A Rehabilitation Program Recommendation for Patients with Juvenile Psoriatic Arthritis

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ABSTRACT
Background: Juvenile psoriatic arthritis has become a well-recognized subtype within the inflammatory arthritis of childhood. Fewer trials describing the outcomes of different rehabilitation regimens were identified. The aim of this study was to compare the effect of aerobic exercises to that of aerobic exercise combined to Narrowband Ultraviolet B in rehabilitation of patients with juvenile psoriatic arthritis.

Participants and Methods: Twenty two children with juvenile psoriatic arthritis whose ages ranged from 10 to 14 years were included in this study. They were randomly distributed into two groups; group I (n=11) received the aerobic exercises and group II (n=11) received aerobic exercises and narrowband ultraviolet B. Treatment frequency and duration for both groups was three times per week for two successive months. Evaluation of physical and psychosocial functioning by using Pediatric Quality of Life Inventory, aerobic capacity using 6-Minute Walk Test and psoriasis severity by Psoriasis Area and Severity Index was conducted pre-treatment and post-treatment (after 2 months).

Results: Physical functioning, psychosocial functioning and aerobic capacity scores revealed significant differences within both groups and between both groups in favor of group II (p < 0.05). Psoriatic severity scores indicated significant differences within group II and between both groups in favor of group II (p < 0.05).

Conclusion: It could be concluded that aerobic exercise combined to narrowband ultraviolet B is efficient in rehabilitation of patients with juvenile psoriatic arthritis.

1. INTRODUCTION
Juvenile idiopathic arthritis (JIA) is a common chronic rheumatic disease affecting children and adolescents. According to the clinical phenotype features of (JIA), seven subgroups have been identified and differentially diagnosed in some children by laboratory investigations such as rheumatoid factor. Juvenile Psoriatic Arthritis (JPsA) defined as one of those groups.
Juvenile psoriatic arthritis represents about 10% of all subtypes of JIA with higher tendencies to affect females. Approximately more than 50% of affected children indicate positive anti-nuclear antibodies (ANAs). Children with JPsA suffer from arthritis persisting more than six weeks prior to the age of sixteen with psoriatic rash, or at least two criteria of the following: psoriatic 1st degree relative, pitting of nails, dactylitis or onycholysis in case of absence of skin rash.

Psoriasis is a common chronic, with relapsing/remitting course, an immune-mediated systemic disease manifested by red, scaly skin patches, and usually itchy plaques. Severity of the lesion is variable; from mild local patches to complete coverage of the body. Plaque or vulgaris is the commonest type frequently affects the skin of the elbows and knees but may affect any areas as palm of hands and soles of feet. Fortunately psoriasis lesions are quiet visible and relatively easy to be assesses by Psoriasis Area and Severity Index (PASI). Severity of psoriasis might be categorized as in remission when PASI=0, mild when 0<PASI≤3, moderate when 3<PASI≤15, and sever when PASI>15.

Despite early medical treatment can alter joint inflammation; arthritis of juvenile onset often persists and experience physical, functional and psychosocial dysfunction and disability in adulthood in addition to its adverse effect on the development in childhood and adolescence stages.

Children and adolescent with JIA has been showed significant impairment of their aerobic capacity. It is also associated with deconditioning, hypo activity and other related problems. This reduced aerobic capacity could be precipitated by muscular dysfunction, cardiac output reduction and anemia.

Children’s physical, emotional, social and school functioning can be measured by Pediatric Quality of Life Inventory (PedsQL) that helps to attain scores through independent rating from the parents and their children. It also rates other relevant problems such as difficulties of daily living activities and pain levels.

Six minute walking test (6MWT) used to quantify the functional abilities. It can provide an indirect assessment of functional capacity during daily living activities; furthermore it could be used for follow up evaluation during treatment, and to measure the baseline cardiovascular function and walking abilities in people with low level fitness or who suffers from diseases.

Narrow band ultraviolet B (NB-UVB) is an effective therapy in treatment of psoriasis. A study of review suggested that NB-UVB tends to clear psoriasis reliably within few number of treatment sessions, and has a long term effect as well. It is often considered as first treatment option in management of psoriasis because of its easy administration. Narrowband ultraviolet B is more convenient and effective agent in treatment of psoriasis even in children and typically used when the psoriasis interferes with the functional capacity.

