EFFICACY OF COMBINATION THERAPY IN REHABILITATION OF ANKLE INJURIES

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ABSTRACT: The ankle joint is among the most complex anatomical functional structures of the locomotor system. The most recent research on lower leg injuries reveals that the ankle joint sprains show the highest incidence rate of 206 injuries per 100 000 people annually, while the injuries most commonly occur among children and adolescents. The most frequent ankle joint injuries in sports are sprains (15%), followed by lesions and contusions. The study aims to determine the statistical analysis of the successful application of combination therapy (kinesitherapy and physical therapy) compared to the use of a single therapy for the treatment of ankle injuries. A prospective analysis of the period February 2012 - November 2014, on 60 subjects of the statistical treatment of the results, in order to compare performance of administration of the combination therapy (kinesitherapy and physical therapy) compared to the use of only one of these therapies in the treatment of ankle joint. The research results obtained show a significant, significant differences between the groups. By analyzing the results, the duration of rehabilitation is the most commonly from 11 to 20 days in both groups, while the use of ultrasound to 81.8% were most frequently used therapy in the groups. The VAS pain scale we have insufficient physical activity gave results that "no pain" was 36.7% of respondents to the end of the study, while the control group this number was 28.3%. The test group at the end of therapy has 5% of the copies of the dorsal flexion of 26 to 30° and the control group was 0%, while the embodiment plantarflexion equal result.In the embodiment of pronation, the majority of subjects at the end of therapy can work pronation 26 to 30° (33.3%) in both groups, with the study group but the control had better 15% of those with 26 to 30°. At the end of treatment in the embodiment of supination 43.3% of both groups could take over supination 30°. After the therapeutic treatment of condition marks respondents score "5" yielded 73.3% of the test group, and 63.3% of the controls. Research has shown better progress in the treatment in patients on combination therapy that fits into the world of research with which we compared our results.

Keywords: *Ankle joint, physical medicine, kinesitherapy, rehabilitation.*

INTRODUCTION

Ankle injuries are injuries to the distal tibia or fibula. During the last decades, the number of ankle injuries has increased significantly and they occur at all ages (Chirvi et al., 2017). A large randomized study conducted in the United States in 2010 registered 2,000,000 ankle injuries in one year, and the treatment and care of these individuals cost 2 trillion US dollars, which was imperative to find an adequate protocol in the diagnosis and treatment of these patients (Gottschalk & Andrish, 2011). In athletes, the most common injuries are the ankle, then the knees and lower legs. The most common type of ankle injury is sprains and bruises (Fong, Hong, Chan, Yung, & Chan, 2007). Distortion is a set of injuries to the ligaments, joint capsule, and attachment of the tendons of the muscles in the area of the joint caused by the action of gross motor force (Whiting & Zernicke, 2008). Distortion manifests itself when the amplitude of movement exceeds the physiological limit (Radulović, Mihajlović, Šolaja, & Pavlović, 2019). Inversion of the foot is cited as a mechanism of an ankle injury. The lateral side of the joint is most often injured, namely the ligament. collateral lateral consisting of three parts: lig.calcaneofibulare i lig.talofibulare anterius et posterius (Gross & Liu, 2003; Ivins, 2006). Numerous protocols and functional tests are used in the literature for the examination of ankle injuries, but none of them gave answers to all questions and did not give satisfactory results. and physiatrist. Only timely adequate diagnostics and early complex physical therapy, which can sometimes be long-term, return the injured person to the previous functional level. (Polzer et al., 2012).

METHOD

This study aims to compare the results of treatment and rehabilitation of ankle injuries using combination therapy (kinesitherapy and physical therapy) with the application of only treatment and rehabilitation with kinesitherapy or physical therapy, to determine the effectiveness of combination therapy (kinesitherapy and physical therapy) in treatment and rehabilitation. The research was conducted in the Institute of Sports Medicine of Sarajevo Canton in the period from February 2020. until November 2021. The study included 60 subjects aged 15 to 30 years, who according to the criteria for inclusion in the study were divided into two equal groups: the study (n = 30) and control (n = 30). The study group consisted of subjects treated with combination therapy (kinesitherapy and physical therapy) and in the control group were subjects treated only with kinesitherapy or physical therapy. The research is prospective, comparative, to compare two methods of treatment: the use of kinesitherapy and physical therapy in the treatment of ankle injuries and the use of only one of these therapies in the treatment. At the end of all treatment protocols, a statistical analysis was performed to determine whether one protocol was more successful than the other. We used the Mann - Whitney U test to process the data.

