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Comparison of isokinetic exercise and standard exercise protocol in patients with spondyloarthropathies

Nenad Petrc[1], Matija Brentin[1], Mirela Vučković[2]*, Tatjana Kehler[1]

[1]Special hospital for medical rehabilitation of heart disease, lung and rheumatism of Thalassotherapy Opatija, Republic of Croatia, [2]Faculty of Health Studies, University of Rijeka, Republic of Croatia

ABSTRACT

Introduction: Spondyloarthropathy is a group of different chronic rheumatic diseases. There are a number of physiotherapy interventions that all aim to support the trunk flexors and extensors, relieve pain, and mobilize the joints. The aim of this study is to compare isokinetic exercises (IE) with a standard exercise protocol in patients with spondyloarthropathies.

Methods: A total of 16 subjects participated in the study and were randomly divided into two groups: The group with the standard protocol (SP) and the other in the isokinetic protocol (IP). Both groups underwent the same follow-up testing: Muscle strength, pain, and functional status. Both groups underwent a total of 15 physiotherapy interventions over a 3-week period.

Results: The mean age in the standard group was 36 ± 7.93 and in the isokinetic group 46.13 ± 13.88. In the isokinetic group, there was a difference in pain intensity between the second and third measurements (p = 0.016). There was an improvement in muscle strength in the isokinetic group (Cohen's d = 0.33). At an angular velocity (AV) of 60°/s, this group is better than the delayed SP, while it is directly better at an AV of 90°/s (d = 0.30). The delayed measurement of the groups (IP) showed a lower functional deficit than the SP group (p = 0.012).

Conclusion: Based on the results of this study and a search of the scientific literature, we can conclude that IE has been shown to be beneficial rather than harmful. Further longitudinal studies with a larger number of subjects are needed to investigate the effects of isokinetics on functional outcomes in rheumatology patients.

Keywords: Isokinetic exercise; pain; spondyloartropathy; standard exercises; trunk muscle strength; functional abilities

INTRODUCTION

Spondyloarthropathy (SpA) is the name given to a group of different chronic inflammatory rheumatic diseases characterized by the absence of rheumatoid factor and a genetic predisposition (HLA-B27 genotype) (1). This group of diseases includes ankylozing spondylitis, reactive arthritis, psoriatic arthritis, SpA associated with inflammatory bowel disease, and undifferentiated SpA (2). The incidence of the disease is approximately 0.1-1.4% worldwide (3). Symptoms of the disease appear in early adolescence, usually between the ages of 20 and 30 years (4,5), and are twice as common in men as in women (5).

Inflammation and pain are the most significant symptoms of SpA that lead to disability. They begin at the vertebrae, intervertebral discs, and ligaments of the thoracic and lumbar spine, as well as at the sacroiliac joints (1,5), and lead to atrophy of the paravertebral muscles and subsequently to muscle atrophy and rapid muscle fatigue (6). Inflammation also stimulates edema formation, intra-articular pressure increases, and the biomechanics of the joint itself are altered. Impaired joint proprioceptors interfere with proper nerve activation, leading to disturbances in the maintenance of muscle strength and endurance, and affecting neuromuscular control of the trunk (7). Disruption of correct posture decreases lung capacity and overall fitness, leading to a decrease in functional abilities, loss of gait coordination and balance (6,7), and ultimately a decrease in the quality of life of the affected individual.

The various physiotherapy interventions are used specifically to relieve inflammation, pain, and stiffness, and only at a later stage, when the clinical signs have subsided, do the physiotherapy interventions include muscle strengthening (5). Strong stabilizers of the trunk and pelvic floor muscles are important for maintaining proper posture, which translates into better biomechanics of walking and thus performing daily activities. A whole range of physiotherapy interventions are described in the literature, from manual techniques, isokinetic exercises (IE), Pilates, standard gym exercise protocols, etc., all aimed at supporting the trunk flexors and extensors, relieving pain and mobilizing

*Corresponding author: Mirela Vučković, Faculty of Health Studies, University of Rijeka, Republic of Croatia. E-mail: mirela.vuckovic@uniri.hr

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UNIVERSITY OF SARAJEVO
FACULTY OF HEALTH STUDIES

the root joints (shoulder, hip, and knee) (8-12). Scientific studies (8-11) describing exercises in SpA patients use standard protocols (SP) for isometric and isotonic exercises to strengthen the upper and lower extremities. The exercises usually last 30-45 min and are performed in a lying and standing position.