The aim of this study was to compare the effect of aerobic exercises to that of aerobic exercise combined to NB-UVB in rehabilitation of patients with juvenile psoriatic arthritis.

2. MATERIALS AND METHODS

2.1. Participants

Twenty two children, who were diagnosed as JPsA by the pediatric rheumatologist according to the definite Vancouver criteria, were included in this study. Their ages ranged from 10 to 14 years. They were recruited from the outpatient clinic of Collage of Applied Medical Sciences, Prince Sattam bin Abdul-Aziz University, King Khalid Hospital, and Prince Sultan Medical Center, Al-Kharj, Saudi Arabia. The work was carried out in accordance with the Code of Ethics of the World Medical Association (Declaration of Helsinki) for experiments involving humans and after the approval of the children and their families and the attainment of informed consent. Children were eligible if they had no musculoskeletal deformities, cardiac or chest problems. Their muscle strength at least grade 3. They had moderate to severe psoriasis (have more than 3% of their body affected) and they were able to follow treatment directions carefully.

After the fulfillment of eligibility criteria, the participants were randomly distributed into two groups of equal number. Group I included 11 children (4 boys and 7 girls) received an aerobic exercise program, and group II included 11 children (5 boys and 6 girls) received combined aerobic exercise program and NB-UVB.

2.2. Methods

2.2.1. For Evaluations

All children in both groups were assessed for physical and psychosocial functioning by PedsQL inventory, severity of psoriasis by PASI, and Aerobic capacity by 6MWT pre-treatment and post-treatment (after 2 months).

2.2.1.1. Pediatric Quality of Life Inventory

The PedsQL™4.0 generic core scale used to measure health-related quality of life (HRQOL) in children and adolescents ages 2–18 years. The PedsQL generic core scale consists of 23 items. It includes four subscales physical functioning (8 items), emotional functioning (5 items), social functioning (5 items), and school functioning (5 items). It gives contribution to 3 summary scores: total scale score (all subscales), physical functioning summary score (physical functioning scale only), and psychosocial functioning summary (emotional, social, and school functioning scales combined). All children rated the PedsQL inventory by themselves after detailed introductory explanation. The items were reverse scored and transformed.
linearly to a 0–100 scale so that the higher scores indicate improvement as follows: 0=100, 1=75, 2=50, 3=25, and 4=0. The physical functioning scores were calculated by dividing the sum item scores by the number of the answered items in this subscale. Whereas the sum of emotional, social and school functioning scores are divided by the number of answered item to calculate the psychosocial functioning score23.

2.2.1.2. Psoriasis Area and Severity Index

The PASI was used to calculate the extent and intensity of chronic psoriatic plaque separately for four regions (head, trunk, upper and lower limbs). Redness, thickness and scariness are rated on a 5-point scale with 0 for no symptoms, 1 slight, 2 moderate, 3 marked and 4 very marked lesions. The lesion scores for each region were added together to create 4 separate lesion score sum24,25. The percentage of involvement of each regions was assigned a numerical value of 0–6 with 0 indicating no lesion, 1 = 1–9%, 2 = 10–29%, 3 = 30–49%, 4 = 50–69%, 5 = 70–89% and 6 = 90–100% body surface area involvement. Then the subtotal score calculated by multiplying the lesion score sum for each region by the area score of this region. Each subtotal score multiplied by the amount of body surface area represented by this region (x 0.1 for head, x0.2 for upper body, x 0.3 for trunk, and x 0.4 for lower limbs). Finally, PASI score calculated by summing the scores of all the body regions. The PASI score varies from 0 to 72 and higher scores indicate severer conditions26.

2.2.1.3. Six-minute walk test

It is a test of sub-maximal aerobic capacity, in which the subjects walk as far as possible in 6 minutes (min) around a pre-measured distance. It is a useful assessment tool for children with chronic musculoskeletal conditions27. Prior to the test, familiarization session was conducted, on this session, the children practiced 6MWT. It was necessary that the children to ensure their comfort with the evaluation protocol. Children were allowed to walk on an unobstructed, rectangular pathway. The therapist followed closely with a stopwatch for safety and to measure the exact distance walked in 6 min. The walking course distance of 30 meters (m) between turning points (two cones) was used. Each child was instructed to cover as many laps of the course as possible in 6 min. without running or jogging28.