Research instruments

Instruments used in both study groups:

a) Visual analog pain scale (VAS). VAS is a centimeter strip 0-10 cm long, where "0" indicates a pain-free condition and "10" indicates the most severe pain condition,
b) Measuring the function of the movement with a protractor,
c) Length of treatment expressed in days for both study groups,
d) Assessment of clinical condition after completion of therapy: 1-5
- grade "1" means unchanged condition (without treatment results);
- grade "2" indicates minimal improvement;
- grade "3" indicates satisfactory functional improvement;
- grade "4" indicates good improvement;
- a grade of "5" indicates improvement without injury or illness.

All of the above instruments were used in the study and control groups of subjects during the first examination, control examination, and at the end of therapy. Questionnaires were filled out for each subject of the examined and control group with detailed generalizations and assessment of the clinical condition. Upon completion of treatment, a questionnaire was completed with a final assessment of the clinical condition.

RESULTS

The analysis of the gender structure of the examinees of the examined groups established that the same number of examinees was from both groups of males, 36.7% in the examined and 36.7% in the control group, while 13.3% were female and 13.3% in the control group. Insight into Table 1 can be seen that the examined groups are the same in the number of males and females where it can be concluded that there are no differences in the examined groups when it comes to gender.

Table 1. Gender structure of respondents in the surveyed groups

sex * group Crosstabulation					
			Group		Total
			examined	control	
sex	female	Number	8	8	16
		%	13.3%	13.3%	26.6%
	male	Number	22	22	44
		%	36.7%	36.7%	73.4%
Total		Number	30	30	60
		%	50.0%	50.0%	100.0%

Table 2. shows the frequency of the first injuries, which is 35.0% in the examined group and 26.7% in the control group. The percentage of recurrent injuries in the examined group is 15% and in the control group 23.3%. Overall, it can be seen that the first injuries were 61.7% and repeated injuries 38.3% of respondents. Analysis of the differences in injuries (first / repeated) of the examined groups (Table 3) showed that there is no statistically significant difference between the examined and control groups of subjects (sig = .188).

Table 2. Injury (first / repeated) of the examined groups

Injuries		Group		Total
		examined	control	
First injury	Number	21	16	37
	%	35.0%	26.7%	61.7%
Repeated injury	Number	9	14	23
	%	15.0%	23.3%	38.3%
Total	Number	30	30	60
	%	50.0%	50.0%	100.0%

Table 3. The difference in injuries (first / repeated) of the examined groups

Test Statistics[a]	
	Injuries
Mann-Whitney U	375.000
Wilcoxon W	840.000
Z	-1.317
Asymp. Sig. (2-tailed)	.188

Analyzing the types of injuries in the examined groups (Table 4), we can see that in the control group there were no injuries of the type: fissure, fracture, rupture.

Table 4. Types of injuries in the examined groups

			Group		Total
			examined	control	
Duration rehabilitation	do 10 days	Number	4	13	17
		%	6.7%	21.7%	28.4%
	11-20 days	Number	18	17	35
		%	30.0%	28.3%	58.3%
	preko 20 days	Number	8	0	8
		%	13.3%	0.0%	13.3%
Total		Number	30	30	60
		%	50.0%	50.0%	100.0%

Table 5 using the Mann-Whitney U test shows the differences in the type of injury in the examined groups that are statistically significant sig = .000

Table 5. Differences in the type of injury in the examined groups

Test Statistics[a]	
	Incidence of injuries
Mann-Whitney U	240.000
Wilcoxon W	705.000
Z	-3.719
Asymp. Sig. (2-tailed)	.000

Table 6 shows the results on the duration of rehabilitation in the examined groups. Most of the respondents in both groups had rehabilitation that lasted from 11 to 20 days.