The standard exercise protocols mentioned above have not proven successful in the long-term, precisely because patients keep coming back for physiotherapy due to persistent symptoms and we know that the cost of this type of therapy is a major burden on the healthcare system.

In the last two decades, isokinetic devices have become increasingly common in rehabilitation centers with modern equipment. They have proven to be a tool that can be safely used in the assessment and physiotherapy exercises in rheumatologic patients (12-15). In isokinetic contractions, exercise occurs under controlled laboratory conditions with constant and targeted angular velocity (AV) and adaptive resistance throughout the range of motion (16,17). In addition, with isokinetic muscle contraction, there is no pain, inflammation, or microtrauma to the muscles, and no overloading of joint structures, reducing the possibility of injury and the development of muscle fatigue (12-21).

Based on the fact that the therapy of chronic diseases is very costly, the aim is to find exercises that have a long-term impact on patients' health. Every day, we see patients with spondyloarthropathies exercising on the isokinetic device, but we have not found scientific evidence to support or refute the benefits of IE. In this study, we use scientific methods to find out which type of exercise is better. We hypothesize that patients who exercise on the isokinetic device will have better functional outcomes and less pain immediately after therapy and 6 weeks after.

METHODS

The study was conducted in accordance with the guidelines of the Declaration of Helsinki. The study was conducted in 2021/2022 in the Department of Physiotherapy and Rehabilitation of the Special Hospital for Medical Rehabilitation of Heart, Lung, and Rheumatism Thalassotherapia Opatija. It was approved by the Ethics Committee of the hospital (01-000-00-425/2018) and the Ethics Committee of the Faculty of Kinesiology in Zagreb (64/2019). The study was conducted according to the guidelines of the Declaration of Helsinki.

A total of 16 subjects participated in the study, 11 women and five men, who were randomly divided into two equal groups, eight per group. One group was included in the SP and the other in the isokinetic protocol (IP). The distribution of the test subjects within the groups was determined with regard to the order of arrival for therapy. This was done in such a way that the first subject belonged to the standard group and the second to the isokinetic group. Subjects with an odd number were therefore assigned to the standard group in the order in which they arrived, while subjects with an even number were assigned to the isokinetic group in the order in which they arrived. In estimating the appropriate sample size for the study, we were guided by the sample size of similar studies, which was 20 subjects per group (22,23) (see the study limitation of our research).

The criteria for inclusion in the study were subjects diagnosed with SpA who came for regular check-ups with a rheumatologist. During testing and conducting research, all subjects received biologics therapy and showed no signs of active joint inflammation. The first biologics for the therapy of patients with SpA diseases are drugs that inhibit the action of tumor necrosis alpha factors (TNF) (24). The TNF inhibitors approved for the therapy of SpA are infliximab, etanercept, adalimumab, and golimumab (25). Exclusion criteria for the study are subjects with a diagnosed herniated disk, spondylolisthesis, stenosis, tumor, infection in the lumbar spine, subjects with cardiovascular disease, and pregnant women.

The measurements were performed at 3 time points for both groups. The first measurement was made before the start of the therapy, the second after 15 days of therapy, and the third 6 weeks after the last therapy. At each measurement time point, pain, and functional ability were assessed and trunk muscle strength (flexor/extensor) was tested at two different AVs (60°/s; 90°/s).

A one-dimensional pain scale (Visual-Analog Pain Scale [VAS]) was used to assess the intensity of pain in the lumbosacral part of the spine. The result is based on a self-assessment of the current pain intensity, which the subject records with a mark on a 10 cm line. The higher this value, the greater the pain intensity perceived by the patient. The results obtained can be used to monitor pain progression, but also to compare pain intensity in different patients (22).

A questionnaire (bath ankylosing spondylitis functional index [BASFI]) was used to measure functional abilities. The questionnaire consists of ten questions related to functional limitations due to structural changes in the musculoskeletal system. The answer to each question is marked with a cross on a 10 cm line. The left side of the line indicates no pain, while the right side of the line indicates intolerable pain. To obtain the overall result, that is, the BASF index, the average of all ten values obtained must be calculated. A higher BASFI index means a higher functional deficit in the patients (26).