2.2.2. For Treatment

Group I: Patients of this group received an aerobic exercise program in the form of treadmill training for 20 minutes, three times per week for two successive months. Treadmill (h/p/cosmos®, German) was used. It has surface areas 150 x 50 cm (59.0 x 19.7 inches) that allowed speed starting from 0.1 up to 22 km/h. The treadmill has adjustable handrails on both sides and adequate safety attachments (pull cord safety stop actuator, chest-belt/harness, and emergency stop button). First, the investigator was explained the procedure of aerobic training and the precautions necessary for safety to the children. Next, the children began the aerobic training that formed of 5 min warming up involving slow walking on the treadmill. Then, comfortable self-guided speed was selected for each child for 10 minutes. Finally, cooling down for 5 min. involving slow walking on the treadmill was performed29. During the training, the children were instructed to stop the training immediately if they felt pain, dyspnea or syncope30.

Group II: Patients of this group received the same aerobic exercise program given to group I with the same treatment duration and frequency in addition to the NB-UVB. Narrowband ultraviolet cabinet (Daavin, Spectra 311, USA) was used. It is a small unit with an operational platform that enables the therapist to elevate the patient to the level of 24 UV lamps (Phillips TL 100W/01). It emits a continuous spectrum of NB-UVB radiation (311nm) which allows whole body treatment at once. It also contains a dosimetry system which measures energy output in real time as the treatment is progressing.

Minimal Erythema Dose (MED) testing at 8 separate doses occasionally at different area was conducted31. Children of this group were instructed to apply a thin layer of mineral oil at the area of lesion at night and wash it off at the morning before the NB-UVB treatment. Also, sunscreen is applied to the neck, lips, pigmented areas and the dorsum of the hand and the genital organs were heavily dressed. Then, each patient is asked to stand undressed in the NB-UVB cabinet for the session planned time. Ultraviolet exposure started with 50% of MED and dose gradually increased by 10% regardless of skin type. The treatment duration started with 10 seconds and increased by 10 more seconds to maximum irradiation time by the end of the program for 4 min32. According erythema reaction to previous treatments, if mild erythema reported, the irradiation dose was held constant for the subsequent treatment, or until resolution of symptoms. If symptomatic erythema or blistering developed, the dose was decreased to that of the previous session33.

2.3. Statistical analysis

Descriptive statistics (mean and standard deviation) were computed for all data. Paired t-test was conducted to compare the mean differences of the outcome measures within both groups. Independent t-test was conducted to compare the mean differences of the outcome measures between both groups. The level of significance for all statistical tests was set at p < 0.05. All statistical analysis were performed through the use of Statistical Package for Social Sciences (SPSS) version 20.

3. RESULTS

3.1. Participant’s characteristics

Table 1 presented the means: SD of age, weight, and height for both groups. Characteristics of both groups were matched at the baseline. No significant differences were recorded (p>0.05).
Table 1: Participant’s characteristics

<table>
<thead>
<tr>
<th></th>
<th>Group I</th>
<th>Group II</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex(M:F)</td>
<td>4:7</td>
<td>5:6</td>
<td></td>
</tr>
<tr>
<td>Age(yrs)</td>
<td>13.09±1.21</td>
<td>12.18±1.60</td>
<td>0.283</td>
</tr>
<tr>
<td>Weight(kg)</td>
<td>37.81±3.09</td>
<td>40.09±3.44</td>
<td>0.119</td>
</tr>
<tr>
<td>Height(cm)</td>
<td>138.18±5.52</td>
<td>134.45±6.02</td>
<td>0.146</td>
</tr>
</tbody>
</table>

Data were expressed as mean ± SD. Years (yrs); M: Male; F: female; Kilogram (kg) and Centimeter (cm).

Table 2: Physical and psychosocial functioning of both groups.

