Hormozgan Medical Journal
Vol 20, No.6, Feb-Mar 2017
DOI:10.18869/acadpub.hmj.20.6.401.

The comparison effects of eight weeks spark and frenkel exercises on static and dynamic balance in the blinds

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(Received 26 Sep, 2016 Accepted 28 Feb, 2017)

Original Article

Abstract

Introduction: One of the most important human senses is vision, which its loss is causing many primary and secondary complications for physical and psychological health such as difficulties in static and dynamic balance. This study aimed to compare the effect of 8 weeks of Spark and Frenkel exercises training on the static and dynamic balance in blind people.

Methods: In this quasi-experimental study, 30 blind people with no other disabilities aged between 15 and 49 years old were randomly assigned to three groups of control (n=10), Spark (n=10) and Frenkel (n=10). At first, a pre-test of static balances and dynamic balance were performed for all three groups; Spark Group received Spark program exercises and Frenkel group received Frenkel exercises for two months, with no intervention for the control group. After two months, the required post-test exercise protocols were performed. Data were analyzed using SPSS 21. Paired t-test, ANOVA, and independent t-test were used to analyze the data.

Results: The results indicated that both Frenkel and Spark training programs had a significant effect on static and dynamic balance of the blind, but Frenkel exercises had a greater influence on the dynamic balance.

Conclusion: It seems that Frenkel and Spark training program are useful and effective methods to enhance static and dynamic balance in bilind people.

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Key words: Spark Exercise, Frenkel Exercises, Static Balance, Dynamic Balance, Blindness

Citation: Rajabi S, Goodarzi B, Mazidi M. The comparison effects of eight weeks spark and frenkel exercises on static and dynamic balance in the blinds. Hormozgan Medical Journal 2017;20(6):373-380.

Introduction:

Primitive societies were so unresponsive to the disabled as they could not live a long life and were destined to die young. In the middle ages, status of people with disabilities witnessed no significant change (1). Royalties paid attention to some of them as a mean to entertain them, finding their disabilities and weaknesses amusing. During Renaissance, when science and literature flourished, society's attitude towards the disabled changed a little but did not progress to the extent that their treatment, care, and education become important. From 1960 onwards, improvements in all fields occurred, including: education, personal rights of the

disabled, efforts to establish equality of opportunity in all areas, supporting the demands and needs of the disabled, passing new laws regarding the education for all the disabled, self-sufficiency and independence of responsibility and attitudes towards their employment (2). Among our five senses, vision is one of the most important ones. Vision loss may be associated with primary and secondary complications. Vision damage consequences that affect a person's physical and mental health are extensive and include: lack of independence, needing help with personal tasks, social isolation, lack of participation in social activities, difficulty inreading, loss of interest in activities, restlessness, impaired cognitive status and functional performance, increased dependence on others, little hope for the future, falling and fracture (3,4). The blind faces challenges related to education, employment, mobility, socialization, psycho-social growth, and all these tensions may affect the adjustment of the person (5). Blindness and visual impairment are two important health issues, with economic and social implications for developed and developing countries (6). Studies have shown that visual impairment affects a person's quality of life and reduce social activities and independence (7,8).

Because of problems caused by vision loss, one participates less in social activities and is more dependent on others. Dependence and the inability to recognize faces are barriers to social life experiences (9). One other factor influenced by visual impairment is the lack of balance. This study aimed to investigate the effect of 8 weeks of Spark and Frenkel workouts on static and dynamic balance of the blind.

Methods:

We performed an interventional field study on the blind community. The sample consisted of 30 visually impaired individuals aged 15-49 years.

