

THE EFFECTS OF MODERN RADIOFREQUENCY THERAPIES IN THE ACUTE REHABILITATION OF HAMSTRING STRAINS

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Abstract: *Hamstring strains are usually a result of a high mechanical stress produced by a quick extensive contraction or a violent stretch of the muscle group. This study aimed the effectiveness of INDIBA therapy (Group B) compared with the use of TECAR therapy (Group A). The first stage of rehabilitation represented first two weeks which were mainly based on the application of radiofrequency therapies to the posterior level of the thigh, progressive exercises and cryotherapy. Numeric Pain Rating Scale, manual muscle testing and range of motion had been used to evaluate the subjects, a significant advantage being shown for group B in the pain assessment.*

Key words: *INDIBA, TECAR, athletes, flexibility, strength.*

1. Introduction

Muscle injuries are a category of sports traumas with a high frequency in many team and individual sports (football, rugby, american football, tennis, etc.). One of the most frequent injury situation in sports involves hamstring strain injuries (HSIs).

Despite the effort to prevent and recover hamstring injuries in sports, injury

occurrence, and re-injury rates have not improved over the last two-three decades and only few strategies for prevention had been promoted [11].

Recurrence high rates is a major aspect in the most of the muscle strains. Furthermore, strength deficits is considered one of the most relevant factors. Understanding the importance for the prevention of these injuries is an active and crucial scientific aim. There is a

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certainly scientific direction based on the importance of an exercise program based on Nordic hamstring exercises. Moreover, it is considered as an efficient therapeutic option in decreasing the incidence of hamstring injuries [4].

There is high rate of recurrent injuries worldwide, in many sports, which suggests clearly that our current understanding of sport traumatology and re-injury risk is incomplete. High intensity efforts such as running, is often identified as the primary type of activity that can lead to HSIs with a different severity level. Main description contains high level of eccentric forces and moderate muscle strain situated on the hamstrings during running sessions as primary factors which determines muscle strains [14].

It is well known that some types of hamstring injuries have a high probability for a requirement of a long-term rehabilitation program and automatically delayed return to competition. According to some recent classification [1], there are two most prevalent types of acute hamstring strains: one occurring during high-speed running which usually involves the biceps femoris long head, the other during efforts and movements leading to extensive lengthening of the hamstrings (examples: high kicking in martial arts, sliding tackle in football). This second category is usually involving the free proximal tendon of a particular muscle from the hamstring group (semimembranosus muscle). Same authors demonstrated in their research project that injuries described by a slow intensity stretch type, while seem to be

less severe at the acute stage of rehabilitation than the sprinting type of muscle injury, actually can require a longer and harder time for recovery in the sport rehabilitation clinics [2], [15].

There is a relevant evidence that muscle tendon's particular details may be an key factor in the traumatic situations of hamstring strains by modifying stretch distributions throughout the muscle [3].

There is an increased volume of factors that have been strongly suggested as good indicators of severity, functionality and time to return to play. Askling et al. suggested according to their multiple studies that the closer the lesion was to the ischial tuberosity the longer the time to return to high performance physical activity [15]. As conclusion, we can admit that there can exist a direct proportional relationship between proximal area to the ischial tuberosity and duration of the recovery based on anatomical principles.

Thus, a recent review on Web of Science [16] identified some conflicting different evidence, reporting an approximately significant correlation between the similar anatomical area (ischial tuberosity) and a possible even longer period to return to play [5], [15], [18].

Main radiofrequency therapies involve a modern technology represented by some multiple versions of devices such as TECAR and INDIBA.

TECAR therapy is defined as non-invasive high-frequency energy (300 KHz - 1 MHz) which may increase the body's self regenerating abilities [17].

The physiological effect of TECAR therapy on tissues is presented as reduction of muscle spasms and contractures, vasodilatation with increased microcirculation, oxygenation and activation of metabolic processes, and increase in internal temperature and capacity [9], [13]. According to the mentioned features of TECAR therapy the synergistic effect between the manual therapy and TECAR therapy provides more effective rehabilitation protocol.

Radiofrequency therapy is an excellent prove, having the action of a pain-free device, easy to tolerate and without side effects [8].

INDIBA systems generate an electromagnetic wave with a frequency of 448 kHz and determine a bio-stimulation and/or thermal effect with an important role in increasing the body's self-healing capacity [10].

There are two modes of electric charge transfer: capacitive, which is focused on soft tissues and muscles that has higher electrolyte content and resistive mode that is focused on larger, deeper and with a higher resistance tissues such as simply bones areas and/or joints.

To date, the following have been demonstrated: the positive effect in increasing deep blood flow [6]; the ability to stimulate stem cell proliferation and differentiation [7]; induction and support of thermal adaptations of skin tissue that reflect an efficiency of cellular metabolism and deep circulation [12]; producing major improvements in pain and disability in acute lateral epicondylitis [8].

2. Objectives

The purpose of the study is to evaluate the short-term effects of modern radiofrequency therapies in the acute rehabilitation of hamstring strains.

The current study aimed to compare the effectiveness of INDIBA Therapy and TECAR Therapy as main therapies in sport rehabilitation. TECAR Therapy is a well-proved therapeutic method while INDIBA technology is an element of novelty in recent years in the functional recovery of athletes.

3. Material and Methods

Twenty-four professional male football players in the age range of 18 to 35 years old, having the primary criteria for selection a hamstring strain were the subjects of the research (Table 1).