A Cybex isokinetic device (HumacNorm 2009 model) was used to measure trunk muscle strength. The strength of the trunk flexor and trunk extensor muscles is expressed by the peak torque (PT) at AV (60°/s and 90°/s). The test was performed according to the protocol prescribed in the Cybex manual (27). The strength test at AV 60°/s begins with three submaximal repetitions followed by four maximal contractions of the trunk flexion and trunk extension. After a 2-min rest, the same test protocol is performed, but at AV 90°/s. The device automatically generates the results of the individual test subjects, which are stored directly on the computer. The highest recorded value of the PT was used for the analysis. The highest PT value obtained indicates greater strength of the individual trunk muscles.

Both groups performed other physical procedures (electrotherapy and hydrokinesitherapy) in exactly the same way. The electrotherapy consisted of the application of transcutaneous electroneutral stimulation in the area of the lumbosacral spine, whereby the strength of the stimulation

was dosed according to the subjective sensation of the subjects. Hydrokinesitherapy took place in a physiotherapy pool with warm seawater (32-34°C). The exercises in the pool were designed to involve all muscle groups of the body, with an emphasis on stretching and strengthening the trunk muscles (paravertebral and abdominal muscles), equally in both groups. The therapy was performed once a day in the morning. The subjects performed a total of 15 physiotherapy interventions over a period of 3 weeks. One physiotherapy intervention lasted 1 h and 20 min (30 min of exercises, 30 min of hydrokinesitherapy, and 20 min of electrotherapy) for both groups.

The group participating in the SP exercise performed isometric and isotonic contractions of the trunk muscles (flexors/extensors) in the supine position on the abdomen and back and in the quadruped position. Each exercise consisted of 10 repetitions with a break of 10 s between repetitions. Ten exercises were performed in the supine position, eight exercises in the pushed-through position, and three exercises in the quadruped position. A total of 21 exercises were performed in 1 day, that is, 210 contractions of the flexors and extensors of the trunk.

Another group performing IP exercises performed isokinetic contractions of the trunk muscles (flexors/extensors) using an isokinetic device (Cybex, HumacNorm 2009 model). The exercises were performed in a standardized standing position with the correct fixation of the joints (knees, hips, and shoulders), which do not participate in the movement. One IE consisted of: 4 × 10 repetitions at AV 120°/s; 4 × 8 repetitions at AV 90°/s; 4 × 6 repetitions at AV 60°/s; 4 × 4 repetitions at AV 30°/s; 4 × 6 repetitions at AV 60°/s; 4 × 8 repetitions at AV 90°/s; 4 × 10 repetitions at AV 120°/s. The subjects performed maximal concentric/concentric contractions of the flexors and extensors of the trunk with 20 s rest between one repetition and 30 s rest between the velocity changes. In total, they performed 208 contractions of the flexors and extensors of the trunk in 1 day. The pauses and the number of repetitions were saved in the computer software and started automatically, and the test subject was guided through the exercise with acoustic and visual instructions.

The difference in the number of exercises between the groups is due to the fact that it is not possible to completely harmonize the number of exercises, as the number of repetitions in IEs changes depending on the recommendation.

The collected data were analyzed using the program IBM's SPSS Statistics version 26. The median test and the Chi-square test were used to test the significance of the differences between two independent groups, and the Friedman test was used to test the differences between more than two dependent samples, when they found significant differences, the Wilcoxon test to test the differences between each pair of measurements. Values < (p = 0.05) were considered significant differences. In addition to testing the significance of differences between groups and differences between measurements within each group, effect sizes (Cohen's d) were also calculated, which in the case of small samples are better indicators of the clinical relevance of the results obtained, since significance in the usual tests for differences is highly dependent on the number of subjects. The usual interpretation methods for Cohen's d were used, that is, the effects are considered very small or practically absent if the value is <0.20, moderate if they are between 0.20 and 0.50, and large if they are more than 0.50 or more than 0.80. These effects are calculated using free online programs. When differences between two independent groups were examined, the effect size calculator (Cohen's D) was used for the t-test (28), and the effect size calculator (29) was used to test differences between the same samples on different measurements.

