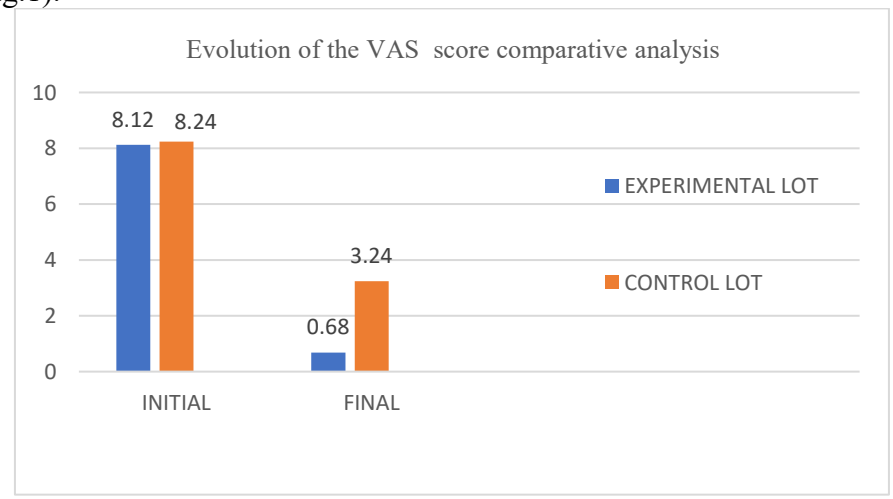

Fig. 1 Evolution of the VAS

In the first analysis, we observed values of four on the VAS scale, which indicated moderate pain. The maximum value- ten indicated a very high pain. In the last

analysis, we observed the VAS scale had minimums of zero in both the LE and LC of junior handball players, indicating that there was no pain in the traumatized area. The LE had values of three, indicating moderate pain, and seven in the LC, indicating severe pain. The latter was demonstrated by a relapse experienced by a solitary junior handball athlete with a conservatively treated injury toward the conclusion of the kinetic program.

Table 2. Evaluation of the questionnaire regarding the limitation of activities - the frequency of cases according to the answer

NO OF CASES N=50	
I. PROFESSIONAL ACTIVITY	
3 - I regularly participate in training, without restriction	6
2 – slight limitation of training activities due to shoulder pain	17
1 - permanent limitation of training	23
0 - unable to train due to shoulder pain	4
II. PHYSICAL ACTIVITY	
3 - I can lift, and carry any object I want	6
2 - I can lift, and carry any object, but with the onset of shoulder pain	18
1 - lifting, and carrying objects is limited due to shoulder pain	25
0 - unable to lift, or carry anything due to shoulder pain	1
III. POSTURE	
3 - I can sit with my hand up without interruption, however much I want	5
2 - I can sit with my hand raised as much as I want but with the onset of shoulder pain	20
1 - I can't hold my hand up for a long time due to shoulder pain	23
0 - I cannot hold my hand up for more than a few minutes due to shoulder pain	2
IV. IRRITABILITY	
3 – pain or discomfort in the shoulder does not bother me, does not irritate me	7
2 - I am sometimes irritable due to shoulder pain	14
1 - I am often irritable due to shoulder pain	26
0 - I am always irritable because of shoulder pain	3
V. PAIN	
3 - I don't usually have shoulder pain	5
2 - sometimes I have pain in my shoulder	27
1 - I often have pain in my shoulder	13
0 - I always have pain in my shoulder	5
VI. INTENSITY OF PAIN	
3 - absence of shoulder pain	4
2 – shoulder pain with mild intensity	24
1 - shoulder pain with moderate intensity	13
0 - shoulder pain with severe intensity	8
ARE YOU COMING. SLEEP / REST	
3 - I have no sleep problems due to shoulder pain	9
2 - I have slight, minimal sleep problems	33
1 - I have moderate sleep problems	6
0 - I have serious sleep problems	2
VIII. THROWING THE BALL	
3 – I have no problem throwing the ball due to shoulder pain	11
2 – I have slight trouble throwing the ball due to shoulder pain	18
1 – I have moderate trouble throwing the ball due to shoulder pain	20
0 – unable to throw the ball due to shoulder pain	1
IX. race	
3 – I can run without problems	29
2 – I can run, but with little difficulty due to shoulder pain	14
1 – I can run, but with significant difficulties due to shoulder pain	6
0 – unable to run due to shoulder pain	1

