



International journal of basic and applied research

www.pragatipublication.com

ISSN 2249-3352 (P) 2278-0505 (E)

Cosmos Impact Factor-5.86

Effectiveness of Russian Currents versus Faradic Currents In Individuals with Flat Foot

Ruchi Vispute¹, Dr. Rhucha Jadhav-Rajapurkar², Dr. Tushar J Palekar³, Dr. Seema Saini⁴, Dr. Rucha Choudhari⁵

¹Intern, Department of Physiotherapy, Dr. D.Y.Patil College Of Physiotherapy, Pimpri, Pune 411018, Maharashtra, India.

²Assistant professor, Department of Physiotherapy, Dr. D.Y.Patil College Of Physiotherapy, Pimpri, Pune 411018, Maharashtra, India.

³Principal, Department of Physiotherapy, Dr. D.Y.Patil College Of Physiotherapy, Pimpri, Pune 411018, Maharashtra, India.

⁴Professor, Department of Physiotherapy, Dr. D.Y.Patil College Of Physiotherapy, Pimpri, Pune 411018, Maharashtra, India.

⁵Assistant professor, Department of Physiotherapy, Dr. D.Y.Patil College Of Physiotherapy, Pimpri, Pune 411018, Maharashtra, India.

Abstract

Background. Flat foot may exist as an isolated pathology or as part of a larger clinical entity. It may occur in up to 20% adults, many of whom are flexible and have no resulting difficulties. But as the condition progresses, it leads to various biomechanical alterations in posture and further deteriorates the quality of life of an individual. **Objectives.** The aim of this study was to determine the effectiveness of Russian currents versus Faradic currents in Individuals with Flat Foot. **Method.** The study performed was a Comparative Experimental Study involving 30 individuals aged 20-25 years with Flexible Flat Foot, 15 subjects in each group, Group A were given Russian currents followed by conventional exercises and Group B were given Faradic currents followed by conventional exercises from Dr. D. Y. Patil College of Physiotherapy, Pimpri, Pune. Flat Foot was assessed using Navicular Drop Test and Staheli's Arch Index was calculated prior the treatment. The intervention of treatment was for 5 days a week for 2 weeks. Post the treatment Staheli's Arch Index was calculated to check the difference. **Result.** The intergroup and intragroup significance was calculated using Unpaired t-test ($P=0.000$). The result of the study demonstrated both the study were effective in decreasing the arch index, but the Russian currents with conventional exercises were more effective in comparison. **Conclusion.** The study concluded that Russian currents as well as Faradic currents were beneficial to the individuals with flat foot, but in comparison between the two, Russian Currents were seen to be more beneficial to the individual.

Keywords: Flexible Flat Foot, Navicular Drop Test, Staheli's Index, Russian Currents, Faradic Currents.

840 | Received: 8 February Revised: 17 February Accepted: 24 February

Index in Cosmos

March 2019 Volume 9 Number 3

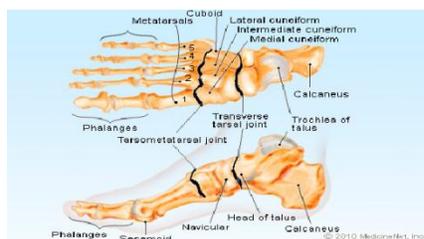
UGC Approved Journal



Introduction:

Flat feet also known as Pesplanus, is a foot deformity in which there is a reduction in the Medial longitudinal arch of the foot. The role of the arch is said to be influenced by the shape of the foot, bony structure, ligamentous stability and muscular fatigue while factors such as race, footwear, age gender are also found to be effect the formation of medial longitudinal arch.¹ The integrity of the arches is governed primarily by the ligamentous support with assistance from bony alignment and the additional support received from the extrinsic muscles of the foot. The plantar fascia, long and short plantar ligaments, the spring ligament, the collateral ligament of the ankle and the interosseous ligament of the subtalar joint; all contribute important soft tissue support to the arches of the foot.¹