RESULTS

The demographic characteristics of the subjects can be found in Table 1. The median test showed no differences between the groups in terms of age (z = 1; p > 0.32), and the Chi–square test that they did not differ in terms of gender (hi = 0.00; p = 1.0) and the study could proceed.

At the third measurement, a statistically significant difference in pain intensity was found between the two groups (p < 0.05). In this regard, the group included in the IP showed lower pain intensity than the other group 6 weeks after the end of therapy. Calculations of the magnitude of the effects show that for pain intensity in the second measurement, the magnitude of the effect reached a moderate level where pain intensity was lower in the SP group than in the IP group. In the third measurement, this effect is large, and it can be seen that the group that performed the IP had lower pain intensity than the group that was involved in SP. Thus, it can be said that the effect of SP is better directly and that the IP shows a better effect with delay (Table 2). Significance tests for the differences in the SP group confirmed no differences in pain intensity between the three measurements. However, additional calculations of the magnitude of the effects showed that there was a high effect between the first and second (Cohen's d = 1.12), a moderate effect between the first and third (Cohen's d = 0.40), and a moderate effect between the second and third pain intensity measurements (Cohen's d = 0.29). Here, pain intensity was lower in the second measurement than in the first measurement, lower in the third measurement than in the first measurement, and higher than in the second measurement. The differences in pain intensity between the three measurements in IP subjects are at the limit of

TABLE 1. Demographic characteristics of subjects

Variables	Isokinetic (n=8)	Standard (n=8)	In total
Age, years mean ±	46.13±13.88	36±7.93	41.06±12.10
Female n (%)	5 (62.5)	6 (75)	11 (68.8)
Male n (%)	3 (37.5)	2 (25)	5 (31.3)

TABLE 2. Descriptive statistical indicators of the VAS scale for both groups of participants and the extent of impact by three measurements

VAS	Isokinetic protocol		Standard protocol		COHEN's d
	M	SD	M	SD	
1st measurement	3.88	3.00	4.25	2.43	0.13
2nd measurement	3.00	1.19	2.25	1.91	**0.47**
3rd measurement	1.50	1.31	3.13	2.53	**0.81**

*all effects higher than 0.20 are marked in bold. Legend: VAS: The visual analog scale, M: Arithmetic mean, SD: Standard deviation, Cohen's d - effect size

statistical significance (p = 0.053). Therefore, the differences between each pair of pain measurements were also tested. This showed that there was a statistically significant difference in pain intensity between the second and third measurements (p = 0.016), that is, pain intensity was statistically significantly lower in the delayed measurement than in the measurement immediately after the end of therapy, while the differences between the first and second or first and third measurements were not confirmed. In addition, there was a moderate effect between the first and second (Cohens d = 0.28), a high effect between the first and third (Cohens d = 0.82), and a high effect between the second and third measurements (Cohens d = 1.26). Compared to the first measurement, which took place before the start of therapy, pain intensity decreased across all measurement points.

The calculations of the magnitude of the effects (Cohen's d) between the groups showed that in the second measurement PT, the effect is almost non-existent in the strength of the trunk flexors at AV 60°/s, but in the third measurement, this effect becomes moderate. Immediately after the therapy, there is no difference between the groups and the group that performed the IP with a delay achieved higher values than the other group. In the second measurement PT on the trunk flexors at AV 90°/s, the effect also reaches a moderate level, but in the third measurement, this effect is very small. The group that performed IP immediately after the end of therapy therefore achieved slightly better results than the group that participated in SP. Furthermore, the results show that for all PT measurements on the trunk extensors at AV 60°/s and 90°/s, the effect size is extremely small and it can be said that both groups are equal (Table 3).

No statistically significant differences in muscle strength improvement were found between three PT measurements on trunk flexors at AV 60°/s or 90°/s in participants in SP.

