

# To Compare the Effect of Eccentric Exercises and Isometric Exercises for Achilles Tendinitis in Skaters

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**Background:** Achilles tendinitis is one of the commonest injuries that happen to skaters. Roller skates traditionally have four wheels onto axles, one under the ball of the foot and one under the heel. Skaters have to maintain a closed kinematics chain which involves continuous trunk and hip flexion along with knee flexion and ankle dorsiflexion. It creates angular tension and strain in the muscles and tendons which can lead to different types of musculotendinous injuries. As not many studies has not been done on the prospect in India this study was done with a objective to compare the effect eccentric exercise and isometric exercise on Achilles tendinitis for skaters.

**Methods:** A Quasi-experimental study with 40 subjects of the age group between 15 and 25 was administered the VISA-A Questionnaire and VAS as outcome measures. A sample size of 40 was separated into two groups of 20 participants each into Group A (eccentric) and Group B (isometric). Pre-test and post-test were done using the VISA-A questionnaire and VAS Scale in the Study period- 4 weeks.

**Results:** There was a significant difference during the comparison between pre-test and post-test values ( $p < 0.005$ ) of isometric exercise and eccentric exercise by VISA-A questionnaire and VAS scale but there was insignificance during the comparison of post-test values ( $p > 0.005$ ) of the same.

**Conclusion:** The study concludes that there is a significant improvement in Achilles tendinitis when assessed with VISA-A questionnaire and VAS Scale for both the exercise; that is, eccentric and isometric, individually but it isn't statistically significant enough to choose one method of intervention over the other.

**Key Words:** Achilles tendinitis, Roller skaters, Inflammation, VAS, VISA-A, Eccentric exercise

## INTRODUCTION

Achilles tendon is one of the largest and the strongest tendon in the body. Achilles tendon is a tough band of fibrous tissue that connects the calf muscle to the calcaneus. When the calf muscle is flexed, the Achilles tendon pulls on the heel; this movement allows us to stand on our toes when walking, running or jumping [1]. Despite its strength the Achilles tendon is also vulnerable to injury due to its limited blood supply and high tensions placed on it. Achilles tendinitis is the inflammation of the Achilles tendon in recreational runners and athletes or any other sport whose training contains of large amount of running and jumping [2].

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Typical symptoms are morning stiffness and disabling pain especially after an activity, including swelling of the tendon and tenderness. It is often associated with impaired function that may prevent the skaters from pursuing their sport.

Over the past two decades training time and intensity of skating have increased in response to rising expectations with a likely increase in repetitive forces propagated through the lower limb [3], with risk of Achilles tendinitis. Furthermore although the foot is somewhat protected by the skating boot. It is maintained in slight plantar flexion this may cause tightening of the calf muscles which may be linked to Achilles tendinitis [4]. It can also be caused by some common training errors such as high intensity training, increasing the distance too soon, improper footwear.

Currently there is no research conducted directly to see the prevalence of Achilles tendinitis in skaters, as they need to maintain a closed kinematics chain which involves continuous trunk and hip flexion along with knee flexion and ankle dorsiflexion [5]. During a single stroke of skaters there are three different phases was distinguished: the glide, push off, repositioning phase [6]. While taking strokes they have to go through alternate hip abduction. After a few stroke they go into gliding push off phase, which increases knee flexion angle. It creates angular tension and strain in the muscles and tendons which can lead to different type's musculotendinous and musculoskeletal injuries. There are two types of exercises given commonly for Achilles tendinitis - Eccentric and Isometric. There have been many studies conducted to prove the effectiveness of these two types of exercises individually, but no studies have compared their effectiveness over each other. Hence this study is done to compare the effectiveness of eccentric exercises and Isometric exercises for Achilles tendinitis in skaters.

