بسم الله الرحمن الرحيم

”و قل اعملوا فسيري الله عملكم و رسوله و المؤمنون“

(التوبة الآية ١٠٥)

Balance Assessment Following Proximal Versus Distal Lower Limb Muscles Cooling in Healthy Females

By

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- **My Family**

Cryotherapy

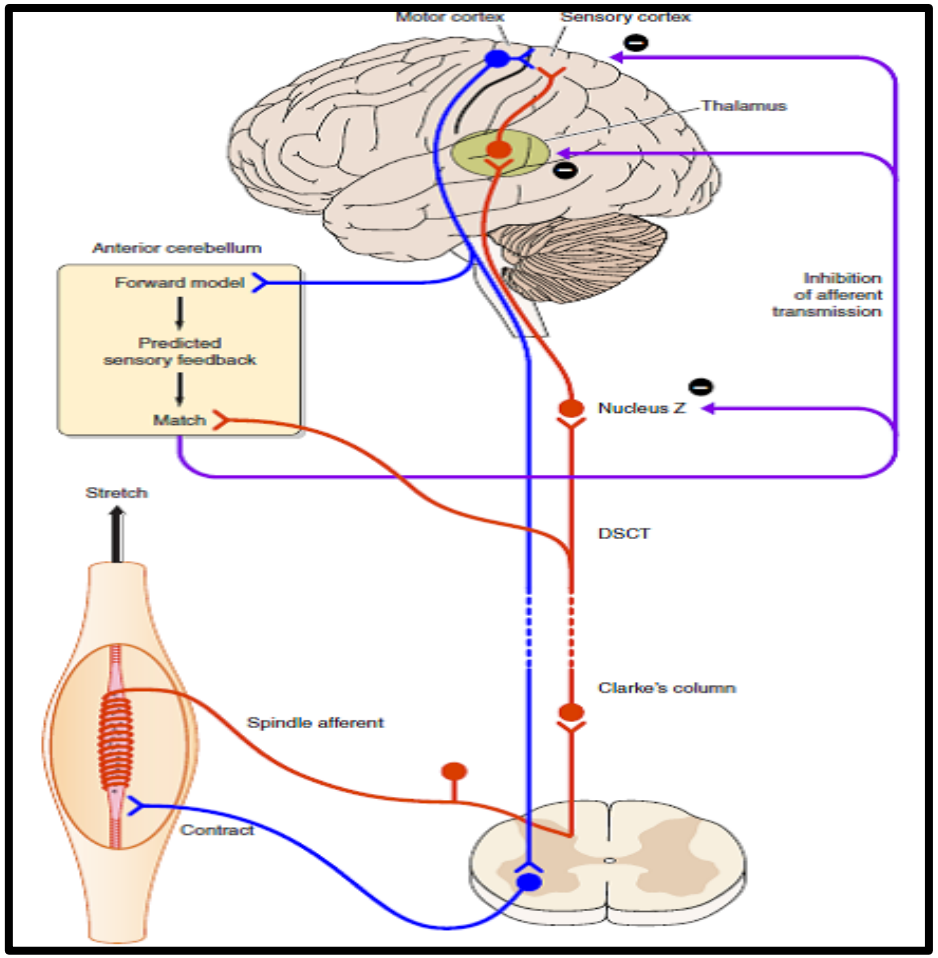
Is one of the most common and inexpensive forms of treatment for both acute and chronic athletic injuries.

Ice has been used to limit the damage caused by the injury.

- Reduces tissue temperatures.
- Reduces metabolic demands.
- Vasoconstriction.
- Alleviates pain, and promotes analgesia.