NO OF CASES N=50	
X. DAY-TO-DAY ACTIVITIES	
3 – I do not need help with my daily personal activities	43
2 – I need minimal help with personal daily activities due to shoulder pain	5
1 – I need significant help with my daily personal activities due to shoulder pain	1
0 – I need full help with my daily personal activities due to shoulder pain	1

We discovered that 46% of junior handball athletes encountered persistent limitations in training activities as a result of shoulder joint pain after administering the questionnaire evaluating activity limitations due to shoulder injuries. Furthermore, 50% of respondents reported experiencing shoulder pain, which impeded their ability to lift objects. Additionally, 40% of the athletes reported difficulties with throwing the ball, while 68% of them experienced sleep disturbances associated with shoulder discomfort. Additionally, 27% of the respondents reported a decrease in their running capabilities as a result of shoulder instability-related discomfort. The junior handball players under investigation experience severe imbalances in their sports activities as a consequence of the restricted activities that result from shoulder injuries. It is critical that we promptly implement effective rehabilitation programs to address shoulder injuries in handball. Preparing adolescents for performance sports necessitates effective communication within the interdisciplinary team and the identification of solutions for training, competition, and rehabilitation periods. The high incidence of injury and relapse serves as a warning regarding the necessity of establishing rehabilitation programs that are compatible with the requirements of modern sports [8].

Table 3. Questionnaire of shoulder functional impotence

No. respondents (n=50)	No. respondents (n=50)	
	Yes	No
1. You suffered a trauma shoulder recntly?	43	7
2. This is the first episode?	the first episode of instability	other episodes in the past
	18	32
3. Did you resort to immobilization in an orthosis or surgical intervention after the injury?	brace	operation
	36	14
4. Did the pain occur during a match?	41	9
5. Did the pain occur during training?	21	29
6. Pain prevents me from training and matches.	37	13
7. The pain is present almost all the time	38	12
8. My performance as an athlete has suffered	44	6
9. When you return to sports activity?	5 months	6 months
	16	34
10. Since when do you play handball (years)?	5 years (95%CI: 4.62 – 5.38) DS.= 1.34	

In conclusion, a recidivism rate of 64% was observed among a substantial number of junior handball athletes, specifically 86%, who encountered a trauma shoulder recently. While the current approach recommends arthroscopic stabilization to facilitate full rehabilitation, the exorbitant taxes and the scarcity of sports trauma doctors are prompting an increasing number of athletes to opt for conservative

treatment, specifically immobilization in an orthosis—a treatment that was implemented by 73% of the junior handball players surveyed.

The shoulder joint's rate of discomfort and instability is a clear indication that the high incidence of injuries during the competitive period is a result of inadequate training levels, the lack of rehabilitation periods, and the increasing demands during matches, specifically 81%. This impacts sports performance in 87% of the cases, with 67% of the respondents experiencing extended periods of inactivity, which average approximately six months. These factors destabilize the team, cause imbalances in team composition, and result in high taxes for rehabilitation.

