Effect of Kinesio Taping On Balance in Children with Juvenile Idiopathic Arthritis

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Abstract: Purpose: To examine the effect of kinesio taping on balance in children with juvenile idiopathic arthritis. **Subjects and Methods:** Thirty children from both sexes with poly-articular JIA, affection in right ankle joint, they were divided in two equal groups control group received selected physical therapy program, study group received selected physical therapy program with kinesio taping. Mean of age was from 9.93±1.16 in control group, 9.86±1.07 in study group, body mass index was17 ±1.37 in control group, 17.74± 1.31 in study group. **Results:** there were decreased in pain and improve in balance in both groups with superior improvement in study group. **Conclusion:** kinesio tape was effective in decreasing pain and improving balance in children with juvenile idiopathic arthritis so that it can be added safely to physiotherapy program in ankle joint stability in JIA.
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Key Words: Kinesio taping, Juvenile idiopathic arthritis, Poly articular, Star excursion balance test.

1. Introduction

Juvenile rheumatoid arthritis is considered the most common type of rheumatoid arthritis in pediatrics population with prevalence approximately 1 per 1000. Juvenile idiopathic arthritis causes persistent joint pain, swelling and stiffness, A few kids may encounter side effects for just a couple of months, while others have side effects for whatever remains of their lives [1].

The causes of JIA is unknown, it's a disease in which the immune system launch attacks to healthy cells and tissues but seems to be related to both hereditary and ecological factors, which result in variations of the illness [2 & 3].

The signs and symptoms of JIA different from one child to another as he/she may limp especially in the morning or after a nap [4]. The most common features of JIA are: Joint contracture because limbs stays in a flexed position, causes tendons to tighten and shorten. Joint damage caused by prolonged inflammation that gradually destroys joint surfaces. Joint inflammation may distort growth as it accelerates or decelerates the growth centers in bones. Inflammation of the synovium lining of the joint causes heat, pain, swelling and stiffness. This can cause limitation in range of motion, joint tenderness and pain [5].

There are many type of JIA including oligoarticular which has two types (persistent and extended), it involves less than 5 joints in its first stages, affects about 50%of all children with JIA, Girls are more at risk than boys. Systemic onset affects about 10% of children with JIA, It starts with repeating fevers that can reach up to 103°F or higher, It can also leave a negative impact on vital organs such as the heart and liver. Polyarticular affects 5 joints or more, it affects large joints such as knee and ankle during the first 6 months and affect boys more than girls, its affect about 40% of all children with JIA [6].

Patients with JIA may have abnormal biomechanics, which increases chances of injury or prospect of articular cartilage damage. There are numerous factors that contribute to musculoskeletal changes such as delayed neuromuscular development, muscular weakness, ligamentous laxity, and generalized or localized growth disturbances [7]. Accordingly, a significant proportion of children with leg arthritis have impaired balance [8].

Foot problems in JIA were previously thought to be common. About 90% of the children with JIA presented with at least one foot problem due to structural or functional problems, such as synovitis, limited range of motion, malalignment and deformity [9 & 10].

In 1980, a new type of elastic tape called Kinesio Taping (KT) was invented by Kenzo Kase. KT is elastic, stretchable and Sensory motor stimulator, 3-5 days of constant use [11]. KT used in fields of physical therapy, pain improve, Facilitates healing process, foot problems, Is also being used in Pediatrics [12]. KT can improve joint function by stimulating the

proprioceptors within the joint by application over the ligaments and biomechanically supporting the joint [13].

The principle of the present study was to examine the effect of KT on ankle joint stability in children with JIA.

2. Subjects, Materials and Methods

Before starting the first assessment, caregivers were requested to sign a consent form if they accepted to let their children participate in this study. This consent has been accepted by the Ethical Committee of the Faculty of Physical Therapy, October 6 University, Egypt.

Setting:

The present study was conducted at the outpatient clinic of Faculty of Physical Therapy, October 6 University, Egypt.

Subjects:

Thirty children with polyarticular JIA with ages ranged from 8 to 12 years old from both sexes, selected from Abu- El-Rish Hospital. The children were included if they met the following criteria: The affected site is right ankle joint. All children suffering from mild to moderate balance problem. All children have morning stiffness at ankle joint. The children were excluded if they have ankle joint subluxation or\and skin problem or open wound in the region that will be applied by KT. The obese children also excluded [14]. They were divided into two groups of equal number, Group A (study group) and Group B (control group). Group A received a tailored designed exercise program with special focus on balance exercises in addition to kinesio taping, while Group B had the same exercise program. All children were diagnosed and referred by a specified Pediatrician; they also received the same medical treatment.