Additional calculations revealed that there was a moderate effect between the first and second (Cohen's d = 0.29), a moderate effect between the first and third (Cohen's d = 0.33), and a very small effect between the second and third measurements (Cohen's d = 0.10). Here, the strength is higher for the second and third measurements than for the first and the same for the second and third. For trunk flexors at AV 90°/s, the effect between the first and second measurement was extremely small (Cohen's d = 0.02), there was a moderate effect between the first and third measurement (Cohen's d = 0.68) and a moderate effect between the second and third measurement (Cohen's d = 0.51). Muscle strength is the same in the first and second measurements, while it is higher in the third measurement than in the previous two.

However, statistically significant intensity differences were found between the three measurements in trunk extensors strength at AV 60°/s (p = 0.002) and 90°/s (p = 0.005), so the differences between each pair of measurements were also tested. It was found that no statistically significant difference was obtained between the first and the second measurement of PT on trunk extensors at AV 60°/s, while this difference was statistically significant between the first and the third measurement (p = 0.012), as well as between the second and the third measurement (p = 0.017). The strength is higher for the third measurement than for the first and second measurements. Furthermore, trunk extensors strength at AV 90°/s, no statistically significant difference was found between the first and second measurement, while this difference was statistically significant between the first and third measurement (p = 0.012), as well as between the second and third measurement (p = 0.050). The magnitude is higher for the third measurement than for the first and second measurements. The calculation of the magnitude of the effects in trunk extensors on AV 60°/s also showed that there was a moderate effect between the first and second (Cohen's d = 0.31), a high effect between the first and third (Cohen's d = 2.05), and a high effect between the second and third measurements (Cohen's d = 1.19). Here, the strength is higher for the second measurement than for the first and higher for the third than for the first and second measurements. For trunk extensors strength at AV 90°/s, high effects were found between the first and second (Cohen's d = 0.71), between the first and third (Cohen's d = 2.20), and between the second and third measurements (Cohen's d = 0.83). The strength in the second measurement is higher than in the first measurement, and in the third measurement, it is higher than in the first and second measurements.

The results of testing the differences in muscle strength over three different measurement time points in the IP subjects showed no significant differences.

However, in the effect size was additionally calculated, moderate effects were found between the first and second (Cohen's d = 0.49), between the first and third (Cohen's d = 0.24), and between the second and third measurements (Cohen's d = 0.20) of trunk flexor muscle force at AV 60°/s. Here, the force in the second measurement is slightly lower than in the first measurement; in the third measurement, it is slightly lower than in the first measurement and higher than in the second measurement. For trunk flexor strength at AV 90°/s, there was a high effect between

TABLE 3. Descriptive statistical indicators of a PT of trunk flexion and extensions at angular velocity (AV) 60°/s and 90°/s in both groups of participants and the magnitude of the impact by three measurements

Variables	Exercise protocol				Cohen's d
	Isokinetic		Standard		
	M	SD	M	SD	
PT 60 FLEX 1	206.63	67.57	186.63	53.67	**0.33**
PT 60 FLEX 2	200.63	54.81	189.88	58.63	0.19
PT 60 FLEX 3	202.13	52.94	191.63	53.63	**0.20**
PT 90 FLEX 1	183.38	67.06	178.38	50.96	0.08
PT 90 FLEX 2	192.38	45.40	178.13	49.05	**0.30**
PT 90 FLEX 3	194.88	52.21	185.75	56.56	0.17
PT 60 EXT 1	181.00	98.93	179.38	52.89	0.02
PT 60 EXT 2	190.00	100.75	190.00	57.76	0
PT 60 EXT 3	203.75	105.24	216.38	61.01	0.15
PT 90 EXT 1	169.38	85.24	157.13	47.05	0.18
PT 90 EXT 2	177.12	98.92	175.13	56.46	0.02
PT 90 EXT 3	183.25	91.70	195.75	54.42	0.16

*all effects higher than 0.20 are marked in bold. Legend: PT: Peak torque value, 60/90 – angular velocity (AV), FLEX/EXT: Movement of the flexion/extension of the trunk, 1/2/3: Measurement points, 1 – before the start of therapy, 2 – immediately after the end of therapy, 3-6 weeks after the end of the therapy, M: Arithmetic mean, SD: Standard deviation, Cohen's d – effect size. PT: Peak torque

the first and second measurement (Cohen's d = 0.56), a moderate effect between the first and third measurement (Cohen's d = 0.48), and a moderate effect between the second and third measurement (Cohen's d = 0.21).