Table 6. Duration of rehabilitation in the examined groups

			Group		Total
			examined	control	
Duration rehabilitation	do 10 days	Number	4	13	17
		%	6.7%	21.7%	28.4%
	11-20 days	Number	18	17	35
		%	30.0%	28.3%	58.3%
	preko 20 days	Number	8	0	8
		%	13.3%	0.0%	13.3%
Total		Number	30	30	60
		%	50.0%	50.0%	100.0%

Mann-Whitney results The test shows statistically significant differences in the duration of rehabilitation in the examined groups sig = .001 (Table 7).

Table 7. Differences in the duration of rehabilitation in the examined groups

Test Statistics[a]	
	Rehabilitation duration
Mann-Whitney U	247.000
Wilcoxon W	712.000
Z	-3.406
Asymp. Sig. (2-tailed)	.001

The results in Table 8 show the results of the VAS pain scale - score at the beginning of therapy in the examined groups. It is noticeable that at the beginning of therapy in both study groups, the highest percentage is in the assessment of pain level "5".

Table 8. VAS pain scale - score at the beginning of therapy in the examined groups

			Group		Total
			examined	control	
VAS pain scale Rating at the beginning of therapy	pain 3	Number	1	2	3
		%	1.7%	3.4%	5.1%
	pain 4	Number	4	7	11
		%	6.6%	11.7%	18.3%
	pain 5	Number	12	12	24
		%	20.0%	20.0%	40.0%
	pain 6	Number	7	4	11
		%	11.7%	6.6%	18.3%
	pain 7	Number	4	4	8
		%	6.6%	6.6%	13.2%
	pain 8	Number	1	0	1
		%	1.7%	0.0%	1.7%
	pain 9	Number	1	1	2
		%	1.7%	1.7%	3.4%
Total		Number	30	30	60
		%	50.0%	50.0%	100.0%

Using the Mann-Whitney U test, it was found that there are no statistically significant differences in the VAS pain scale - score at the beginning of therapy in the examined groups sig. =. 215 (Table 9)

Table 9. Differences - VAS pain scale - score at the beginning of therapy in the examined groups

Test Statistics[a]	
	VAS pain scale Rating at the beginning of therapy
Mann-Whitney U	369.500
Wilcoxon W	834.500
Z	-1.240
Asymp. Sig. (2-tailed)	.215

VAS pain scale - the assessment at the end of therapy in the examined groups in Table 10 shows that in the examined group 36.6% of the respondents had "no pain", while in the control group this percentage is 28.3%.

Table 10. VAS pain scale - evaluation at the end of therapy in the examined groups

			Group		Total
			examined	control	
VAS pain scale Rating at the end of therapy	no pain	Number	22	17	39
		%	36.6%	28.3%	64.9%
	pain 1	Number	7	12	19
		%	11.7%	20.0%	31.7%
	pain 2	Number	1	1	2
		%	1.7%	1.7%	3.4%
Total		Number	30	30	60
		%	50.0%	50.0%	100.0%

No statistically significant differences in the VAS pain scale were obtained using the Mann-Whitney U test - score at the end of therapy in the examined groups sig. =. 198 (Table 11).

Table 11. Differences - VAS pain scale - evaluation at the end of therapy in the examined groups

Test Statistics[a]	
	VAS pain scale Rating at the end of therapy
Mann-Whitney U	377.500
Wilcoxon W	842.500
Z	-1.287
Asymp. Sig. (2-tailed)	.198

After the treatment of the condition of the subjects, we can see from Table 12 that the grade "5" was 73.3% of the subjects of the study group, and 63.3% of the subjects of the control group. Grade "4" was given to 26.7% of respondents in the study group, and 36.7% of respondents in the control group.