Current research indicates that eccentric exercise is an effective form of treatment for lower extremity tendinitis [7]. Exercises that load the tendon are promoted as being beneficial for tendinitis with isolated exercises receiving the most attention. Eccentric exercise may produce better outcomes than some treatment, such as splinting, non-thermal ultrasound, and friction massage, and be most effective during a respite from activity-related loading [8]. It is also recommended that clinicians follow the eccentric exercise protocol devised by Alfredson et al. and have patients rest for 4 to

6 weeks for optimal reduction of tendinitis symptoms [9].

Isometric exercises are one of the best ways to reduce tendon pain, speed up recovery, and prevent injury to the tendon from occurring again. They are easy and quick to do as well. You usually don't need any special equipment [10]. Heavy isometric exercise reduces cortical muscle inhibition and maybe a factor in the mechanism of the pain reduction. It may be useful in season, pre-activity or post-activity and it can be used to reduce pain and change muscle inhibition without a reduction in muscle strength [11]. There have been many studies conducted to prove the effectiveness of these two types of exercises individually, but no studies have compared their effectiveness over each other. Hence this study is done to compare the effectiveness of eccentric exercises and Isometric exercises for Achilles tendinitis in skaters [12].

This study is focused to find the comparison between the eccentric and isometric exercises as there are no studies conducted till date to compare their effect on Achilles tendinitis in skaters.

## MATERIALS AND METHODS

A quasi experimental study of pre and post-test type was conducted in Independent Speed Skating Academy, East CIT nagar, Nandanam, Chennai with a sample size of 40 subjects for a period of 4 weeks. The samples were selected by Convenient Sampling method. The inclusion criteria for selection was only men aged between 15 to 25 years of age who have a minimum 2 years of skating experience and those who have bilateral pain symptoms in Achilles region. The skater must have a VAS score of 5-7 and VISA- A score of 30-60 to be selected as a participant. Anyone with Recent lower extremity fractures or an injury. (within one year), Rupture of Achilles tendon, Previous surgeries done on Achilles or Patellar tendon. (within one year) and Participants who recently received oral or injected corticosteroids were excluded from the inclusion. VAS and VISA A questionnaire was used as a outcome measure in order to obtain a pre-test and post-test values.

Participants after meeting the were inclusion and exclusion criteria were selected for the study. The selected participants were explained about the procedure and their

consent for participation was taken before the initiation of the study. Their assessment and history was collected as many of the studies included patients diagnosed with tendinitis by history and physical examination alone. The severity of the condition was checked using the VISA-A (Victorian Institute of Sports Assessment-Achilles) questionnaire and VAS (Visual Analogue Scale) [13].

A sample size of 40 was selected and was randomly allocated into two groups of 20 participants each. A pre-test was done using the VISA-A (Victorian Institute of Sports Assessment-Achilles) questionnaire and VAS (Visual Analogue Scale), the score and value of respective outcome measures was recorded. Group A was given eccentric exercise and Group B was given isometric exercise for a period of 4 weeks.

Group-A received (Eccentric exercise) which included Hakan Alfredson’s heel drop protocol. The participant begins by standing with one foot on a step and the heel raised up. Then the heel is slowly lowered down keeping the leg straight until the foot is parallel to the ground but no further. Then its pushed up to the starting position using the other leg to assist and repeat. The participant performed 3 sets of 15 repetitions each with one min interval between each set, twice a day for 4 weeks [14].

While the Group-B received (Isometric exercise)which included static hold, the participant was asked to perform the isometric gastrocnemius exercise with the ankle in maximum plantar flexion and knee in full extension. The patient has to hold the position for 45 seconds, each repetition would be painless. The participant performed 3 sets of 5 repetition of isometric contraction with one minute rest interval between each set, twice a day for 4 weeks. Regular

follow up was given to the participants throughout the period of 4 weeks and the exercises were done under the guidance of the coach [15].

After the period of 4 weeks post-test was taken and the participants were reassessed manually and the severity was checked using the VISA-A (Victorian Institute of Sports Assessment-Achilles) questionnaire and VAS (Visual Analogue Scale). Each participant’s data was collected and recorded separately to compare and perform statistical analysis between the group A and group B participants.