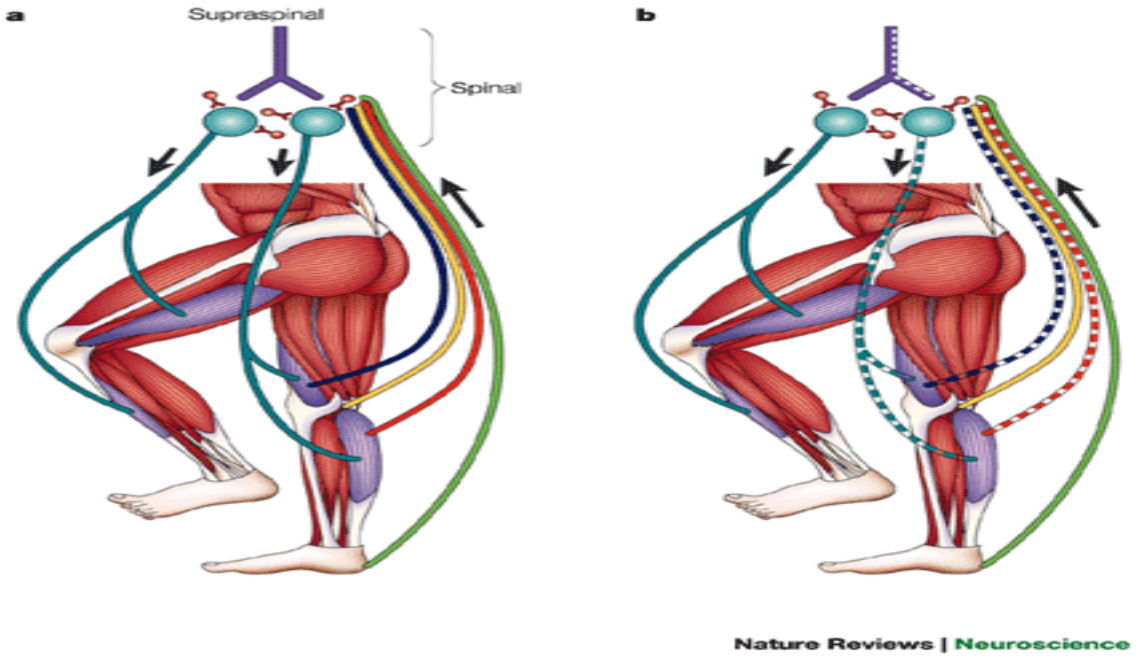
Negative effects of cryotherapy

- Decline in all the sensations.
- Reduction of proprioception.
- Reduction the Nerve Conduction Velocity (NCV).

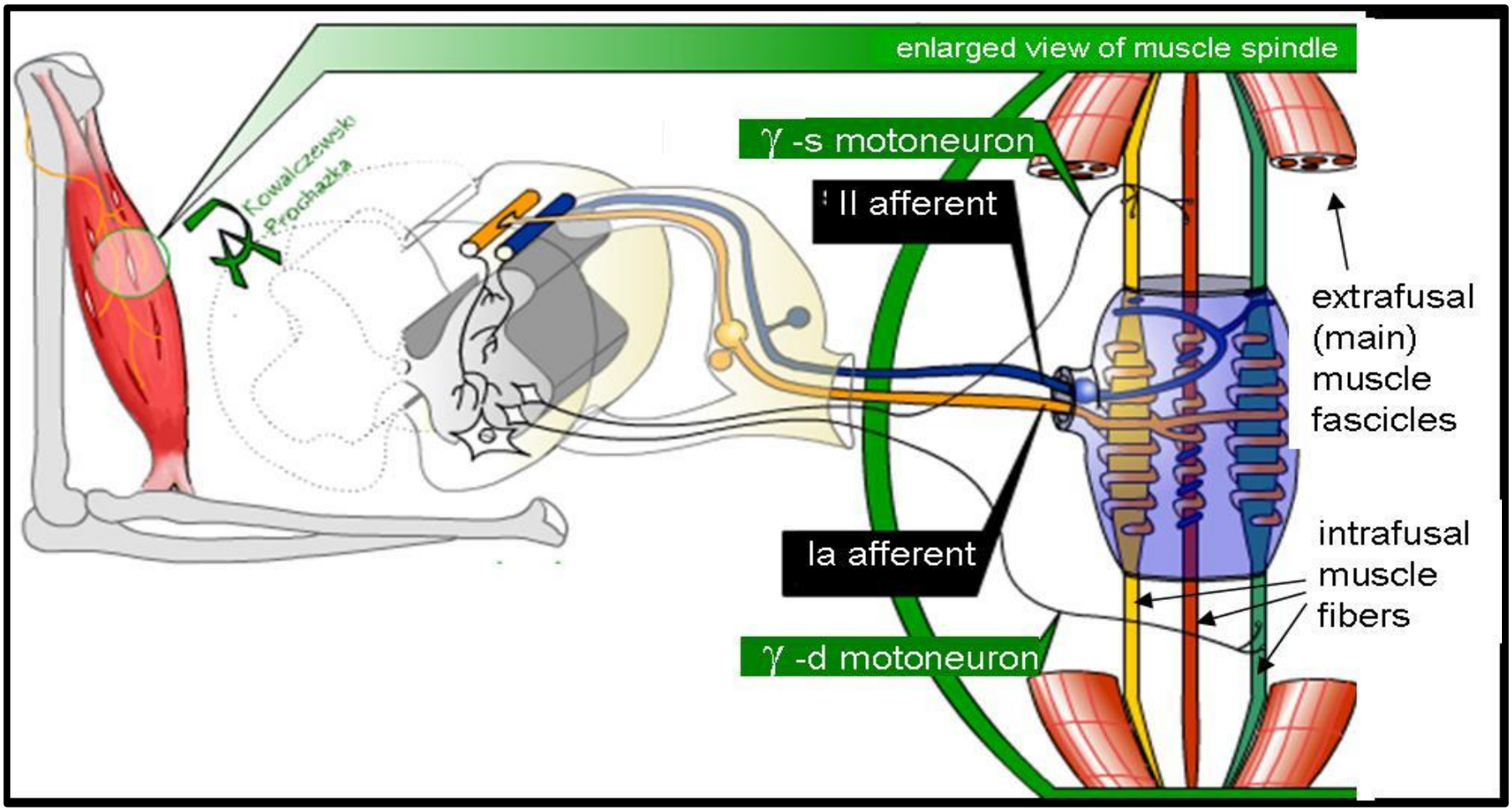


Proprioception and Balance

- Possible affection of the athlete's postural stability.
- Possible affection of the athlete's performance.
- Possible increase in future risk of injury.