Subjects was belong to both male and female and with no the lack of lower extremity injuries, neuromuscular disorders, pain, swelling, and limitation of movement. Subjects were randomly assigned to one of three groups: Control, Spark, Frenkel groups (10 subjects in each group). The exercises were performed for 8 weeks, three times per week, each session 45 minutes, under the supervision and support of a coach. The subjects in the Control group performed their everyday tasks without any intervention. Subjects did not use any medications, supplements, or alcohol and did not smoke. First of starting they were educate and received training packages. These packages included training booklets, training session's guides, an introduction for the test and the necessity of the test exercises for visually impaired. Before the trial, personal information forms were completed for each participant (name, age, gender, non-dominant foot, the group name and length of the leg), and were informed of the type and duration of the exercise. Then static and dynamic balance pre-tests were performed. Both groups were monitored during and after exercises, and at the end, a post-test was performed with the same condition as the pre-test. To measure the length of the legs, the subjects were asked to stand next to a wall without any footwear, and the length of legs was measured and recorded using a tape (10). Standing Stork Test with open and closed eyes were used to evaluate static balance. For this test, participants put their hands on their hips**,** while the sole of the dominant leg rest against the inner region of the knee of the non-dominant leg. The subject should keep this situation as much as he can by standing on the ball of the foot. If the non-dominant foot's heel touches the floor or hands are separated from the hips or the foot sole of the dominant leg released from the knee of the non-dominant foot, the effort ends. Each subject should do three trials with the intervals of 15 seconds for rest (and to omit the effects of learning). The stopwatch starts the moment the dominant leg is detached from the ground. The best time in three efforts were recorded as the score for each subjects. Star Excursion Balance Test (SEBT) was used to evaluate the dynamic balance (11).

The dynamic balance of the subjects was recorded as the ability to reach eight positions: anterior, anteromedial, anterolateral, medial, lateral, posterior, posteromedial and posterolateral. In this test, eight axes are drawn on the ground with an angle of 45 degrees between each two axes. In order to run this test and normalizing the data, foot length- the length of leg from the anterior superior iliac spine to interior ankle- was measured. Examiner explained how to do the test and then, each subject did six test runs to learn the method.

Before starting the test, dominant leg of the subjects was determined. If the right foot was the dominant limb, the test was done counter-clockwise and if left foot was dominant, the test was done in a clockwise direction. The subject was placed in the center on the dominant leg and with the other leg, tried to reach to eight directions without errors (error: moving the dominant foot from the center of the star, relying on the other foot at the place touching the line and falling). The distance between the free feet to the center of the star is defined as the reaching distance. Each subject tried each direction for three times and the mean values were calculated, divided by length of feet (cm) and then multiplied by 100 to achieve reaching distance as the percentage of the length of the leg.

Spark exercises

1. General warm-up: Since Spark exercises require physical activity, each subject had 5 minutes of warm-up including walking slowly, a few jumps, stretching the upper and the lower body; and one minute rest.
2. Performing specific movements that are explained in the exercise protocol.
3. Cool down: As in the first stage, they would perform some stretchesafter the specific exercises.

Spark training protocol

Spark training shown in table 1 (12).

Table 1. Movements

Skills	Main exercises and games
Dynamic balance	- Walking on straight lines and curves (up to 5 steps is sufficient) - Front roll (Preliminary) (Note that there is no obstacle in front of the person)
Static balance	- Trying to stand on one leg (one hand leaning against the wall and the other leg leaning into the inner region of the knee) - Angel
Axial movements	- Bending (with feet fixed and only the trunk is bent downward and the knees bent) - Twisting (fixed legs, only trunk rotates) - Turning (Trunk moves with legs in 4 main directions)

Table 2. Movement exercise

Skills	Main exercises and games
Walking	- Walking forward, backward, sideways (up to three steps is sufficient)
Jumping	- Jumping down and up (a 20 cm height for jumping down, but there is no need for an obstacle or elevation for jumping up, just perform it on the spot)
Skipping	- Hopping (with help the of an adult or resting a hand on the wall)
Sliding and slipping	- Slipping to the side and to the front (sit on the ground, then slide sideways and forward.)

Frenkel exercises(10)

Frenkel training protocol

Exercise in the supine position

* The patient lie down on the bed or floor, the first group of exercises includes:

1. Bend one leg at hip and knee with the foot flat on the bed in a smooth and coordinated manner. Now the movement is done in the reverse direction
2. The same movement as number 1, plus moving the foot closer to the body and then moving it in the opposite direction until the leg is not bent anymore
3. The same movement as number 1, just bending the knee half its domain
4. The same movement as number 1 halfway around and moving the thigh close and far.