Table 12. Assessment of the condition of the subjects after the treatment

	1-5	Number / Percentage	Group	
			examined	control
Grades	5	Number	22	19
		Percentage	73,3%	63,3%
	4	Number	8	11
		Percentage	26,7%	36,7%
Total		Number	30	30
		Percentage	100%	100%

DISCUSSION

Ankle injuries are one of the most common injuries. They occur as a result of twisting the feet. They can occur when walking on uneven surfaces, while running, when stumbling, when athletes land on someone else's foot, slip, etc. The most common ankle injuries are distortion (sprain), luxation (dislocation), and fracture (fractures), (Banović, 2006). The goal of rehabilitation is to reduce pain, improve range of motion, and it is equally important to restore strength and proprioception (Singer, Jones, & Taillon, 1995). Meta-analysis has shown that neuromuscular rehabilitation results in faster improvement in function (de Vries, Krips, Sierevelt, Blankevoort, & Van Dijk, 2011). We compared the results we obtained with the results of research by other authors. The results of our study agree with the study (Pavlović A, 2011), with the proviso that our study shows that a higher percentage of subjects were on combination therapy without pain at the end of treatment. The results of performing dorsal flexion in subjects at the beginning of therapy in the examined groups show that in the control group we have the same percentage when it comes to dorsal flexion up to 5 ° and from 6 ° to 10 ° (23.3%). In our study, subjects were involved in the treatment of physical and kinesitherapy as well as in the treatment of only one of the therapies. At the beginning of treatment, dorsiflexion was at most 15 ° in the total number of subjects, and at the end of treatment 55% of subjects had over 15 °, also, in plantar flexion at the beginning of treatment no subject had over 50 °, and at the end of the study in 30 % of subjects, PF was over 50 °. The treatment lasted an average of 3 weeks and as with the author (Kim & Jeon, 2016) who researched soccer players with recurrent ankle injuries who underwent functional exercises to strengthen joint muscle strength in combination with balance. The rehabilitation program lasted 12 weeks to improve muscle strength and dynamic coordination of the lower extremity. Muscle strength and dynamic coordination were assessed using the Y balance test and isokinetic exercises where they measured dorsal and plantar flexion, inversion, and eversion, before and after 12 weeks. After 12 weeks of rehabilitation, there was a statistically significant improvement in performing dorsal and plantar flexion, inversion, and eversion on the ankle. The results of performing dorsiflexion at the end of treatment are smaller compared to the study they performed (Biškupić G, 2011) where only 5% of subjects were up to 30 °, while the results of performing plantar flexion at the end of treatment showed significantly better results in our study, 30% of subjects over 50 °. The use of combined muscle strengthening and proprioceptive exercises for those who have functional joint instability is more successful than the use of only muscle strengthening exercises. Research (Urguden et al., 2010; Willems, Witvrouw, Verstuyft, Vaes, & De Clercq, 2002) has shown that the use of combined muscle strengthening and proprioceptive exercises for individuals with functional joint instability is more successful than the use of only muscle strengthening exercises. The results of our study at the end of treatment showed that the performance of plantar flexion, dorsiflexion, inversion, and eversion in the study and control groups were equal, but subjects on combination therapy achieved better results faster. In our study, 46.7% of subjects at the beginning of therapy could perform supination over 30 °, while at the end of the study this number was 86.7% taking into account the total number of subjects, while in (Eils & Rosenbaum, 2001; Refshauge, Kilbreath, & Raymond, 2000; Wennerberg, 1991), after an exercise program, there was a significant (almost

60%) reduction in the frequency of ankle inversion. Comparing the study (Bleakley, McDonough, & MacAuley, 2008) with ours, it is concluded that the results of our study contradict these results. Our research showed significant progress in joint mobility in subjects who were on the combination, as well as on the use of only one of the therapies. This especially refers to the performance of dorsal flexion, which is 51.7% of subjects was up to 5 ° at the beginning of the study, and in the end, only 1.7% performed dorsal flexion of 5 °, while other subjects had visible progress.

CONCLUSION

The program of rehabilitation therapy for ankle injuries should be started as early as possible, it must be individually conceived and include a combination of physical therapy and kinesitherapy. Prevention of ankle injuries consists of adequate warm-up before sports activities, adequate sports shoes, and improvement of fitness, balance, and proprioception.