Thereby, the strength in the second measurement is higher than in the first measurement, and in the third measurement, it is higher than in the first and in the second measurement. In addition, there was no difference in trunk flexors strength at AV 60°/s, there was a moderate effect between the first and second (Cohen's d = 0.21), a moderate effect between the first and third (Cohen's d = 0.41), and a moderate effect between the second and third measurements (Cohen's d = 0.47). Here, the strength is higher for the second measurement than for the first measurement and higher for the third measurement than for the first and second measurements. In trunk extensors strength at AV 90°/s, it was shown that there is no effect between the first and second (Cohen's d = 0.13), a moderate effect between the first and third (Cohen's d = 0.25), and no effect between the second and third measurements (Cohen's d = 0.18). The strength is the same for the first and second and for the second and third measurements, and it is higher for the third than for the first.

Based on the results related to the level of dysfunction, it can be observed that the effect size was extremely small in the second measurement and small in the third measurement. In this regard, the group that performed the IP in a delayed manner showed a smaller functional deficit than the group that was included in the SP (Table 4). Differences in the magnitude of functional deficit by three measurements were also not confirmed. However, calculations of the magnitude of the effects showed that there was a high effect between the first and second (Cohen's d = 0.68), a high effect between the first and third (Cohen's d = 0.61), and a moderate effect between the second and third measurements (Cohen's d = 0.35). Here, the dysfunction is lower for the second measurement than for the first measurement, lower for the third measurement than for the first, and higher than for the second.

The results also show that the differences between the three measurements of dysfunction are statistically significant (p = 0.010). In addition, a statistically significant difference was found between the first and second measurements (p = 0.012), with the level of dysfunction immediately after therapy being statistically significantly lower than at baseline. The differences between the first and third and the second and third measurements were not found. In addition, there was a high effect between the first and second (Cohen's d = 1.32), a high effect between the first and third (Cohen's d = 0.64), and a moderate effect between the second and third measurements (Cohen's d = 0.25). Thereby, the dysfunction is lower in the second and third measurements than in the first measurement and higher in the third measurement than in the second measurement.

TABLE 4. Descriptive statistical indicators of the BASFI scale on both groups of participants and the size of the impact by three measurements

BASFI	Isokinetic protocol		Standard protocol		COHEN's d
	M	SD	M	SD	
1st measurement	3.01	1.80	2.70	1.74	0.17
2nd measurement	1.69	1.41	1.96	1.62	0.18
3rd measurement	1.96	1.57	2.27	1.59	**0.20**

*all effects higher than 0.20 are marked in bold. Legend: BASFI: The bath ankylozing spondylitis functional index, M: Arithmetic mean, SD: Standard deviation, Cohen's d - effect size

DISCUSSION

Six weeks after the end of treatment, subjects in the IP exercise group reported less pain. In this study, results were obtained indicating greater improvement in muscle strength in the IP group, but only in flexion movements. Interestingly, this group is better at AV 60°/s than SP delayed, while it is better at AV 90°/s direct. Immediately after the end of treatment, both groups were equal in terms of functionality, but at the delayed measurement, the IP group had a smaller functional deficit than the group that participated in SP.

The group included in the IP showed lower pain intensity than the other group 6 weeks after the end of therapy. The effect of physical therapy is often delayed in patients, and the benefits of physiotherapy interventions only become apparent after some time. In addition, isokinetics is carried out under controlled laboratory conditions and it is more likely that the desired muscle groups will be trained. Unwanted muscle groups are not strained, pain is reduced and the functional result is improved. As we stated at the beginning, pain is the symptom that leads to disability. Compared with the initial measurement pain intensity decreased across all measurement points, the results of this study are consistent with the studies of Nambi et al. (20) and Bueyuekvural Şen et al. (21), who confirmed an improvement in pain, a decrease in inflammatory scores, and functional abilities of the subjects in favor of group who exercised with IP after a 4-week therapy. Furthermore, a study conducted on patients with knee osteoarthritis showed that exercises on an isokinetic device 3 times a week for 8 weeks resulted in a significant reduction in pain and stiffness and an improvement in range of motion compared to standard exercises, while the difference in improvement in thigh muscle strength was not confirmed (13).