## RESULTS

The obtained data was analyzed using the IBM SPSS version 20 software compatible for windows. The statistical tool used in the study was paired sample test, independent ‘t’ test. Paired sample test was used for analysis of pre-test and post-test means within the groups; whereas independent t-test was used for analysis of the comparison between the Group-A and Group-B.

According to Table 1 the VISA-A pre-test mean value of the participants doing isometric exercise is 40.65 and the post-test mean value is 46.00, which has significant value of 0.00. The VAS pre-test mean value 7.05 and post-test mean value is 5.30, which is significant with value of 0.00. with significant difference (p-value 0.005) improved post-test with VISA-A and VAS for participants doing isometric exercise. Graph.1 depicts there was a significant difference between pre-test and post-test values taken by VISA-A and VAS for participants doing isometric exercise.

According to Table 2 the VISA-A pre-test mean value of the participants doing eccentric exercise is 41.20 and the post-test mean value is 51.90, which has significant value

**Table 1.** Comparison between pre-test and post-test values during Isometric exercise for VISA- A questionnaire and VAS

	Mean	SD	t-value	p-value*
Visa A (pre-test)	40.65	7.680	-15.625	.000
Visa A (post-test)	46.00	8.367		
Vas scale (pre-test)	7.05	1.099	10.925	.000
Vas scale (post-test)	5.30	1.174		

SD: standard deviation, VISA-A: Victorian Institute of Sports Assessment-Achilles, VAS: Visual Analogue Scale.

\*p < 0.05.

**Table 2.** Comparison between pre-test and post-test in eccentric exercise for VISA-A questionnaire and VAS

	Mean	SD	t-value	p-value*
Visa A (pre-test)	41.20	8.186	-9.025	.000
Visa A (post-test)	51.90	11.064		
Vas scale (pre-test)	7.20	1.240	9.444	.000
Vas scale (post-test)	4.60	2.088		

SD: standard deviation.

\*p < 0.05.

of 0.00. The VAS pre-test mean value 7.20 and post-test mean value is 4.60, which is significant with value of 0.00. Thus Table 2 shows there was significant difference ( $p < 0.005$ ) and improvement in the post-test with VISA-A and VAS for participants doing eccentric exercise. Graph.2 depicts there was a significant difference between pre-test and post-test values taken by VISA-A and VAS for participants doing eccentric exercise.

According to Table 3 the VISA-A post-test mean value of participants doing isometric exercise is 46.00 and the post-test mean value of participants doing eccentric exercise is 51.90, which has insignificant value of 0.065. The VAS post-test mean value of participants doing isometric exercise is 5.30 and post-test mean value of participants doing eccentric exercise is 4.60, which has an insignificant value of 0.199. Graph 3 depicts the significant difference between post-test value of isometric and eccentric taken by VISA-A questionnaire and VAS respectively.

According to Table 1, when comparing the pre-test mean value to the post-test mean value with VISA- A questionnaire and VAS there is a significant difference,  $p < 0.005$ . Thus there is improvement in post-test in comparison to pre-test for Isometric Exercise.

According to Table 2, when comparing the pre-test mean value to the post-test mean value with VISA- A questionnaire and VAS there is a significant difference,  $p < 0.005$ . Thus there is improvement in post-test in comparison to pre-test for eccentric exercise.

According to Table 3, when comparing Isometric and Eccentric Exercise post-test values with VISA-A and VAS ( $p > 0.05$ ) there was an insignificant difference between Isometric and the Eccentric group, with VAS shows insignificant value of 0.199 and VISA-A with an insignificant value

of .065.