Each exercise should be done 4 to 5 times on each leg alternately and slowly and ankles must be bent upward so that loose muscles of the shin are not stretched. In the next stage, both legs are moved together and gradually more intense training programs are added. Some examples are as follows:

1. Bend one leg at the hip and the knee with the heel raised from the bed. Now reverse the movement.
2. Bend one leg at the hip and the knee and place the heel of that leg on the knee of the opposite leg which is

extended. Now reverse the movement.

3. Bend one leg at the hip and the knee and place the heel of that leg on the knee of the opposite leg which is extended .Now slide the heel down the shin of the extended leg up to the ankle .Reverse the movement. Repeat the movement with the other leg.
4. Flex one leg at the hip and the knee and keep its heel on the knee of the other leg which is kept extended. Now bring the heel down and keep it on the bed by the side. Now extend the leg by sliding along the bed till heel reaches the middle of the tibia. Now place the heel on the tibia. Now bring the heel down and keep it on the bed by the side. Now extend the leg by sliding along the bed till the heel reaches the level of the ankle. Now place the heel on the ankle. Again bring the heel down and keep it on the bed by the side. Now complete the extension. Reverse the movement. Repeat with the other leg.
5. Bend one leg at the hip and the knee and place the heel of that leg on the knee of the opposite leg which is extended .Now slide the heel down the shin of the extended leg up to the ankle .Reverse the movement. Repeat the movement with the other leg.
6. The same exercise as number 5, except that the movement starts from the ankle moving towards the knee and back.
7. Using both legs simultaneously, bend the leg at the hip and the knee with the heel rose from the bed. Now reverse.
8. The same as number 7 but with a pause.
9. One leg (left leg for example) is bent, and the other leg moves away and bends, then bring the right leg to the left and extend both legs. Until the end of the exercise, heels do not come in contact with the bed.
10. One leg, for example, the left one bends, then extends as the right leg is bending, then bend the left leg again while the right leg extends. This training starts again with the right leg.
11. Bend the right leg at the hip and the knee and place the right heel on the knee of the left leg which is kept in extension. With the right heel in this position, the left leg is flexed. Reverse the movement. Repeat the exercise with the other leg.
12. Flex one leg at the hip and the knee and keep its heel on the knee of the other leg which is kept extended. Now extend the leg by sliding along the leg till heel reaches the middle of the tibia. Now place the heel on the tibia. Now extend the leg by sliding along the leg till the heel reaches the level of the ankle. Now place the heel on the ankle. During these movements, the other leg bends and extends. Repeat with the other leg.

Exercises in sitting position

* These exercises are not necessarily an advanced mode of the supine position and are significantly simpler than the advanced exercises of the supine position. These exercises should be done sitting on a chair or stool

1. Patient pulls his knees under the stool
2. Then bends the trunk forward.
3. He stands up by extending his hips and knees.
4. The patient is forced to touch the points marked on the ground with their feet.

Standing exercises

* These exercises are planned for retraining walking and should be done in a big area, preferably in an area where marking on the ground is possible

1. Walking sideways along the therapist: keeping the balance in this position is easier, because except for the strides, the patient does not have to put all his weight on one foot's toes. Patients alternatively walk with right and left

legs in half steps and therapist counts to three for every step.

For example, a half-step to right:

a) The patient put his right foot half-step forward on the ground.

b) Then passes his weight from the left to the right foot.

c) Bring the left foot to the right foot.

Then the patient walks with ¼ steps, then full steps and finally a combination of 3 steps. For example, ¾ steps to the right, ¼ steps to the left, then ½ steps to the right, and a full step to the left.

Strides are harder because toes are put down on the ground first,and since the heel is raised from the ground, the patient has a smaller supporting surface.

2. Walking forward

A full step, ½ step, ¼ step forward and alternately with each leg, and like the previous one by counting to three for each step.

Starting with the right leg, the heel is placed right at the front on the ground, then the weight is transferred to the right leg and left heel is lifted off the ground and eventually left foot is placed next to the right foot.