Results that were obtained indicated greater improvement in muscle strength in the IP group, but only in flexion movements. We assume that the reason for this is that the trunk flexors have a much larger physiological cross-section of muscles and a much larger studying lever. Furthermore, due to the nature of the disease and the formation of osteophytes on the spinous processes and surrounding structures of the spine, flexion is always easier and less painful to perform than extension. The group that performed the IP in a delayed manner showed a smaller functional deficit than the group that was included in the SP. Immediately after the therapy, there is no difference between the groups in muscle strength, and the delayed group that performed the IP achieves more values than the other group. Methodologically, the study by Sertpoyraz et al. (30) is very similar to ours. It was performed on subjects with chronic low back pain and showed that there was no difference between the group that exercised SP and the group that exercised IP 1 month after the end of therapy. In this study,

there was a linear reduction in pain and a linear improvement in flexor and extensor strength in both groups. The results of two studies conducted on 60 young football players aged 18-25 years with chronic back pain (18,19) are also confirmed by the results obtained. In these studies, participants were divided into three groups, one of which performed IE, the other performed trunk muscle strengthening exercises, and the control group did not exercise. It was found that the IE group showed a more significant improvement in musculature strength, and functional ability as well as a decrease in pain and inflammation indicators in the lumbar spine compared to the other groups. Reyes-Ferrada et al. (31) conducted a meta-analysis on the effect of isokinetics on low back pain and pointed out the insufficient number of studies. Isokinetics is cited as a newer method, but the benefits for core muscle strength and functional outcomes are visible, which is consistent with our research.

Studies comparing isokinetic and standard exercise protocols in patients with different diagnoses, such as chronic low back pain, knee osteoarthritis, and stroke, found no differences in efficacy (17,23,30,32,33). However, the authors note that IE is reliable and safe for patients and the therapy results in reduced pain and inflammation, improved muscle strength, mobility, range of motion, improved patient functioning, and quality of life.

For a long time, the main reason for not using IE was its poor availability (high cost of equipment) and the requirements for special training of personnel, but today, IE is increasingly being used. Such therapies are adapted to the modern trends of personalized medicine and are sought by every serious rehabilitation center in the world (15). Our study is the first to examine the effects of IE compared with SP exercises in patients with SpA receiving concomitant biologics therapy. If IP exercises are proven to reduce pain, which is a fundamental clinical sign of disability, the initially more expensive therapy would prove to be more cost-effective in the long run, as patients would not return to repeated therapies, which are a major burden on the healthcare system.

The main limitation of the study that influenced the results obtained is the small sample size, which was formed for several reasons. The first reason is the nature of the disease (relatively low incidence of the disease) and the subjects who participated in the study had to receive biological therapy. The third reason is that the COVID-19 epidemic was still ongoing and patients were afraid to participate in the study due to their underlying disease. The final reason is that the subjects had to agree to stay in the hospital for 3 weeks during rehabilitation, and for many of them it was difficult to reconcile this with their study and personal commitments.

The advantage of this study is a longitudinal design examining two different exercise programs in SpA and its comparative advantage related to the clinical application of the results and long-term financial benefit.

CONCLUSION

The pain is better in the IP group 6 weeks after the end of therapy. Immediately after completion of therapy, the two groups were equivalent in terms of functionality, but at the later measurement, the group that performed IP had a lower functional deficit than the group that participated in SP. This is the first clinical study of novel therapy of spondyloarthropathies on an isokinetic device and as such is of great importance both for practice and for the scientific literature.

FUNDING

This research received no external funding.

INSTITUTIONAL REVIEW BOARD STATEMENT

The study was conducted in accordance with the guidelines of the Declaration of Helsinki. It was approved by the Ethics Committee of the hospital (01-000-00-00-425/2018) and the Ethics Committee of the Faculty of Kinesiology in Zagreb (64/2019).

INFORMED CONSENT STATEMENT

Informed consent was obtained from all subjects involved in the study.

DATA AVAILABILITY STATEMENT

The data generated by this research and the protocol of exercises can be obtained from the corresponding author within reasonable requirements.

DECLARATION OF INTEREST

Authors declare no conflict of interest.

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