By comparing the functional equilibrium of the shoulder over time, it is evident that female players in the LE performed significantly better (P = 0.00018). Consequently, the null hypothesis is disproven. Compared to the LC, the LE exhibited substantially higher functionality in the comparative analysis of the functional balance of the handball athletes presents in the program. The handball players in the LE exhibited a considerable improvement in their functional balance, as evidenced by the final evaluation, which indicating a value of 98.00+2.06. The initial value of the functional balance was 47.00+7.66, indicating severe shoulder damage. The preliminary average value for the functional balance evaluation in the LC was 50.48+7.72, while the final average value was 76.12+3.81. The handball players in the LC experienced a satisfactory result. However, the handball players in this group continued to experience pain, limited mobility in specific areas of movement, and a slight strength deficit at the final evaluation (Fig.2).

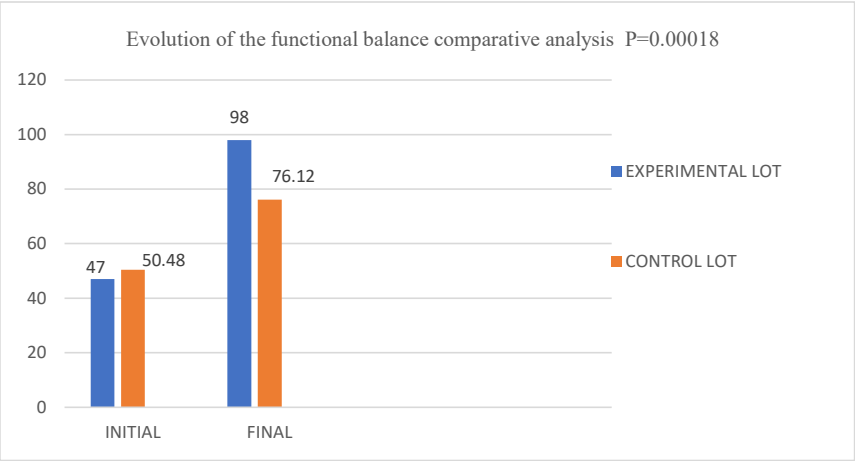

Fig. 2 Evolution of the functional balance

Discussions: Well-established criteria are the foundation of progressive training in postoperative rehabilitation, which guarantees seamless progression. To

achieve optimal results, it is essential to follow several principles: the medical team must communicate effectively to achieve the most favorable and rapid results; rehabilitation procedures must be progressive and customized to the athlete's progression; physiotherapists should prioritize the rehabilitation to have a positive result. Kevin G. Laudner, and Souhail Hermassi investigated the glenohumeral joint in handball players. Based on their investigation, 25.8% of handball players in the German minor league reported shoulder injuries throughout the season. The risk was significantly higher during the competitive period than during training, with a ratio of 68.2% to 31.8% [9,10]**.** Landreau P., conducted a study on shoulder injuries in handball in 2018, it was discovered that repetitive overhead movements, which result in overuse injuries, are responsible for up to 37% of all handball injuries sustained at the shoulder. These alterations may lead to internal impingement, rotator cuff tears, labrum tears, and scapular dyskinesia [11,12].

To formulate effective injury rehabilitation strategies, an epidemiological analysis must be implemented as the initial phase, as emphasized by Van Mechelen. The scope of this analysis should encompass injury incidence, burden values, and availability. The global incidence of injuries per 1000 hours of total exposure for handball players has been demonstrated in studies to be between 4.1 and 12.4. The lower extremities, specifically the ankle, knee, and cranium, are the most frequently affected by injuries, upper extremity trauma, including those to the shoulder, are not as extensively investigated [13].

Conclusions: The comprehensive nature of the physiotherapist's function in the rehabilitation process is demonstrated by the analysis of all data. A complex therapy program is necessary to update the kinetic plan, which is a difficult task. This program should include international protocols that emphasize mobility, strength development, conditioning, and stability exercises. The integration of handball-specific exercises will enhance the recovery prognosis of athletes and enable them to return to sporting activities promptly, with a minimal relapse rate."By applying functional re-education programs, the recovery time can be considerably reduced" [14]. "It is necessary to know the overall condition of the athletes' body, especially biological parameters, for it gives us information on how the athlete behaves in training and competition" [16].

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