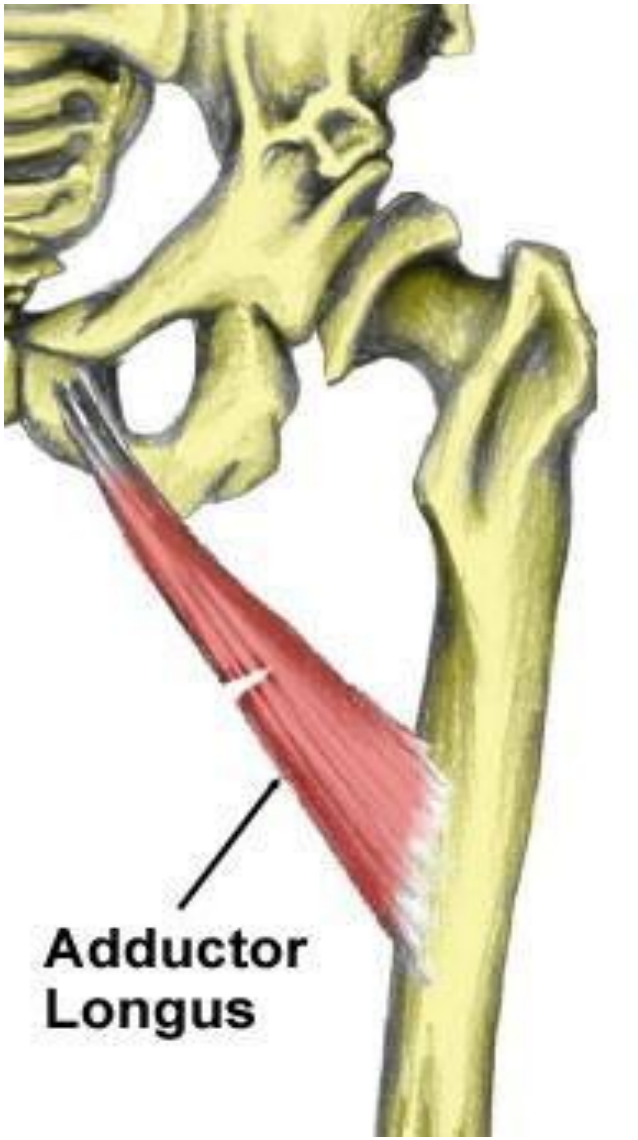
There is a deficiency in research concerning the impact of cooling lower limb muscles on balance in healthy females.



Most common injuries

- Hip adductor muscles.
- Ankle evertors muscles.

Females



Purpose of the study

This study aimed at examining the effect of cryotherapy application on:

The Overall postural stability index (OSI), Medio-Lateral postural stability index (MLSI), and the Antero-Posterior postural stability index (APSI) in healthy females.

- **To compare between the effect of cryotherapy application on the proximal (hip adductors) versus distal (ankle evertors) lower limb muscles on postural stability indexes in healthy females.**

Methodology

1- Patient Selection

- ✓ 33 female participants.
- ✓ Age: ranged from 18-20 years.
- ✓ Weight: ranged from 49- 85 Kg.
- ✓ Height: ranged from 1.4- 1.8 m.
- ✓ All participants had unrestricted ankle and hip joints range of motion.
- ✓ All participants had ankle and hip muscles strength grade four to five.