Procedures:

Outcome measures:

Outcome measures were recorded before and after the end of the exercise program in both control and study groups for the affected ankle joint. These were pain score which gained from Wong-Baker FACES Pain Scale and balance parameters which gained from The Star Excursion Balance Test (SEBT).

Evaluative procedures:

1) Pain Assessment:-

Wong-Baker FACES Pain Scale was used to illustrate pain intensity levels to the children, a person who feels happy indicates no pain (hurt) while a person who feels sad indicates that they are experiencing some or a lot of pain, Face 0 is very happy because he doesn't experience pain at all. Face 10 severe pain which lead to crying [15 & 16]. The child was asked to choose the face that best describes his pain from the scale.

2) **Balance assessment**

In order to detect reach deficits in the children, SEBT was used as it's functional, valid, easy to apply and cost effective [17]. The SEBT is a group of single-limb squats by the non-stance limb to reach a point along 1 of 8 designated lines on the floor. The lines were arranged in a grid **(Figure 1)** that extends from a center point and were 45° from one another. The reaching directions were named according to the stance limb as anterior, anteromedial, anterolateral, medial, lateral, posterior, posteromedial, and posterolateral. The goal of the task was to ensure that the individual establishes a stable base of support on the stance limb in the middle of the testing grid and maintain it through a maximal contact excursion in one of the given directions [18]. The patients were to stand on one limb then reach as far as they can while the distal portion of the reaching limb is along each given direction without shifting their weight. Then the distance was measured with a measuring tape (in/cm) from the center of SEBT to the point of the foot reach, and then the reaching limb was returned to the starting position [19].

Treatment procedures

1-Treatment for control group:

Patients of the control group received a selected physical therapy program for one hour per session, two times per week for three successive months in a form of:

A) Electrotherapy:

The ultrasonic (US) protocol consisted of continuous ultrasonic waves of 1 MHz frequency and power of 0.8 W/cm. The patients were placed in a supine position, and an acoustic gel that did not contain any pharmacologically active substance was applied. Ultrasound was used in circular movements with the probe at right angles to the medial and lateral parts of the ankle in to ensure greatest absorption of the energy. Each session lasted 5 minutes [20].

B) Stretching Exercises:

Passive stretching of the calf muscle was performed while the patient lied in a Supine position, the physiotherapist gently stretched the ankle into dorsiflexion.

C) Strengthening Exercises.

The first exercise involved using thera-band for resisted range of motion exercises. The band was placed around the top of the child's foot and curled the toes at the end of the movement to activate the internal muscles of the foot. The exercise consisted of 3 sets of 20 repetitions in each direction [21].

The second exercise focused on strengthening the ankle muscles *via* a calf raise. Calf raises were performed both seated and standing. The exercise consisted of 3 sets of 20 repetitions [21].

The third exercise was used to strengthen the ankle by performing **plyometric workouts in the**

form of Scissors hops and Standing Squat jumps. Plyometric training used jumping type movements to strengthen muscles and make them more explosive. Each exercise was done for 10 to 15 times.

Scissor Hops:

Begin in a lunge position. Jump and switch feet in mid-air landing with the opposite foot forward. [21]

Standing Squat Jumps:

Begin in a quarter squat positions. Jump from that position and land softly [21].

The fourth exercise included the use of Treadmill in an inclination mode for resistance [21].

D) Proprioception Exercises

***Mat exercises*:**

Exercise intensity was increased gradually, the child stood on one foot on a flat surface (matt) with eyes open (30 seconds), then stood on one foot on a flat surface with eyes closed (30 seconds), after that stood on one foot on a matt with eyes closed and moved his head from side to side (30 seconds) [22].

Balance board:

Proprioception was enhanced using a balance board, at the beginning the child may need to hold onto the wall until have gained a stronger sense, the exercise was performed for 30 seconds and repeated for 5-10 repetitions [22].

Figure (1): Assessment of balance by SEBT

2- Treatment for study group:

In this group patients received the previous selected physical therapy program while applying KT. Application of KT as shown in Fig (2).

Fig (2): Application of KT.

The child's foot was positioned initially at 90 degree.