## DISCUSSION

The current study compares between eccentric and isometric exercise for Achilles tendinitis in skaters. In the study 40 samples were taken according to the inclusion and exclusion criteria. They were randomly allocated into two groups of 20 each, group A and group B. Group A was given eccentric exercises and group B was given isometric exercises for a period of 4 weeks, with regular follow up and guidance of the coach. According to the statistical analysis, when comparing the pre-test and post-test mean values with VISA-A and VAS in both the groups individually, that is; the group doing eccentric exercise and isometric exercise, there was significant difference ( $p < 0.005$ ) and improvement in the post test values of VISA-A and VAS in both the groups that is; eccentric and isometric groups. When comparing the post-test mean values of the eccentric group to the isometric group with VISA-A and VAS, there was statistical insignificance ( $p > 0.005$ ) despite the improvement that is shown in the mean values.

Single resistance training bout of isometric contractions reduced Achilles tendon pain immediately for at least 45 min post intervention and increased Manual Voluntary Isometric Contraction. The reduction in pain was paralleled by a reduction in cortical inhibition, providing insight into potential mechanisms [16]. Isometric contractions can be completed without pain for people with Patellar Tendinopathy. The clinical implications are that isometric muscle contractions may be used to reduce pain in people with Patellar Tendinopathy without a reduction in muscle strength. So it has a positive correlation with this study [17]. While Magnussen et al. concluded that Eccentric exercises have the most evidence of effectiveness in treatment of mid portion Achilles tendinitis [18]. During eccentric exercise tendon pain is expected, but the pain would not be progressive or disabling. There are physiological changes with increased strength and muscle stiffness. There was a significant change in the subjects after the 4 weeks intervention period and most of the subjects were satisfied with the treatment as their pain have subsequently subsided, therefore this study is in positive correlation the earlier

**Table 3.** Comparison between post-test of isometric exercise and eccentric exercise for VISA- A questionnaire and VAS

	Mean	SD	t-value	p-value*
Visa A (isometric)	46.00	8.367	-1.902	.065
Visa A (eccentric)	51.90	11.064		
Vas scale (isometric)	5.30	1.174	1.307	.199
Vas scale (eccentric)	4.60	2.088		

SD: standard deviation.

\* $p > 0.05$ .

findings.

With both isometric and eccentric interventions the samples showed reduced pain and increased mobility which was visible in the VISA-A score and the VAS measurement. Despite the improvement there was Statistical insignificance when comparing the post-test between both the group A and B. This can be due to the marginal difference present when comparing both the groups, the small sample size also supports this reasoning, which can be added as a limitation. When the samples tried doing eccentric exercise over the step they experienced pain while performing the exercises. Within 6 weeks the samples were pain free and continued doing their regular activity [19]. Therefore there can be a hesitation while doing the exercise as it is painful, but in the end it will show results and relief in pain. Increased fear of movement might have a negative effect on the effectiveness of exercise treatment as stated another reason for the insignificance as the eccentric heel drop protocol can be painful and the fear of pain can affect the post test results [20].

The short period of study can be another reason A van der Plas et al. found that follow up treatment plan showed better results from 49.2 at baseline to 83.6 [21]. Isometric exercises has an analgesic effect which can lasts for 45 min, for long term effects the intervention period should be longer in exercise induced activity [22]. Both the treatment protocols are effective that is, eccentric and isometric according to statistical data ( $p < 0.005$ ) for the treatment of Achilles tendinitis but further studies have to be done, considering all the limitation in this study to derive a superior intervention protocol for Achilles tendinitis. The study have some limitations smaller sample size, study duration is very less, we have include only male participants and only one study setting. On the basis of which recommendations of performing Randomized Control Trail in Multiple Setting for the same study can be done. A large sample size and wider scope of selection of participants. Female skaters can also be included in the study inclusion criteria to analyze the effect of same in female skaters also. Some additional strengthening exercises protocol can be experimented with same samples to improve the skaters Community.

## CONCLUSION

The study concludes that there is significant improvement in Achilles tendinitis when assessed with Visa A questionnaire and VAS Scale for both the eccentric and isometric exercises but this study shows statistical insignificant results when comparing both the isometric and eccentric exercise. So it is enough to choose one method of intervention over the other.

## CONFLICTS OF INTERESTS

None to declare.

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