<table>
<thead>
<tr>
<th></th>
<th>Group I Mean ± SD</th>
<th>Group II Mean ± SD</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical functioning</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre</td>
<td>52.84±10.87</td>
<td>51.70±11.97</td>
<td>0.818</td>
</tr>
<tr>
<td>Post</td>
<td>64.49±11.88</td>
<td>74.14±7.79</td>
<td>0.036</td>
</tr>
<tr>
<td>p-value</td>
<td>0.029</td>
<td>0.006</td>
<td></td>
</tr>
<tr>
<td>Psychosocial</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre</td>
<td>48.03±3.23</td>
<td>50.30±4.20</td>
<td>0.171</td>
</tr>
<tr>
<td>Post</td>
<td>51.96±5.77</td>
<td>59.69±7.68</td>
<td>0.015</td>
</tr>
<tr>
<td>p-value</td>
<td>0.025</td>
<td>0.001</td>
<td></td>
</tr>
</tbody>
</table>

Data were expressed as mean ± SD* Significant at p < 0.05

Table 3: Psoriasis Area and Severity Index scores of both groups.

<table>
<thead>
<tr>
<th></th>
<th>Group I Mean ± SD</th>
<th>Group II Mean ± SD</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Psoriasis area and</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>severity index</td>
<td>18.12±9.03</td>
<td>16.00±7.02</td>
<td>0.546</td>
</tr>
<tr>
<td>Pre</td>
<td>16.04±6.86</td>
<td>10.74±4.20</td>
<td>0.040</td>
</tr>
<tr>
<td>p-value</td>
<td>0.206</td>
<td>0.002</td>
<td></td>
</tr>
</tbody>
</table>

Data were expressed as mean ± SD* Significant at p < 0.05

Table 4: Six minute walk test of both groups.

<table>
<thead>
<tr>
<th></th>
<th>Group I Mean ± SD</th>
<th>Group II Mean ± SD</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>6MWT scores</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre</td>
<td>455.45±68.79</td>
<td>464.45±75.59</td>
<td>0.773</td>
</tr>
<tr>
<td>Post</td>
<td>530.09±95.17</td>
<td>619.81±89.90</td>
<td>0.034</td>
</tr>
<tr>
<td>p-value</td>
<td>0.022</td>
<td>0.001</td>
<td></td>
</tr>
</tbody>
</table>

Data were expressed as mean ± SD* Significant at p < 0.05

3.2. Physical and psychosocial function

Physical functioning: As presented in table 2, there were no significant differences in the pre-treatment mean values between both groups (p>0.05). Significant differences between pre and post treatment mean values were recorded within each group (p<0.05). Significant differences of the post treatment mean values between both groups in favor of group II were recorded (p<0.05).

Psychosocial functioning: As presented in table 2, no significant differences were recorded between both groups (p>0.05) pre-treatment. Significant differences were recorded within both groups (p<0.05). Significant differences in favor of group II were noticed post-treatment (p<0.05).

3.3. Psoriasis Area and Severity Index

As presented in table 3, no significant differences pre-treatment (p>0.05), no significant differences within group I were identified (p>0.05) (fig. 1). Significant differences within group II were observed (p<0.05) (fig. 2). Finally post treatment significant differences between both groups were perceived in favor of group II.

3.4. 6-Minute Walk Test

As presented in table 4, there were no significant differences between both groups pre-treatment (p>0.05). Significant differences were recorded within each group (p<0.05). Post treatment comparison between both groups revealed significant differences of physical functioning (p<0.05) in favor of group II.
4. DISCUSSION

Juvenile idiopathic arthritis is a diagnosis that involves all chronic arthropathies of childhood onset; it has many subtypes including psoriatic arthritis juvenile onset. It has been well known that children with idiopathic arthritis may show functional limitation due to effusion, joint destruction or limitation of joint mobility. However studies reporting the role of physical therapy programs that addresses treatment for both arthritis and psoriasis simultaneously are very limited. So, the aim of this study was to compare the effect of aerobic exercises to that of aerobic exercise combined to NB-UVB in rehabilitation of patients with juvenile psoriatic arthritis.

This study conducted on children aged from 10 to 14 years that was consistent with the previous series of clinical studies. It is noted that the mean age of onset of JPsA about 10–12 years of age. Furthermore the psoriasis may proceed or follow the onset of arthritis or within the subsequent years with a peak onset of psoriasis between 5 and 15 years.