Table 1
Subjects of the research

Variable (unit)	Group A (n=12)	Group B (n=12)
Age (years)	26.08±4.73	26.92±4.75
Weight (kg)	75.60±7.80	78.70±8.90
Height (cm)	176.30±5.48	179.70±3.94

Clinical and functional diagnose had been indicated according to the MRI results, visual examination, palpation, ROM and muscle active testing.

MRI investigation allowed us to identify the severity of the injury according to the view of the muscular hematomas, a strong indicator for the evaluation of the body self-healing

efficiency.

Subjects of the research were structured in two equal groups. Both groups followed a therapeutic plan for approximately two weeks as it shows: Group A: TECAR Therapy using Tecno Red Coral device; Group B: INDIBA therapy using the device of INDIBA Active 701. Despite the different devices used for the both groups, their application was similar (15-30 minutes at a medium and/or subthermal unit) and included progressive active exercises, stretching and sporadic cryotherapy (-2°).

Numeric Pain Rating Scale (NPRS) had been used to assess the level of the pain during palpation. Every patient had to evaluate on the 11-point numeric scale which contains values from minimum 0 (no pain) to maximum 10 (worst pain imaginable).

The active ROM test of the knee extension assesses the ability of a subject (athlete in the current research)

to realize a full movement of extension of the knee while the hip of the same leg is at 90° of flexion. Previous research had shown the importance of a high active level of ROM, hamstring flexibility being a relevant predictor for the rehabilitation time.

Manual muscle testing is a system of examination techniques to assess the strength of the hamstring group. Initial and final evaluation contained values from 3+ to 5 (“+” and “-” were used in order to gain a finer separation of the muscle strength values). The highest value indicates the performing of a full movement against a normal/high external force.

These three indicators has been used for both groups in the baseline and after two weeks of the rehabilitation plan.

Evaluation of the therapeutic effect was made using SPSS software, One-Sample T test, Paired-Samples T Test and Pearson Correlation being main analyzing tools.

4. Results and Discussions

Table 2

Baseline and Week 2 evaluation indices

	Group A			Group B			p – value (t test, between groups, week 2)
	Baseline	Week 2	Std. Error	Baseline	Week 2	Std. Error	
NPRS SCORE	6.08±1.24	3.00±.739	.418	6.08±1.44	2.33±.985	.415	.000
ROM Active Knee Extension	115.4±1.3	127.9±1.4	1.97	115.8±1.62	128.3±1.17	1.85	.085
Manual muscle testing - hamstrings	4.01±0.28	4.75±0.28	.103	4.00±0.70	4.66±0.23	.084	.007

Table 2 identifies the main indices of the physical examination performed at the baseline and after two weeks of the rehabilitation plan. NPRS final score shows a significant difference between Group A (3.00±.739) and Group B (2.33±.985) in the favor of the INDIBA group, p values associated with the t test being < 0.01.

Pain is considered one of the most important objectives to be analyzed, pain's value being a key factor for adapting the physical exercises and stretching methods.

A lower level of pain is associated with the possibility of an increased intensity for the progressive stretching and optimal loading of the injured leg.

Values of ROM Active Knee Extension are quite appropriate for both groups for the final evaluation (min=120°, max=135°), value of p=0.085>0.01 showing that there are no significant differences between the average measures of groups A and B.

Manual muscle testing had been performed by the same physiotherapist for the baseline and week 2 evaluation and included a slightly difference in the favor of group B (4.66±0.23). Furthermore p=0.07>0.01 shows no significant differences between the final evaluation. The interpretation using the main muscle testing scale demonstrates final scores with a range of 4+ to -5/5.

Range of motion (ROM) for the knee joint and the strength's level of the hamstring group muscles is essential to be evaluated periodically during an acute stage of a rehabilitation program for a hamstring strain.

Pearson correlation was used to correlate the final scores of ROM Active Knee Extension and Manual muscle testing-hamstrings for Group A (Table 3) and Group B (Table 4).

Table 3

Correlation matrix of the group A final evaluation results

GROUP A – Week 2		ROM Active Knee Extension	Manual muscle testing-hamstrings
ROM Active Knee Extension	Pearson	1	.610
	Sig. (2-tailed)		.035
	N	12	12
Manual muscle testing-hamstrings	Pearson	.610	1
	Sig. (2-tailed)	.035	
	N	12	12

Table 4

Correlation matrix of the group B final evaluation results

GROUP B – Week 2		ROM Active Knee Extension	Manual muscle testing-hamstrings
ROM Active Knee Extension	Pearson	1	.650
	Sig. (2-tailed)		.022
	N	12	12
Manual muscle testing-hamstrings	Pearson	.650	1
	Sig. (2-tailed)	.022	
	N	12	12

According to the upper correlation matrices, there is a moderate to strong correlation, directly proportional for the group A ($r=.610$; $0.5 < r < 0.75$; $\text{sig} < 0.05$) and group B ($r=.650$; $0.5 < r < 0.75$; $\text{sig} < 0.05$).

Statistical interpretation of the results shows the moderate correlation between ROM of the knee and the level of hamstrings strength. Moreover, the flexibility of hamstrings is an interdependence relationship with the muscle strength.

5. Conclusions

According to Table 2, the only significant differences during the final evaluation had been observed for the NPRS score ($p < 0.01$) which was evaluating the level of pain on palpation for the injured area.

TECAR Therapy and INDIBA Therapy had shown good improvements of pain and functionality. Group B obtained a lower level of pain during palpation for the final evaluation, INDIBA Therapy being considered more effective than TECAR Therapy for the pain assessment.

The values for the ROM Active Knee Extension and Manual muscle testing for

hamstrings shows a moderate correlation which help the practitioners to understand and evaluate the rehabilitation's main objectives.

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