Figure no.1:- Bony formation in normal foot



There are two types of flat foot deformities. The first type (Rigid or Congenital FlatFoot) is relatively rare. The second type is (Acquired or Flexible Flat Foot). In flexible flat foot, the subject's arch is maintained when not weight-bearing, but on weight-bearing, the foot pronates excessively and the arch structure collapses. In rigid flat foot, the subject's arch is flattened irrespective of the weight bearing position of the foot. Flexible flat foot can be occasionally painful with more specific complaints after intense exercises or long walks. The pain is diffuse in the feet and lower legs.²

Rigid type includes states in which Medial longitudinal arch has dropped regardless of bearing weight, while in flexible type of flat foot the Medial longitudinal arch is formed without bearing weight but disappears during weight bearing.³

Figure no.2:- Difference of arch in Normal foot vs Flat foot.





A Flat Foot is one in which the apex of the arch is not merely low but also shifted medially. Usually the head of Talus gets displaced medially and distal from the Navicular. As a result, the Spring Ligament and the tendon of the Tibialis Posterior muscle are stretched, so much that the individual with pesplanus loses the function of Medial Longitudinal Arch. A flexible pesplanus is caused due to dysfunction in Tibialis Posterior muscle. It is an extrinsic muscle of foot which helps in maintaining the medial longitudinal arch during dynamic weight bearing and balance. In addition, it provides foot adduction, supination and plantarflexion, assists in controlled flattening of the medial longitudinal arch through eccentric contractions during the stance phase in gait cycle.³

Physiotherapy management available for flat foot includes strengthening of the Intrinsic muscles such as Flexor digitorum brevis, Abductor hallucis and Abductor digiti minimi and Extrinsic muscles of foot such as Tibialis anterior, Tibialis posterior, Extensor hallucis longus, stretching of the Achilles tendon, taping and orthosis or use of wedge to correct the foot posture, mobilizing the bones of the midfoot and Faradic stimulation¹.

Figure no.3:- Difference of arch in Normal foot vs Flat foot.



Faradic currents are short duration interrupted direct current with a pulsed duration of 0.1-1ms and frequency of 50-100Hz, it is believed to be more effective in stimulating the muscles. These currents are always surged for treatment purposes to produce a near-normal tetanic like contraction and relaxation of muscle. The current is surged so that the intensity of successive impulses increases gradually, each impulse reaching a peak value greater than the preceding one.⁴

Russian currents is a high intensity current in rectangular burst frequency of 50 Hz which means each burst is of 10 ms duration and the duty cycle is 50%, therefore it is believed to be more comfortable and effective than pulsed current and evoke muscle contraction as it allows to penetrate the tissues with less discomfort. They are also been advocated for use in increasing muscle force.^{5,6}

Also foot strengthening exercises can be given in all age groups for extrinsic and intrinsic muscles as an extra intervention to develop the medial arch which includes:-

- 1) Curling of toes in inversion and eversion of foot.
- 2) Curling of toes against resistance.
- 3) Toes and heels on the ground and attempt to raise medial longitudinal arch.
- 4) Walking on inclined surfaces.
- 5) Inversion with resistance
- 6) Heel to Toe walking.^{3,7}



A study has shown that Russian currents have been effective in strengthening the muscles and also increasing their force. There is also a dearth of literature on faradic stimulation for the intrinsic muscles of foot. So, a comparative effect of these treatments on the strength of the foot muscles and the Staheli's Arch Index in individuals with flat foot should be done to find out which one is more effective and comparatively beneficial to the individual.

Materials & Methodology:-

The following study is a comparative experimental study conducted in Dr. D. Y. Patil college of Physiotherapy, Pimpri, Pune. The target population were the 30 individuals with flexible flat foot. The individuals were chosen with convenient sampling method. The inclusion criteria was individuals between the age group of 20-25 male and female both and individuals with flexible flat foot unilateral or bilateral. Individuals with fracture of lower limbs, soft tissue injury like sprain, any management received for flat foot and any neurological conditions of lower limb were excluded from the study. The materials required for the study were piece of cardboard paper, pencil, ruler, Russian current therapy, Faradic stimulator, Pad electrodes, Graph paper and Ink.

Procedure:-

Individuals with Flat Foot In D.Y.Patil college of Physiotherapy were screened using a screening form. 30 subjects were selected those who met the inclusion criteria and who were willing to undergo this study. All the subjects were informed about the purpose of the study and a written consent was obtained from each of them.