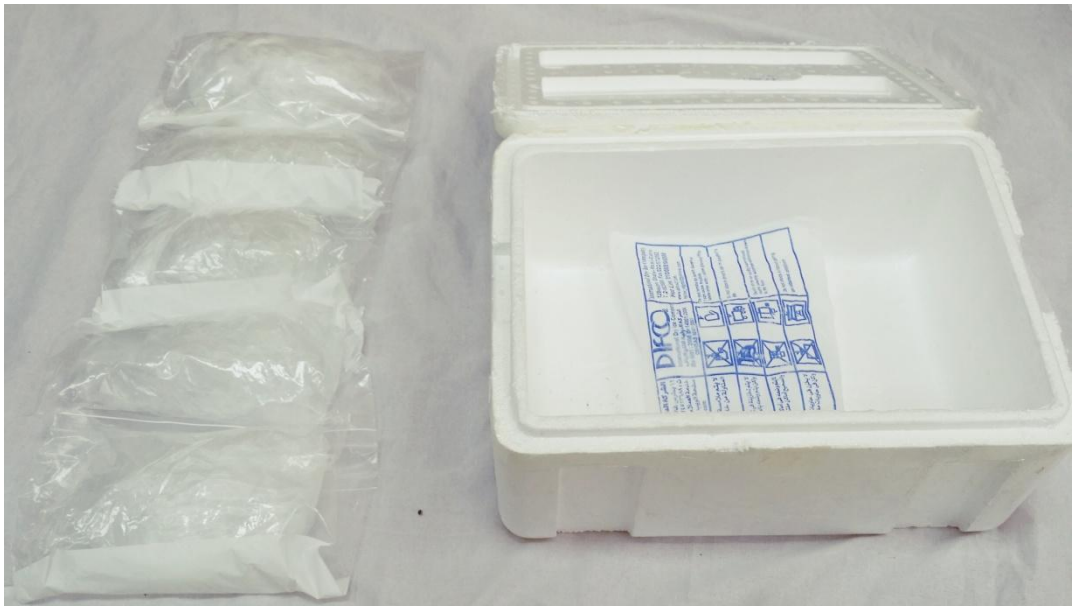
Name	Age	Weight	Height	Dominant Limb
1. Hayam El Sayed	20	70.5	150	L
2. Hanaa Ahmed	20	67	165.5	L
3. Youmna Akram	20	56	153	L
4. Hala Hussein	19.5	82	171	R
5. Nourhan Hassan	20	57	159	R
6. Yasmine Seliman	19	79	178	R
7. Nourhan Ahmed	19	55	158	R
8. Heba Salah El Din	19	62.5	156.5	R
9. Noura Mohamed	19	68.5	165	R
10. Yasmine Ashraf	20	65	164	R
11. Yasmine Mohamed Taha	19	59	166	L
12. Yasmine Emara	20	71	173	R
13. Hala Yasser	19	66	165	R
14. Nourhan Allam	20	55.5	161	R
15. Wafaa Ibrahim	20	55.5	161	L
16. Hagar Ashraf	19	67	159.5	R
17. Hadeer el Sayed	19	56.5	151.5	L
18. Hager Hassan	19	49	156.5	R
19. Nourhan Moh.Ashraf	19	52	158.5	R
20. Asmaa Ibrahim	19	76	155	L
21. Tasneem Aziz Ali	20	76	165	R
22. Basma Khaled	20	81	159	R
23. Eman Saeed Ibrahim	20	85.5	162	R
24. Basma Zaki Mohamed	20	56	154	L
25. Esraa Hamdy	19	57	159	L
26. Dina Hamdy	19	57	157	L
27. Aya Mohamed Adel	20	56.5	154	R
28. Eman ashraf	20	61	163.5	R
29. Soha Hanafy Sayed	20	70.5	152	R
30. Ayat Ragab Abdel Fatah	20	52.5	159.5	L
31. Iriny Joseph Aziz	20	48	153	L
32. Eman Hamdy	20	76	168	L
33. Aya Hendy Mohamed	20	55	157	R

2- Instrumentation

- ***Biodex Balance System (BBS)***

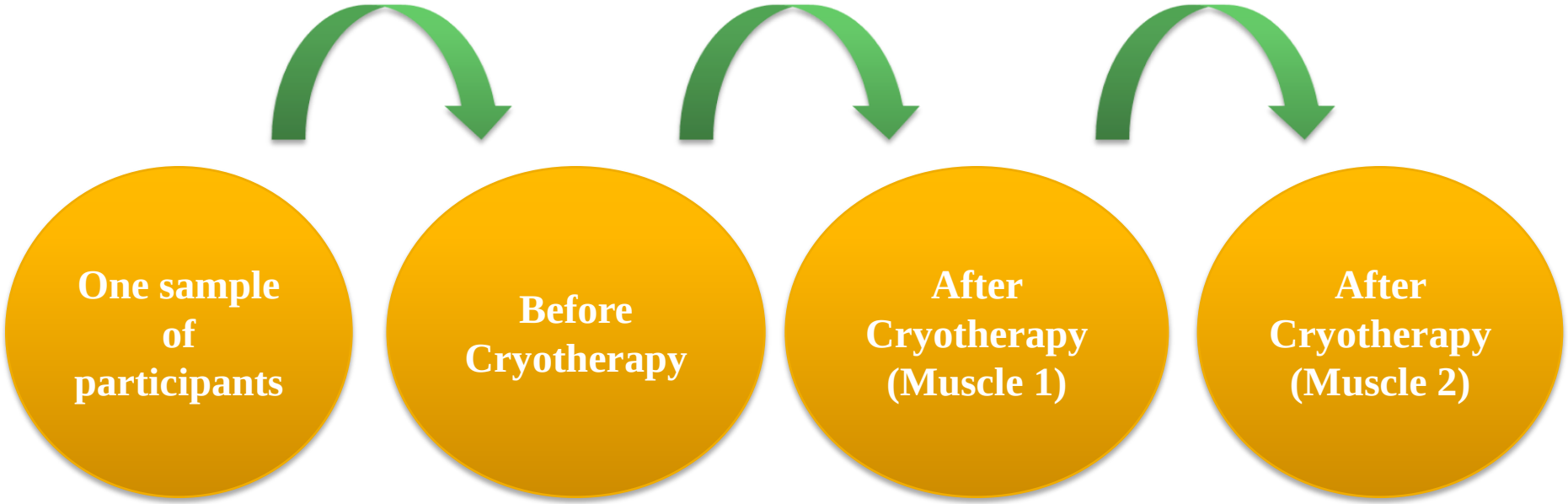
3 Measures	High Score	Varying Stability

- ***Ice packs***
- ***Height and weight scale***



3- Procedure

This study involved a within-subject experimental design



1- Preparatory Phase

A- Pre-experimental instructions

APPENDIX II

Data sheet

Personal Data:

1- Name:

2- Age:

3- Height:

4- Weight:

5- BMI:

6- Telephone number:

7- Dominant limb:

8- Lower limb injuries:

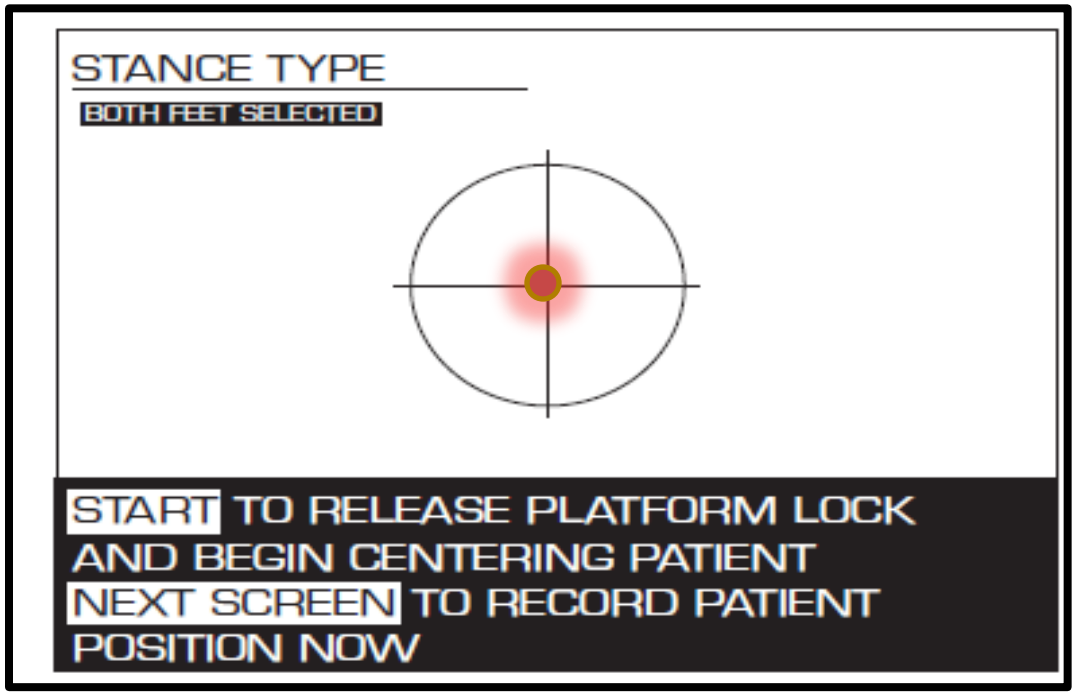
9- Balance problems:

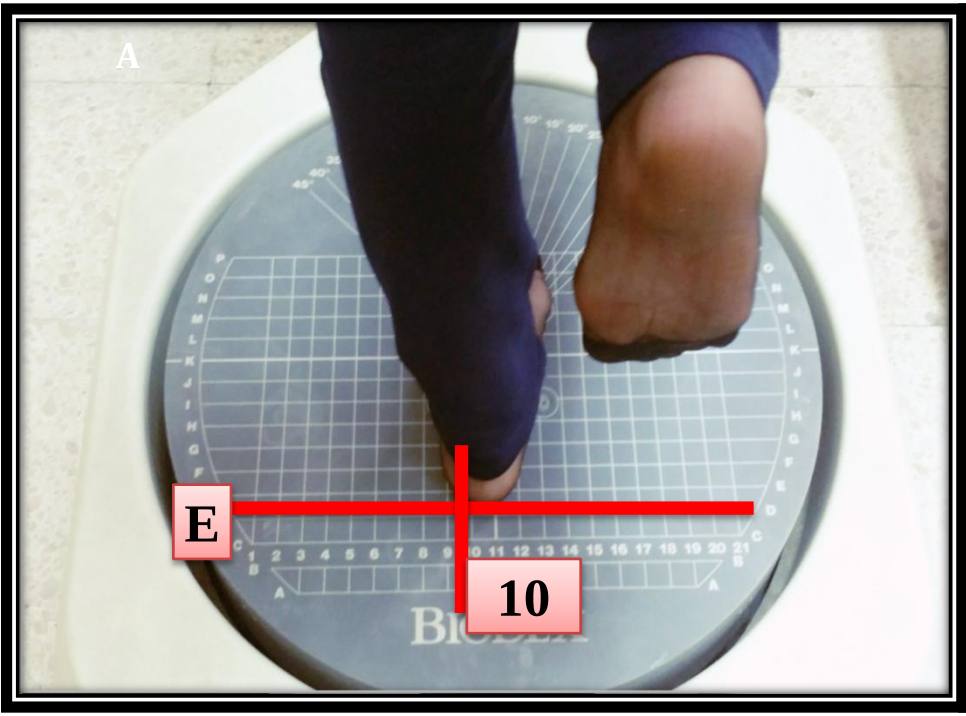
10- Participation in any sports activities:

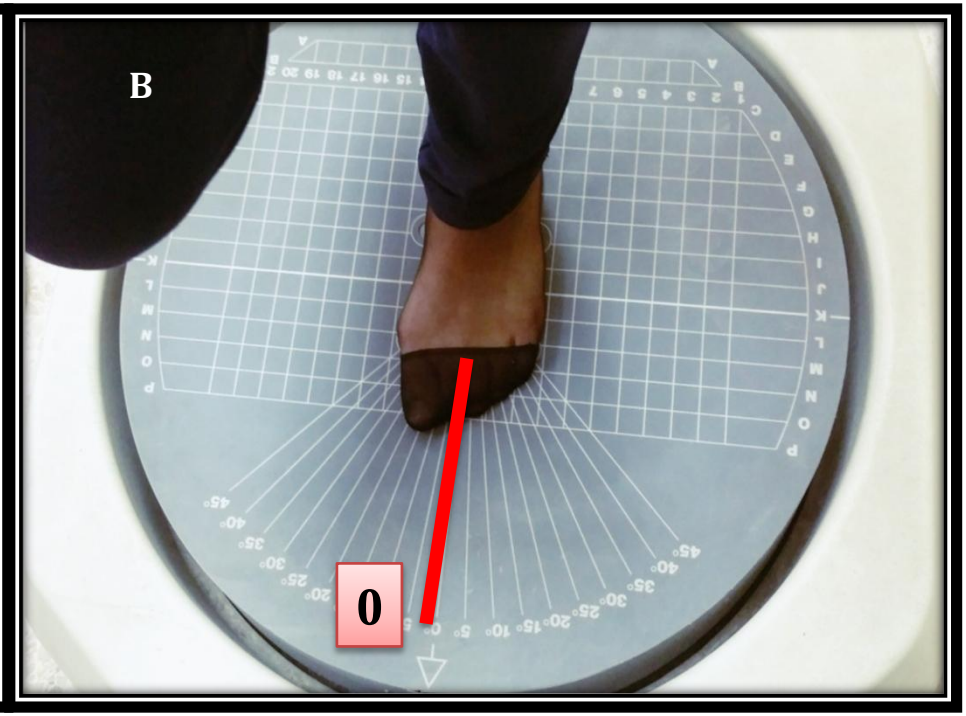
postural sway Index											
Adductors						Evertors					
Before Ice			After Ice			Before Ice			After Ice		
O	ML	AP	O	ML	AP	O	ML	AP	O	ML	AP

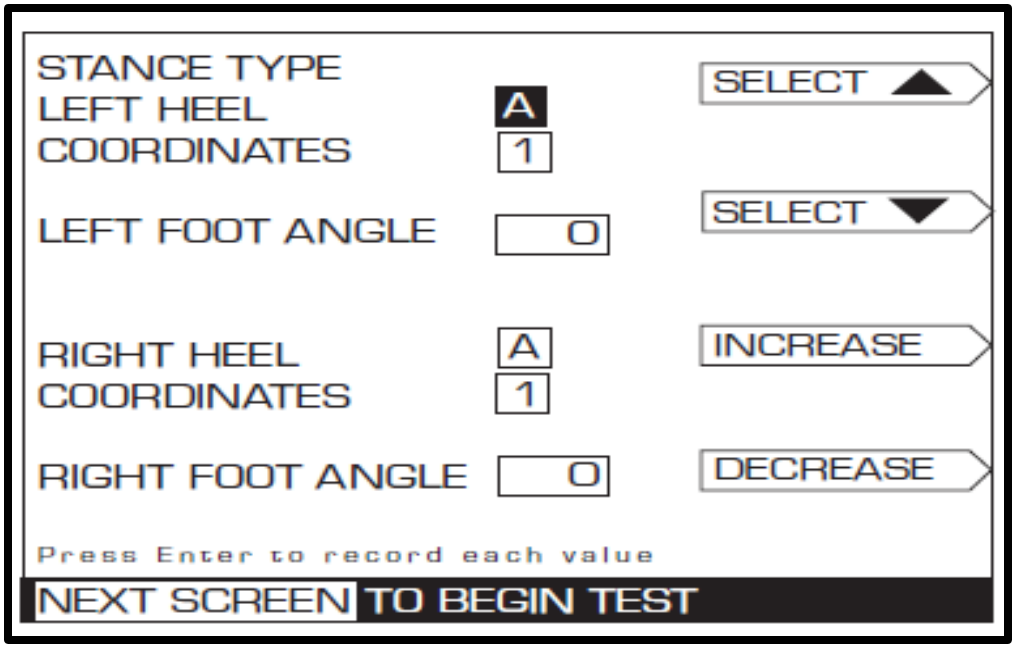
Comments.....