3. Walking back.

3. Walking from heel to toe

4. Walking on special bulging marks on the ground

5. Turning (axial turning done in stages)

6. Going up and down the stairs

In the first phase, the patient initially goes up one step and then he starts climbing the stairs like a normal person. Also, in the beginning, patient do the practice with someone's help, then does this without support

Results:

Physical characteristics of the subjects of this study are presented in the table below.

Kolmogorov-Smirnov test results show normal distribution of data in both groups. Twelve patients (40%) used the right leg as the non-dominantone (for support). None of the demographic data were significantly different in the Control, Spark and Frenkel groups.

After the intervention, there was 0.13, 1.27, and 0.14 seconds increase in the static balance in Spark, Frenkel, and Control groups, respectively. There was 0.96 and 2.83 units increase and 1.1 units decrease in the dynamic balance (star test) in Spark and Frenkel and Control groups, respectively. Changes in static balance and dynamic balance before and after the intervention in both groups were significantly different. The level of $P \leq 0.05$ was considered significant.

Table 3. General characteristics of subjects

Name of the group	Average age	Length of the leg
Control group	34	91.00
Spark Group	32	91.00
Frenkel Group	33	91.20

Table 4. Compare Dynamic balance and Static balance between and within group studies before and after interventions

Subject	Groups	Before	After	Within group test	Independent samples-t test
Static balance	**Control**	2.71±0.51	T=1.83 P=0.001	2.57±0.54	
	Spark	3.55±0.90	T=5.43 P=0.000	3.68±0.88	T=1.89 P=0.079
	Frenkel	3.48±1.02	T=4.86 P=0.001	4.75±1.56	
Between groups test		F=10.15 P=0.001			
Dynamic balance	**Control**	4.39±1.14	3.29±0.70	T=3.93 P=0.003	
	Spark	4.04±0.86	5±0.79	T=5.20 P=0.001	T=3.57 P=0.002
	Frenkel	4.42±1.33	7.25± 1.81	T=6.32 P=0.000	
Between groups test		F=26.62 P=0.000			

Conclusion:

The aim of this study was to compare the effect of 8 weeks of Spark and Frenkel training on static and dynamic balance of the visually impaired. Our results showed that after the intervention, there was 0.13, 1.27, and 0.14 seconds increase in the static balance in Spark, Frenkel, and Control groups, respectively. Also, we noticed 0.96 and 2.83 units increase and 1.1 units decrease in the dynamic balance (Star Test) in Spark and Frenkel and Control groups, respectively. Ghadiri (2014) studied the effect of Frenkel exercises on coordination and balance in elderly and concluded that the practice could improve coordination and balance in older men (13). Ghasemi et al. (2009) studied Frenkel exercise effects on ataxia, balance, daily activity and depression in patients with cerebellar ataxia caused by multiple sclerosis. They came to the conclusion that performing Frenkel exercise continuously (assuming stable conditions for patients) could result in an improvement in the indicators of ataxia, balance, ADL, and depression in patients with MS. But due to the disease process, the patient's condition will return to the original state if he stops exercising (1).

Alessandro Pin et al. (2011) evaluated the role of Frenkel exercise in rehabilitation after hemorrhagic stroke AVE with cerebellar involvement. The results showed a significant increase in terms of balance and coordination of functional activity with the inclusion of Frenkel exercises in the rehabilitation approach (14). Frenkel exercises would have a significant impact on improving people's balance and coordination. Salary et al. (2014) showed that core stability exercises significantly affect the balance of blind female athletes (15). Also, Lotfi (2014) with research on the blind community concluded that exercise can increase physical activity and physical self-concept in visually impaired (16). Given that visually impaired face many problems regarding maintaining their balance, and balance is one of the main necessary elements for performing everyday tasks, therefore, specific training should be used to solve these problems for blind people so that they can greatly improve their balance and their quality of life. As mentioned earlier, Spark and Frenkel training have great impacts on coordination and balance. In the present study, it was observed that Spark and Frenkel exercises can have an acceptable effect on static and dynamic balance. On the other hand, the effects of spark and Frenkel exercise in improving static balance were not significantly different (P=0.079) and both were almost equally effective. But Frenkel exercise training was more effective than Spark training on the dynamic balance of the blinds.