Subjects with bilateral or unilateral flat foot were included in this study.

Subjects were assessed before the treatment session with the following:-

1. Navicular Drop Test:- The test was done in which the subject was asked to sit on the chair with feet on ground and no weight bearing, the talus was kept in a neutral position by the therapist, the distance of the navicular tuberosity from the floor was measured. Then with the subject in standing position with full weight bearing and talus in neutral position, the navicular distance from the floor was measured. The difference between both the readings were recorded and a measurement more than 10mm was considered as flat feet.⁸ The Navicular Drop Test demonstrated an excellent reliability, with an inter-rater reliability of ICC= 0.73-0.99⁹

Figure no.4:- Navicular drop test

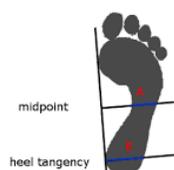




2. Staheli's Arch Index:-This was taken pre and post the treatment.

Figure no.5:- Staheli's Index

Plantar Arch Index = A/B



Subject were be randomly divided in to 2 groups using chit method. The Arch index was the main outcome measure. Outcome was recorded in the data collection form on Day 1 and was recorded again on Day 10 post treatment. **Group A** and **Group B**: Group A subjects (n=15) were treated with Russian currents and Conventional Exercises, Group B subjects(n=15) were treated with Faradic Currents and Conventional Exercises.

Group A: Group A weregiven Russian Currents for the foot following which they had to perform the conventional exercises. Currents are delivered in Rectangular bursts with a Burst frequency of 50 Hz. The electrode placement will be at Tibialis Posterior muscle. Treatment will be given for 10 mins.⁶

Figure no.6:- Treatment of Russian Currents.



Group B: Group B were given Faradic currents and conventional exercises. The placement of the electrodes will be, at Tibialis posterior muscle . The Galvanic setting will be zero. The Faradic setting will be determined by patient's tolerance and 30 contractions of 3 sets will be given.²



Figure no.7:- Treatment of Faradic Currents.



Post the treatment of both the groups subjects were said to perform conventional exercises which includes⁷:-

- 1)Curling of toes against resistance.
- 2)Toes and heels on the ground and attempt to raise medial longitudinal arch.
- 3) Strengthening exercises for tibialis posterior muscle.³

Figure no.8:- Strengthening of tibialis posterior muscle.



- 10 Repetitions of each exercise was performed. Treatment was given for 5 days a week for 2 weeks.

Evaluation of the collected data was done and tested statistically to draw a conclusion.



Outcome measures: Demographic data was collected and staheli's arch indexes was measured pre and post the 2 weeks intervention.

1. **Staheli's arch index:** A thin, large piece of sponge was placed in a box and diluted ink was poured. The sponge absorbs all the ink and when foot is placed, the ink sticks on the surface of foot. The foot was then immediately placed on a graph paper which the contralateral knee in flexion from 30° – 90° to obtain the print. For calculating the arch index, a tangential line was drawn connecting medial forefoot edge and heel region. The mean point of this line is calculated. From this point, a perpendicular line was drawn crossing the foot print. The same procedure was repeated for heel tangency point. The width of the central region of the foot print was considered as A and the width of the heel region was considered as B. The plantar arch index was obtained by dividing the A value by B value (PAI= A/B)¹⁰

The Arch Index demonstrated excellent reliability, with an intra class correlation of (ICC) 0.99 (95%CI, 0.97-0.99).²

Figure no.9:- Assesment of Staheli's Index Figure no.10:- Calculation of Staheli's Index



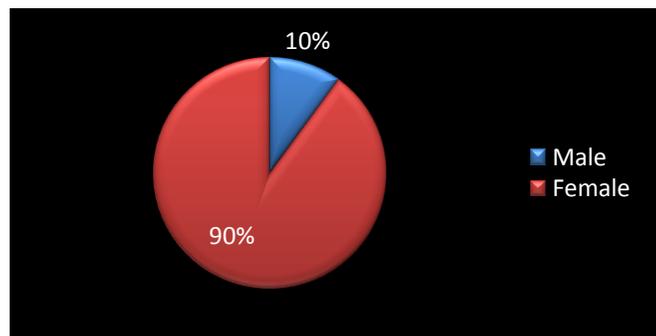


Data analysis and interpretation:-

Table 1:- Gender Distribution in sample size.