- *Strip one:* **Anchor:** (0% stretch) full strip two inches above ankle. **Apply:** (50% stretch) tape down outer ankle, across bottom of heel. And up inner side of ankle. **Finish:** (0% stretch) lay last two inches without stretch.
- *Strip two:* **Anchor:** (0% stretch) full strip along instep of foot. **Apply:** (50% stretch) lay the tape around the back of the heel and across arch. **Finish:** (0% stretch) lay last two inches down without stretch on inside of foot.
- *Stripe three:* **Anchor:** (0% stretch) full strip along outside of foot. **Apply:** (50% stretch) lay tape around back of heel and across arch. **Finish:** (0% stretch) lay last two inches down without stretch on inside of foot. [23]

Statistical Analyses

All statistics were calculated by using the statistical package of social sciences (SPSS) version 23. Descriptive statistics (mean and standard deviation) were computed for all outcomes measures which are pain score and SEBT parameters. The significance level adopted was 0.05.

3. Results:

Descriptive statistics:

There were no significant differences between patient characteristics (age, weight, and height) between the two groups of the study before the program. Control group the mean age, height, weight and BMI of the subjects was 9.93±1.16 years, 139.33±2.42 cm, 33.38±2.12kg and 17.17±1.37 respectively as shown in table 1. For study group the mean age, height, weight and BMI of the subjects were 9.86±1.07 years, 139.2±1.91 cm, 34.48±2.16 kg and 17.74±1.31 respectively as shown in (**Table 1**) and **(Figure 3).** There were no significant differences in baseline characteristics of both groups (p>0.05). Both groups were homogenous.

Table (1): descriptive data for control and study group

Parameters	Control group	Study group	P value	SIG
Age	9.93±1.16	9.86±1.07	0.1	NS
Height	139.33±2.42	139.2±1.91	0.6	NS
Weight	33.38±2.12	34.48±2.16	0.2	NS
BMI	17.17±1.37	17.74±1.31	0.5	NS

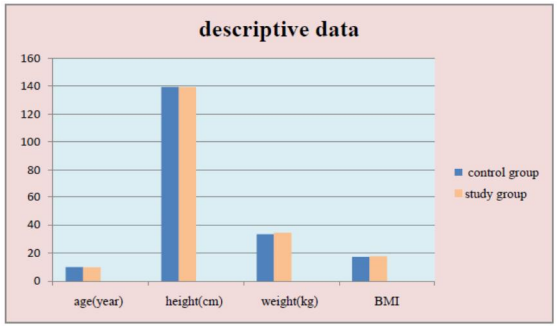

Fig (3): Descriptive data for study and control group

Table (2): Statistical analysis for pain intensity between control and study group pre- and post- the program

	Pre-program	**Post-program**
Control group	5.86 ± 1.30	3.46 ± 1.24
Study group	5.8 ± 1.32	3.26 ± 1.38
P value	0.7	0.03
Sig	NS	S

1- Pain:

Regarding within subjects differences in control group, there was a significant improvement in pain score between pre and post test. Also pain scores improved within the study group. While when comparing pain scores between the 2 groups at pre testing stage there were no significant differences between the 2 groups, however in post testing significant differences were found as shown in **Table 2 and Fig. 4**.

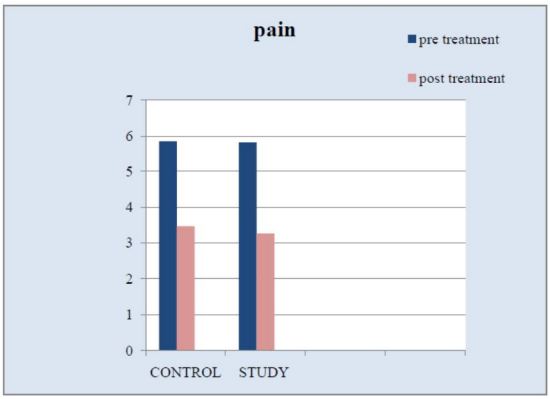

Fig (4): Pain pre and post treatment for study and control group

2- Balance parameters:

There were significant improvement of balance parameters between pre and post test within control group but there was no significant improvement in posterior, posteromedial and posterolateral directions. Also there were significant improvements of balance

parameters between pre and post test in the study group. When comparing between both groups, the results showed significant differences in favor of the study group as shown in tables 3, 4, 5.