REFERENCES

1. Banović, M. (2006). i saradnici Povrede u sportu. Drugo izdanje, Drasler Partner, Beograd, 167-169.
2. Biškupić G, M. R. (2011). Mogućnosti fizikalne terapije kod distorzija skočnog zgloba. Zbornik radova/11 kongres fizijatara Srbije sa međunarodnim učešćem, Zlatibor – Balneoclimatologia
3. Bleakley, C. M., McDonough, S. M., & MacAuley, D. C. (2008). Some conservative strategies are effective when added to controlled mobilisation with external support after acute ankle sprain: a systematic review. Australian Journal of Physiotherapy, 54(1), 7-20.
4. Chirvi, S., Pintar, F., Yoganandan, N., Banerjee, A., Schlick, M., Curry, W., & Voo, L. (2017). Human foot-ankle injuries and associated risk curves from under body blast loading conditions. Stapp car crash journal, 61, 157-173.
5. de Vries, J. S., Krips, R., Sierevelt, I. N., Blankevoort, L., & Van Dijk, C. (2011). Interventions for treating chronic ankle instability. Cochrane Database of Systematic Reviews(8).
6. Eils, E., & Rosenbaum, D. (2001). A multi-station proprioceptive exercise program in patients with ankle instability. Medicine and science in sports and exercise, 33(12), 1991-1998.
7. Fong, D. T.-P., Hong, Y., Chan, L.-K., Yung, P. S.-H., & Chan, K.-M. (2007). A systematic review on ankle injury and ankle sprain in sports. Sports medicine, 37(1), 73-94.
8. Gottschalk, A. W., & Andrish, J. T. (2011). Epidemiology of sports injury in pediatric athletes. Sports medicine and arthroscopy review, 19(1), 2-6.
9. Gross, M. T., & Liu, H.-Y. (2003). The role of ankle bracing for prevention of ankle sprain injuries. Journal of orthopaedic & sports physical therapy, 33(10), 572-577.
10. Ivins, D. J. (2006). Acute ankle sprain: an update. American family physician, 74(10), 1714-1720.
11. Kim, K., & Jeon, K. (2016). Development of an efficient rehabilitation exercise program for functional recovery in chronic ankle instability. Journal of physical therapy science, 28(5), 1443-1447.
12. Pavlović A, M. N., Milenković D. . (2011). Terapijske mogućnosti elektromagnetnog polja kod pacijenata sa distorzijom skočnog zgloba. Zbornik radio/11 kongres fizijatara Srbije sa međunarodnim učešćem, Zlatibor – Autocollimator
13. Polzer, H., Kanz, K. G., Prall, W. C., Haasters, F., Ockert, B., Mutschler, W., & Grote, S. (2012). Diagnosis and treatment of acute ankle injuries: development of an evidence-based algorithm. Orthopedic reviews, 4(1).
14. Radulović, N., Mihajlović, I., Šolaja, M., & Pavlović, R. (2019). Injuries in elite athletes.
15. Refshauge, K. M., Kilbreath, S. L., & Raymond, J. (2000). The effect of recurrent ankle inversion sprain and taping on proprioception at the ankle. Medicine and science in sports and exercise, 32(1), 10-15.
16. Singer, K., Jones, D., & Taillon, M. (1995). Ligament injuries of the ankle and foot. The Lower Extremity and Spine in Sports Medicine, 1, 423-440.
17. Urguden, M., Kizilay, F., Sekban, H., Samanci, N., Ozkaynak, S., & Ozdemir, H. (2010). Evaluation of the lateral instability of the ankle by inversion simulation device and assessment of the rehabilitation program. Acta orthopaedica et traumatologica turcica, 44(5), 365-377.
18. Wennerberg, D. (1991). Reliability of an isokinetic dorsiflexion and plantar flexion apparatus. The American journal of sports medicine, 19(5), 519-522.
19. Whiting, W. C., & Zernicke, R. F. (2008). Biomechanics of musculoskeletal injury: Human Kinetics.
20. Willems, T., Witvrouw, E., Verstuyft, J., Vaes, P., & De Clercq, D. (2002). Proprioception and muscle strength in subjects with a history of ankle sprains and chronic instability. Journal of athletic training, 37(4), 487.

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