Gender	Male	Female
No. of people	3	27

Figure no.11:- Gender Distribution in sample size.

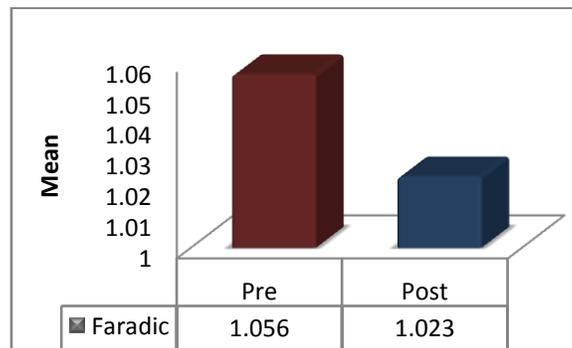


Interpretation: Out of 30 sample collected of individuals with flat foot, 03 of them i.e. 10% were Male and 27 i.e. 90% were Female.

Table 2:- Effect Of Faradic Currents On Pre And Post Treatment On Arch Index.

Type	Pre	Post	P value	T value
Mean	1.506	1.023	0.000	10.347

Figure no.12:- Effect of Faradic Currents on Pre and post treatment on Arch Index.



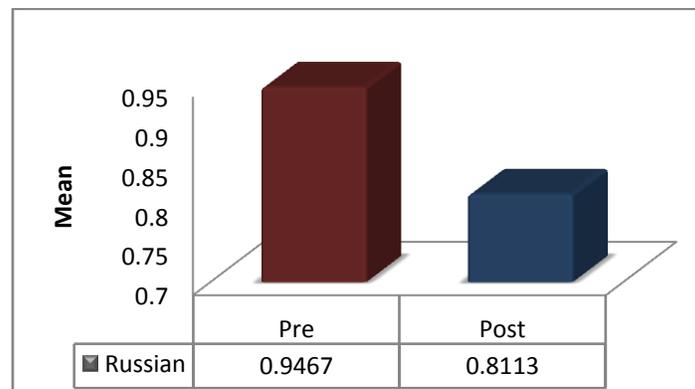


Interpretation: Figure no.12 shows that mean of arch index pre treatment was 1.056, later the post treatment of Faradic currents index was 1.023, which shows a mean difference of 0.033.

Table 3:- Effect of Russian Currents Pre and Post the Treatment on Arch Index.

Type	Pre	Post	P value	T value
Mean	0.9467	0.8113	0.000	9.736

Figure no.13:- Effect of Russian Currents Pre and Post the treatment on Arch Index.



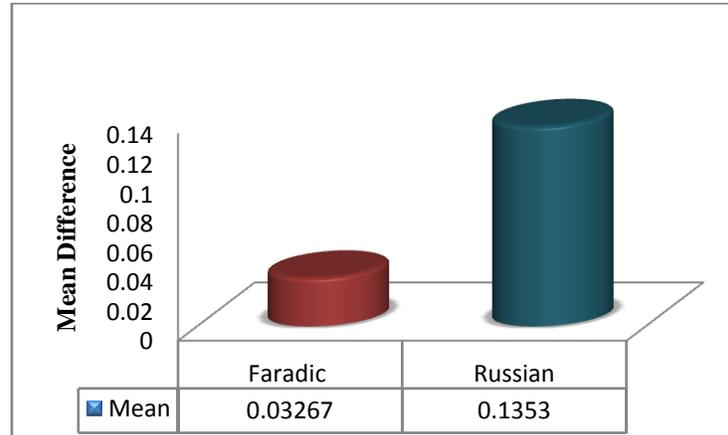
Interpretation: Figure no.13 shows that mean of arch index pre treatment was 0.9467, later the post treatment of Russian currents index was 0.8113, which shows a mean difference of 0.1354.

Table 4:- Comparison between Mean Difference of Faradic and Russian Currents on Arch Index.