Table (3): SEBT for Control group

	pre	post	P value	SIG
Medial	40±1.72	41.5±1.39	0.00687	**S**
Lateral	44.4±1.16	45.8±1.17	0.00135	**S**
Posterior	39.53±3.226	41.5±3.81	0.06631	**NS**
posterolateral	43±3.38	44.86±3.49	0.07456	**NS**
Posteromedial	29.53±1.06	30.2±1.40	0.07605	**NS**
Anterior	45.8±2.16	47.6±2.29	0.01741	**S**
Anterolateral	41.26±1.95	43.8±2.14	0.00099	**S**
Anteromedial	47.2±1.2	48.4±1.09	0.00377	**S**

Table (4): SEBT for Study group

	pre	post	P value	SIG
Medial	40.4±1.85	42.8±1.75	0.0052	**S**
Lateral	46.1±0.94	47.3±1.08	0.0014	**S**
Posterior	39.86±3.335	44.45±3.38	0.00042	**S**
posterolateral	43.46±2.80	47.6±2.84	0.0002	**S**
Posteromedial	30.13±2.03	31.7±1.11	0.0138	**S**
Anterior	45.46±1.68	49.93±2.28	0.00001	**S**
Anterolateral	40.73±2.05	45.53±1.45	0.00001	**S**
Anteromedial	47.6±1.29	50.8±1.3	0.00001	**S**

Table (5): Comparing post mean value of both groups:

	Post group I	Post group Π	P. value	SIG
Medial	40.8±1.39	42.8±1.75	0.0323	S
Lateral	45.4±1.17	47.3±1.08	0.0011	S
Posterior	41.5±3.81	44.45±3.38	0.0330	S
posterolateral	44.86±3.49	47.6±2.84	0.0256	S
Posteromedial	30.2±1.40	31.7±1.11	0.00174	S
Anterior	47.6±2.29	49.93±2.28	0.0093	S
Anterolateral	43.8±2.14	45.53±1.45	0.0150	S
Anteromedial	48.4±1.09	50.8±1.3	0.0001	S

4. Discussion

This study was conducted to investigate the effect of KT on ankle joint instability and pain in children with JIA. The results of this study showed that a three months program of combined kinesiotaping and physical therapy produced better improvement in pain and balance parameters compared with a three months program of physical therapy alone. Juvenile idiopathic arthritis (JIA), also well-known as juvenile rheumatoid arthritis (JRA), is the most widespread form of arthritis in children and adolescents and it is considered as a major cause of chronic disability [24]

Significant improvement was noted within groups for all measured variables (pain and balance parameters after three months of treatment) except posterior, posteromedial and posterolateral directions in the control group which showed no significant improvement. However, noticeable improvement was achieved in the study group rather than control group in all measured parameters.

Pain relief may be credited to the use of Ultrasound. And this came in agreement with Gould and Harry, 2007 [25] who stated that ultrasound therapy is an effective form of treatment for heel pain. It drives sound waves with a frequency of one million vibrations per second to the affected area. These waves move at a frequency of one million vibrations per second. They can go through over 2 inches into the body providing the targeted body section a relief of pain.

In the study group, improvement in pain level may be attributed to the use of kinesiotape and this come in agreement with Białoszewski D, 2009 who reported that KT was believed to alleviate pain, develop muscle function, eliminate lymph accumulating under the skin and improves proprioception. KT widens the gap between the skin

and muscle tissue leading to facilitated blood and lymph flow. KT is better tolerated by patients and can be worn for 1-3 days [26].

KT is proven to relieve pain by microscopically lifting the skin and thus improving lymphatic and blood circulation as well as relieving pressure and irritation of receptors [27]. Halseth, 2004 found that KT stimulates cutaneous mechanoreceptors at the taped area that affect the ROM also [28].

Improvement of balance may be due to pain relive, improvement in muscle strength and improvement in proprioceptive sense, these come in agreement with Muragod 2016, who stated that balance training exercises had better improvement than the progressive resistance training which was analyzed in terms of balance improvement, risk of falls and gait speed [29], but the non-significant improvement in posterior, posteromedial and posterolateral direction may indicate that we need to increase the duration of treatment as posterior direction improve later after anterior and sideways directions.

Superior improvement in the study group can be attributed to the use of KT which came in agreement with Mohamed et al 2016, who stated KT has superior effect than athletic tape in patients with first degree ankle sprain and can be used safely for improving ankle joint stability [30].

Also Murray and Husk, 2001, stated that once applying KT to the skin, the continual stretch on the skin itself is said to stimulate cutaneous mechanoreceptors that in turn send information to the central nervous system [31]. The enhanced feedback to the central nervous system is said to improve the ability of the neuromuscular system to control movement by improving joint position sense [32 & 33].

Also Fayson, 2013, found that KT may be used over a longer amount of time than traditional tape to aid in the prevention of ankle sprains [34].

Conclusion

KT was effective in decreasing pain and improving balance in children with JIA so that it can be added safely to physical therapy program in ankle joint stability in JIA.

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Conflict of Interest: None.

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