B-Balance system and Subject preparation




A
E
10

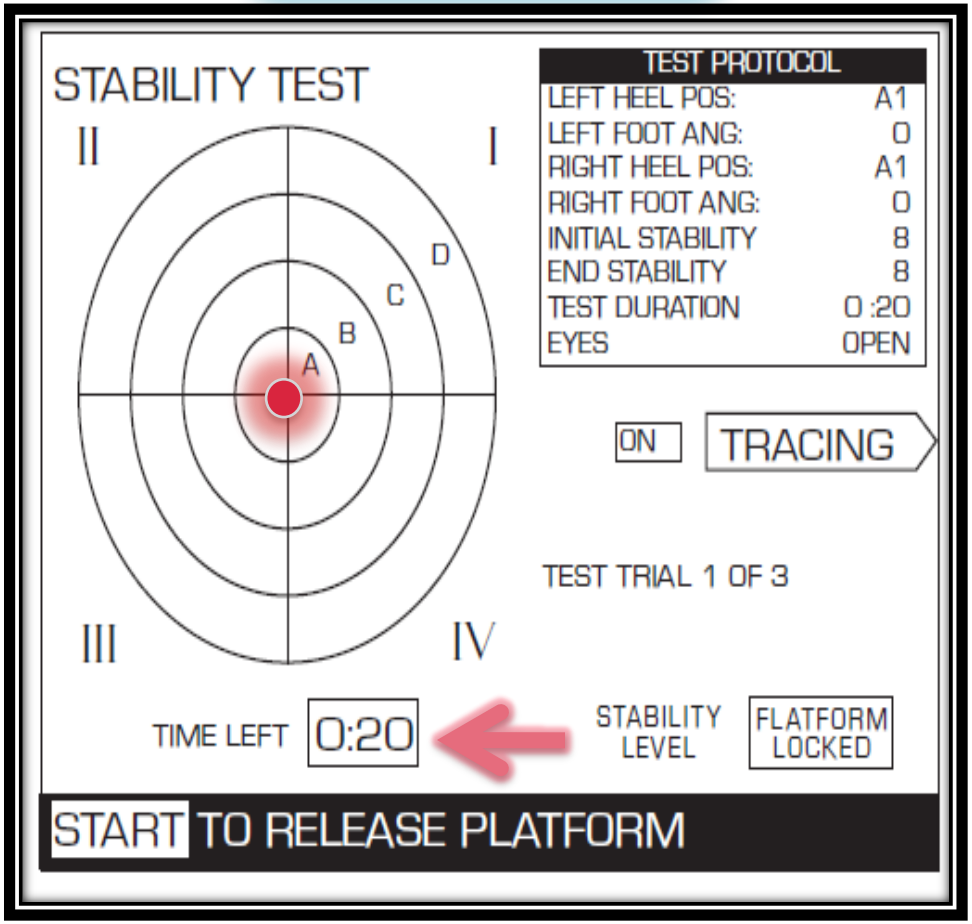

B
0

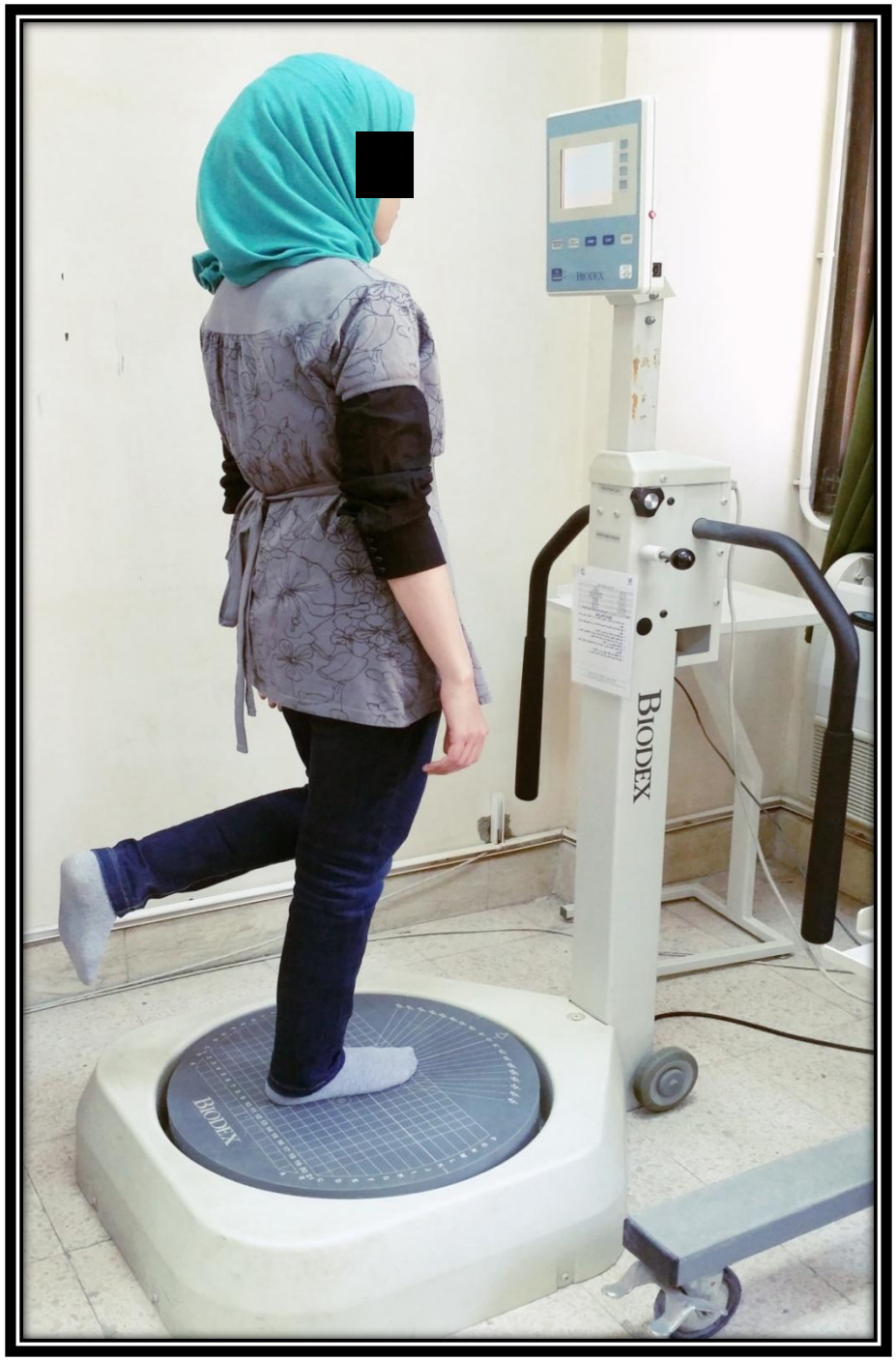

STANCE TYPE
LEFT HEEL
A
COORDINATES
1
SELECT
LEFT FOOT ANGLE
0
SELECT
RIGHT HEEL