Type of current	Faradic	Russian	P value	T value
Mean Difference	0.03267	0.1353	0.000	-7.203



Figure no.14:- Comparison between Mean Difference of Faradic and Russian Currents on Arch Index.

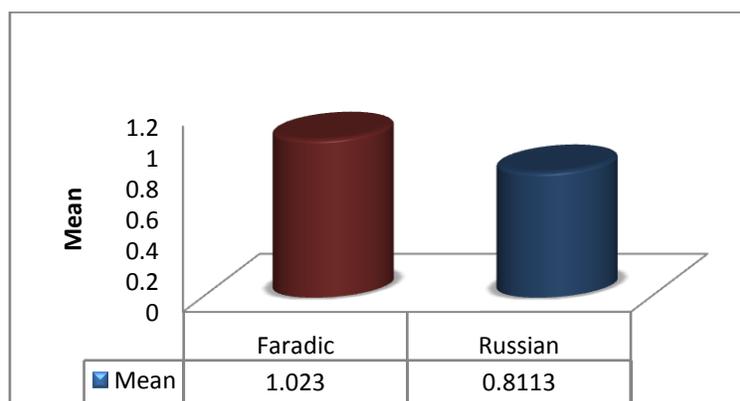


Interpretation: - Figure no.14 shows that mean difference of arch index in faradic current is 0.03267 whereas in Russian currents it is 0.1353. This indicates the effect of Russian current was more in decreasing the arch index in individuals with flat feet.

Table 5:- Comparison Between the Effects of Faradic versus Russian Currents on the Decrease of Arch Index.

Type of current	Faradic	Russian	P value	T value
Mean	1.023	0.8113	0.000	4.260

Figure no.15:- Comparison Between the Effects of Faradic versus Russian Currents on the Decrease of Arch Index.





Interpretation: Figure no.15 shows the comparison between the two currents post the treatment. It shows the effect of faradic current on the arch index was 1.023 and the effect of Russian current on the arch index was 0.8113. This shows that there was a significant decrease in the arch index post the treatment of Russian currents.

Results:-

As there were studies on effect of faradic currents and Russian currents to strengthen the muscles, this study was done to compare the effect of both the currents in flat foot. After the data analysis and interpretation, Results were obtained using the Primer application and statistics were done using the t-test and paired t-test.

The results of the study are as follows:-

Figure no.11 shows that out of 30 sample collected of individuals with flat foot, 03 of them i.e. 10% were Male and 27 i.e. 90% were female. This shows the study has dominantly female population.

Figure no.12 shows that the mean of arch index pre treatment was 1.056, later the post treatment of Faradic currents index was 1.023, which shows a mean difference of 0.033. Thus it shows a significant decrease in the arch index.

Figure no.13 shows that mean of arch index pre treatment was 0.9467, later the post treatment of Russian currents index was 0.8113, which shows a mean difference of 0.1354. Thus the treatment of Russian currents shows a significant decrease in the arch index post the treatment.

Figure no.14 shows that mean difference of arch index in faradic current is 0.03267 whereas in Russian currents it is 0.1353. This indicates the effect of Russian current was more in decreasing the arch index in individuals with flat feet.

Figure no.15 shows the comparison between the two currents post the treatment. It shows the effect of faradic current on the arch index was 1.023 and the effect of Russian current on the arch index was 0.8113. This shows that there was a significant decrease in the arch index post the treatment of Russian currents.

Thus through the result it is seen that the Russian current stimulation on the tibialis posterior muscle seem to be more effective than faradic current stimulation, and is statistically significant.

Discussion:-

The study was aimed to find the effectiveness of Russian currents versus Faradic currents in Individuals with Flat foot. An experimental study was carried out in 30 samples. In which there were 3 male and 27 females between the age group 20-25 years. The samples were divided in to two groups by chit method i.e. Group (for Faradic current) and Group B (for Russian current). The participants were examined with their prior permission after explaining the need of study. Participants from both



the group were assessed with the Navicular drop test and the Plantar arch index was calculated using the Staheli's Index prior the treatment. Participants in Group A were treated with Faradic currents following the conventional exercises. Those in Group B were treated with Russian currents following the conventional exercises. As the outcome measure was the Staheli's Index each individual was assessed on the 1st day i.e. pre intervention and on the 10th day i.e. post intervention and participants were intervened for 5 days a week for 2 weeks. TejashreeBhoir, Deepak Anap et al. (2014)¹¹ conducted a study on Prevalence of flat foot among 18-25 years old physiotherapy students in an Indian population. They concluded that prevalence of flat foot in a population of 18-25 years old physiotherapy students was 11.25% for all participants affected with bilateral flat foot.