Balance training improves proprioception, as a result, Frenkel exercise could have more impressive result compared to Spark training because Frenkel exercises are more detailed and have simple to complicated stages while Spark program is more general. Frenkel exercises could improve the balance in patients and Frenkel has first used these exercises on tabesdorsalis patients with tremor, stature, and coordination disorders. Frenkel announced a series of general exercises used to treat other conditions. The purpose of these exercises is to stimulate voluntary movement control, using sensory mechanisms that have remained intact (especially visual, auditory and tactile mechanisms) to compensate for the loss of kinesthetic sense (17).

Therefore, the use of spark and Frenkel training exercises and especially Frenkel training would have a significant impact on static and dynamic balance and quality of life of the visually impaired

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مقایسه تأثیر ۸ هفته استفاده از تمرینات اسپارک و فرانکل بر تعادل ایستا و پویای نابینایان

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مجله پزشکی هرمزگان سال بیستم شماره ششم ۹۵ صفحات ۳۸۰-۳۷۳

چکیده

مقدمه: *حس بینایی علاوه بر مهمترین حس انسان، مهم ترین عامل ارتباط ما با جهان بیرون است و در برقراری تعادل آدمی و وضعیت فیزیکی وی موثر است که از دست دادن حس بینایی باعث عدم تعادل میگردد. این مطالعه با هدف بررسی تاثیر ۸ هفته استفاده از تمرینات اسپارک و فرانکل بر تعادل ایستا و پویا نابینایان انجام شده است.*

روش کار: *در این پژوهش تحقیق نیمه تجربی، ۳۰ نفر از معلولین نابینا بدون معلولیت دیگری در دامنه سنی ۱۵ تا ۴۹ سال به طور تصادفی در سه گروه کنترل (۱۰ نفر)، اسپارک (۱۰ نفر) و فرانکل (۱۰ نفر) قرار گرفتند. در ابتدا پیش آزمون از تعادل ایستا و تعادل پویا از هر سه گروه به عمل آمد، سپس گروه اسپارک، تحت تمرینات برنامه حرکتی اسپارک و گروه فرانکل تحت تمرینات فرانکل به مدت دو ماه قرار گرفته در حالی که گروه کنترل تحت تأثیر هیچ مداخله‌ای در این دو ماه قرار نگرفتند. پس از اتمام پروتکل‌های تمرینی مورد نظر پس آزمون به عمل آمد. از آمار توصیفی و آمار استنباطی جهت تحلیل داده‌ها استفاده شده است. برای تجزیه و تحلیل داده‌ها از آزمون تی همبسته و تی مستقل و آنالیز واریانس استفاده شد.*

نتایج: *نتایج نشان داد که تمرینات برنامه حرکتی اسپارک و تمرینات فرانکل تأثیر معنی‌داری بر تعادل ایستا و تعادل پویا نابینایان دارند ولی در قسمت تعادل پویا، تأثیرگذاری تمرینات فرانکل بیشتر است.*

نتیجه‌گیری: *نتایج تحقیق نشان داد تمرینات برنامه حرکتی اسپارک و تمرینات فرانکل می‌توانند به عنوان یک روش مؤثر و مفید جهت تقویت تعادل ایستا و تعادل پویای نابینایان مورد استفاده قرار گیرد.*

کلیدواژه‌ها: *تمرینات اسپارک، تمرینات فرانکل، تعادل ایستا، تعادل پویا، نابینایان*

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نوع مقاله: پژوهشی

دریافت مقاله: ۹۵/۷/۵ اصلاح نهایی: ۹۵/۱۲/۷ پذیرش مقاله: ۹۵/۱۲/۱۰

ارجاع: رجبی سیاوش، گودرزی بیژن، مزیدی مریم. مقایسه تأثیر ۸ هفته استفاده از تمرینات اسپارک و فرانکل بر تعادل ایستا و پویای نابینایان. مجله پزشکی هرمزگان ۱۳۹۵؛۲۰(۶): ۳۸۰-۳۷۳.