In this study, the measuring variables showed no significant differences in between both groups at the baseline (P> 0.05). All measuring variable showed significant improvement within both groups except for the PASI scores that showed no significant improvement within group I but significant improvement within group II was recorded. Also the results of the study demonstrated that group II who received aerobic exercise program in addition to NB-UVB showed more improvement than group I in the measured clinical parameters based on the increase in physical health, psychosocial health and aerobic capacity scores, and the decrease in the PASI scores.

This findings of the physical functioning scores comes in agreement with the findings of another study concluded that structured low intensity aerobic training programs do not aggravate joint arthritis but can lead to improvement of functional abilities and quality of life in children and adolescents with idiopathic arthritis. Also current evidence supports that physical activity could be beneficial in rehabilitation of children with idiopathic arthritis as it reduces pain, decreases the number of inflamed and swollen joints and improve aerobic endurance and bone health. Furthermore, engagement in an exercise program has the potential to improve immune function and help to reduce chronic inflammation. So we believed that the aerobic exercises effects such as reduction of pain, swelling and improvement of aerobic endurance were the contributing factors that resulted in improvement of the physical function. Increasingly, significant improvement in group II the effect NB-UVB when combined with aerobic exercises, Previous study confirmed that UVB can vastly improve the symptoms of pain and pruritus in psoriatic patients with relatively few short-term side-effects. So, such effects together with the previously mentioned effect of aerobic exercises may give rise to the significant improvement in group II.

Aerobic capacity is well known to be reduced in clinical remission and active disease in all subtypes of juvenile idiopathic arthritis in adolescents and young adults. Inactivity during active disease and lack of knowledge about the benefits of exercise and considering exercise as harmful to joints result in self-limited even during remission period, so the improvement of aerobic capacity demonstrated by 6MWT scores may be attributed to the effect of aerobic exercise which argued by a study reported that children trained with aerobic exercise tend to show higher levels of physical activities and aerobic fitness as indicated by maximum oxygen uptake (VO2 max). However significant improvement of aerobic capacity in group II is a consequence to alleviation of the symptoms and improvement of the physical function when NB-UVB combined to aerobic exercises.

The resolution of psoriatic inflammation and the improvement of PASI scores recorded in group II could be attributed to the effects of NB-UVB received by the group participants. It is a clinically effective therapy that helps to modulate the anti-
inflammatory pathway such as vitamin D, glucocorticoid and peroxisome proliferator-activated receptor, in addition to its molecular and gene modification involved in the keratinocyte. Narrowband UV-B results in a rapid depletion of cells that are implicated in the pathogenesis of psoriasis, including dermal and epidermal, lymphocytes, macrophages, and dendritic cells. Also, the findings came in accordance with the findings of laboratory studies: the UVB may have anti-inflammatory effect due to the release of neuropeptides from the skin into the circulation.

Regarding to the psychosocial functioning, they were more likely disrupted in children with chronic rheumatic illnesses. However, these children didn’t play as frequent as their healthy controls, they participate in fewer social activities with their families and friends than their peers. Moreover, the findings of previous studies reported that psoriatic patients are significantly affected in their general health perception and social functioning.

However the studies that report treatment effects on the psychosocial function in JpsA are very limited. We believed that the improvement within both groups could be attributed to the remission of the symptoms related to arthropathies as we have mentioned previously in concern to the physical functioning, consequently improvement in the psychosocial functioning may results. This perspective might be supported by a review study conducted by Biddle and Asare 2011 who concluded that physical activity is likely to have positive psychosocial outcomes. In addition physical activity can be associated with improved cognitive performance, classroom behavior, academic achievement in young people, and may enhance psychological well-being. Furthermore, the significant changes favouring the outcomes of group II may be related to alleviation of dermatological symptoms after combination of narrowband UVB and the aerobic exercise program. This could be explained by a previous study reported that the severity of psoriasis can influence psychosocial functioning: patients with mild psoriasis less bothered than those with severe lesion. So, improvement of psoriasis in addition to the positive effects of the aerobic exercises made the favouring psychosocial improvement of group II.

5. CONCLUSION

According to the obtained results of this study, it could be concluded that combination of aerobic exercises and NB-UVB offers important benefits and should be considered in rehabilitation of patients with juvenile psoriatic arthritis.

Conflict of Interests: Authors of this work declare that there is no conflict of interests regarding the publication of this paper.

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