The goal of this study was to see which current was more effective on the individual with flat foot. There were many studies showing the effect of faradic stimulation on flat foot and also the effect of Russian currents in strengthening the muscles, but the main reason for this study was that there was no comparison between these both currents to find which was more beneficial to the patient.

Faradic stimulation is used in our field in a very large scale to strengthen the muscles. It is also used to Facilitate the muscle contraction because the changes taking place within the muscle are similar to those associated with voluntary contraction, thus in this study the contraction of muscle Tibialis posterior is done as the dysfunction of the muscle causes a flexible Pesplanus. It is a low frequency pulsed current. The pulses originally produced were asymmetrical biphasic with a frequency of between 30 and 70Hz and a pulsed duration of 1ms.

As electrical stimulation is used extensively in physical therapy, and "Russian currents" have been advocated for use in the increase of muscle force. In this study, Russian currents were used to strengthen the Tibialis posterior muscle group as till now no study has identified use of this type of electrical stimulation in relation to improvement of arch index in individuals with flat foot. Electrical stimulation, however, recruits the fast-twitch, fast-fatigable motor units associated with sudden, rapid movement, precise motor control, and gracefulness of movement. Moreover electrical stimulation will be helpful for strengthening in those elderly who cannot voluntarily perform the exercise due to health problems.

The major outcome measure in this study was on the arch index which was calculated by Staheli's Index which has demonstrated an excellent reliability, with an intra class correlation of (ICC) 0.99 (95%CI, 0.97-0.99).

As the staheli's index was calculated manually, chances of error in the calculations are there, but maximum effort was done to minimize the error to get appropriate results.

Improvement observed was highly significant in both the groups post treatment. From the findings it could be suggested that the Tibialis Posterior muscle strength is an important component for maintaining the arch index. By strengthening the Tibialis posterior muscle can decrease the arch index and minimize the flat foot.



Post the treatment individuals in both the group were said to perform conventional exercises. A study was done on Effect of faradic stimulation vs. muscle strengthening exercises of foot in young individuals with flat foot by Dr. Siddhi S Tendulkar (2018)¹². In which it was concluded that the muscle strengthening exercises were more beneficial to the individuals.

In this study, it is seen that the effect of both the currents which are the Faradic currents as well as Russian currents is significant to decrease the arch index which means to increase the reduced arch in flat feet.

This also shows that the P value of mean in pre and post values of plantar arch index in the treatment of faradic currents is less than 0.05 which shows that it is statistically significant, in same case the p value of mean difference in pre and post values of plantar arch index in the treatment of Russian currents is also less than 0.05 which makes it statistically significant.

But in comparison with both the treatment Russian currents were more effective in the individuals with flexible flat foot. As Russian currents have a high significance in strengthening the muscles by stimulation in a burst frequency protocol, where the muscle get a period of relaxation and contraction at a regular interval and it makes the muscle less fatigable and due to which it gains a proper strength over a period of time.

Thus the arch index was majorly reduced by the treatment of Russian currents which makes it more beneficial for the patient in future. The reason of this is because Russian currents are applied in trains of burst with a '10/50/10' treatment application. The burst of current are applied for 10s followed by a 50s rest period and the stimulation is repeated for 10 minutes of treatment. Kots' original finding was that the '10/50/10' treatment regimen was needed to avoid muscle fatigue, thus he reported large strength gain as result of stimulation using this regimen.¹³

Conclusion:-

The study proves that the Faradic currents as well as the Russian currents were effective in decreasing the value of Plantar Arch Index which was calculated by Staheli's Index.

The study concluded that in comparison of both the currents, Russian currents showed a significant decrease in the value of arch index that is to increase the arch helping an individual to increase the strength of Tibialis Posterior muscle and minimize the flat feet.



References:-

1. SantoshMetgud, Charleend'Silvia, AnandHeggannavar.(July 2017). International Journal of Multidisciplinary Research and Development ,Vol 4.Effect of low dye taping and faradic foot bath in subjects with flat foot: A randomized clinical trial. 467-471.
2. VeerpretKaur, ParamjeetKaur, KavitaKaushal. (July 2018). IJSRVol 7; Issue 7.Effect of Faradic Foot Bath on Flexible Flat Foot.556-558.
3. Da-bee Lee, Jong-duk Choi.(2016). PhysTher Korea.23(4).The Effects of Foot Intrinsic Muscle and Tibialis Posterior Strengthening Exercise on Plantar Pressure and Dynamic Balance in Adults Flexible PesPlanus.27-37.
4. Forster and Pallastanga. (2005). Clayton's Electrotherapy Theory and Practice. Electrical Stimulation of Nerve and Muscle. 8th Edition. CBS Publishers. Delhi. 40-49
5. Amira Mahmoud Abd-Elmonem, RehmanHussein Diab, HazemAtyea Ali. (August 2015). Trends in Applied Science Research.Vol 10.Alteration of muscle function and mobility after Russian current stimulation in children with knee hemarthrosis.183-194.
6. Sonia Singh, N K Multani. (April 2013). Human Biology Review.Vol 2(2).Effect of Dorsiflexor Muscle Strengthening using Russian currents on Balance and Function in Elderly.176-184.
7. K Vadivelan, Ms. GowthamiKiyanduru. (June 2015). IJPHY.Vol 2(3). Comparison of foot taping versus custom-made medial arch support on pronated flatfoot in school going children. 491-501.
8. David J. Magee. (2014). Orthopedic Physical Assessment. Lower Leg, Ankle and Foot, Special Tests. 6th edition. Reed Elsevier India. Haryana. 929.
9. Julia Deng, Rita Joseph, Christopher Kevin.(2010). Journal of Student Physical Therapy Research. Vol 2. Reliability & Validity of the sit to stand Navicular drop test: Do static measure of Navicular height relate to dynamicNavicular motion during gait. 21-28.
10. Arnaldo Jose Hernandez, Luiz Koichi Kimura, Maros Henrique Laraya, EdimarFavaro. (2007). SciELO. Vol 15 no 2.Calculation of Staheli's Plantar Arch Index & Prevalence of Flat Feet: A study with 100 children aged 5-9years.
11. Miss. TejashreeBhoir, Dr. Deepak B. Anap, Dr. AbhijitDiwate. (September 2014). Indian Journal of Basic and Applied Medical Research.Vol 3; Issue-4. Prevalence of flat foot among 18-25 years old physiotherapy students: cross sectional study. 272-278.



International journal of basic and applied research

www.pragatipublication.com

ISSN 2249-3352 (P) 2278-0505 (E)

Cosmos Impact Factor-5.86

12. Dr. Siddhi S Tendulkar, Vaishali V Naik, Dr. Ujwal L Yeole. (2018). International Journal of Physical Education, Sports and Health.5(1).Effect of faradic stimulation vs. intrinsic muscle strengthening of foot in young individuals with flat feet. 135-138.
13. Val Robertson, Alex Ward, John Low, Ann Reed. (2010). Electrotherapy Explained: Principles and Practice. Type of Current and Implications of Different Parameters. 4th Edition. Reed Elsevier India. 103.
14. J.Taradaj, T.Halski, M.Ozon, J.Rajfur.(2013). Biomed Research International.The Effect of Neuromuscular Electrical Stimulation on Quadriceps Strength and Knee Function in Professional Soccer player: Return to Sport After ACL Reconstruction. 40-60.

Acknowledgement:-

I will sincerely like to express my gratitude to the Principal **Dr. Tushar J Palekar** Ph.D. and my Guide **Dr. Rhucha Rajapurkar** (PT) and my teachers for their guidance. I would also like to thank all the individuals who participated in my study for their co-operation in completion of my project.