A
COORDINATES
1
INCREASE
RIGHT FOOT ANGLE
0
DECREASE
Press Enter to record each value
NEXT SCREEN TO BEGIN TEST

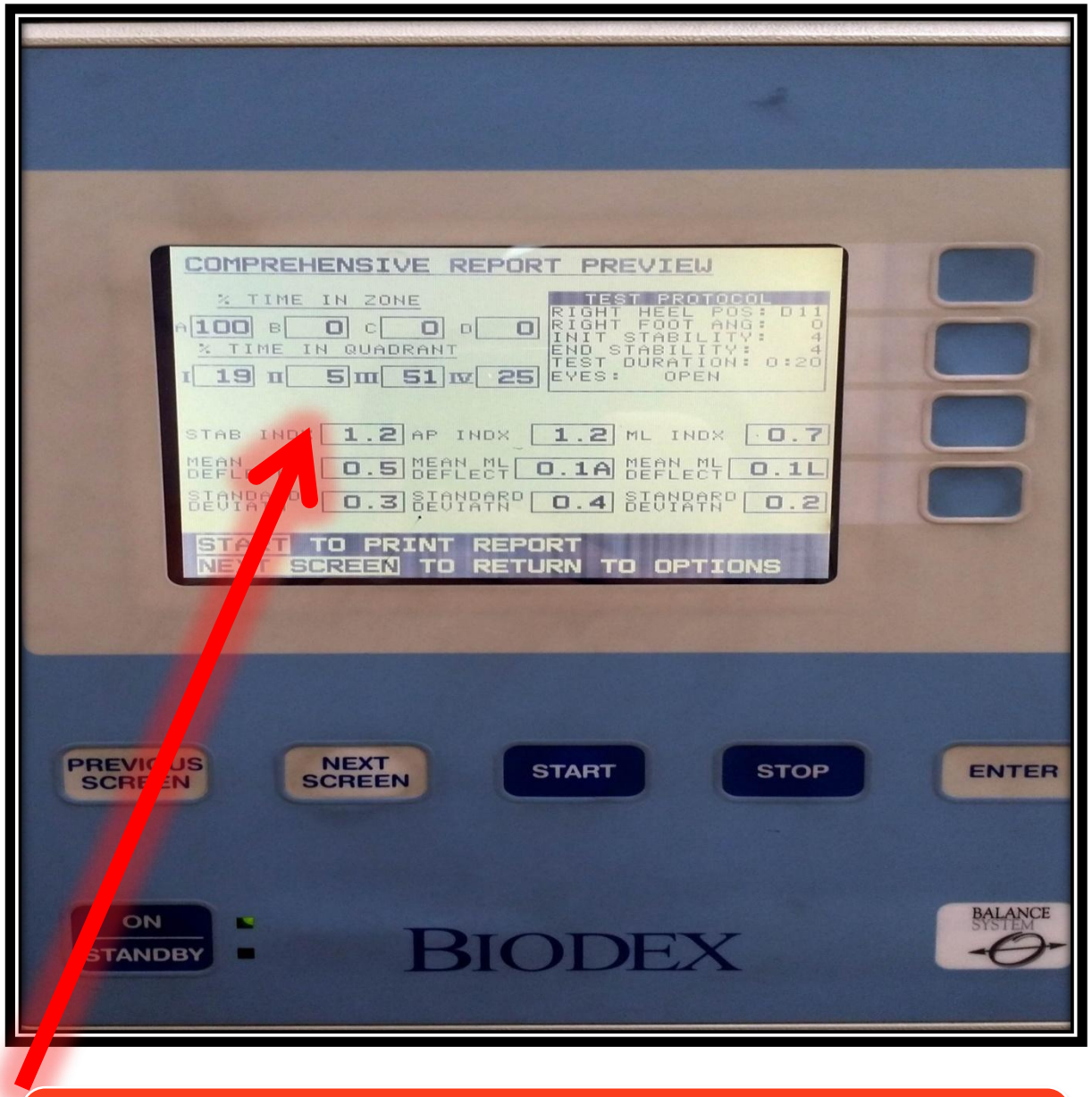
2- Experimental Phase

A- Balance Testing

Practice Trial

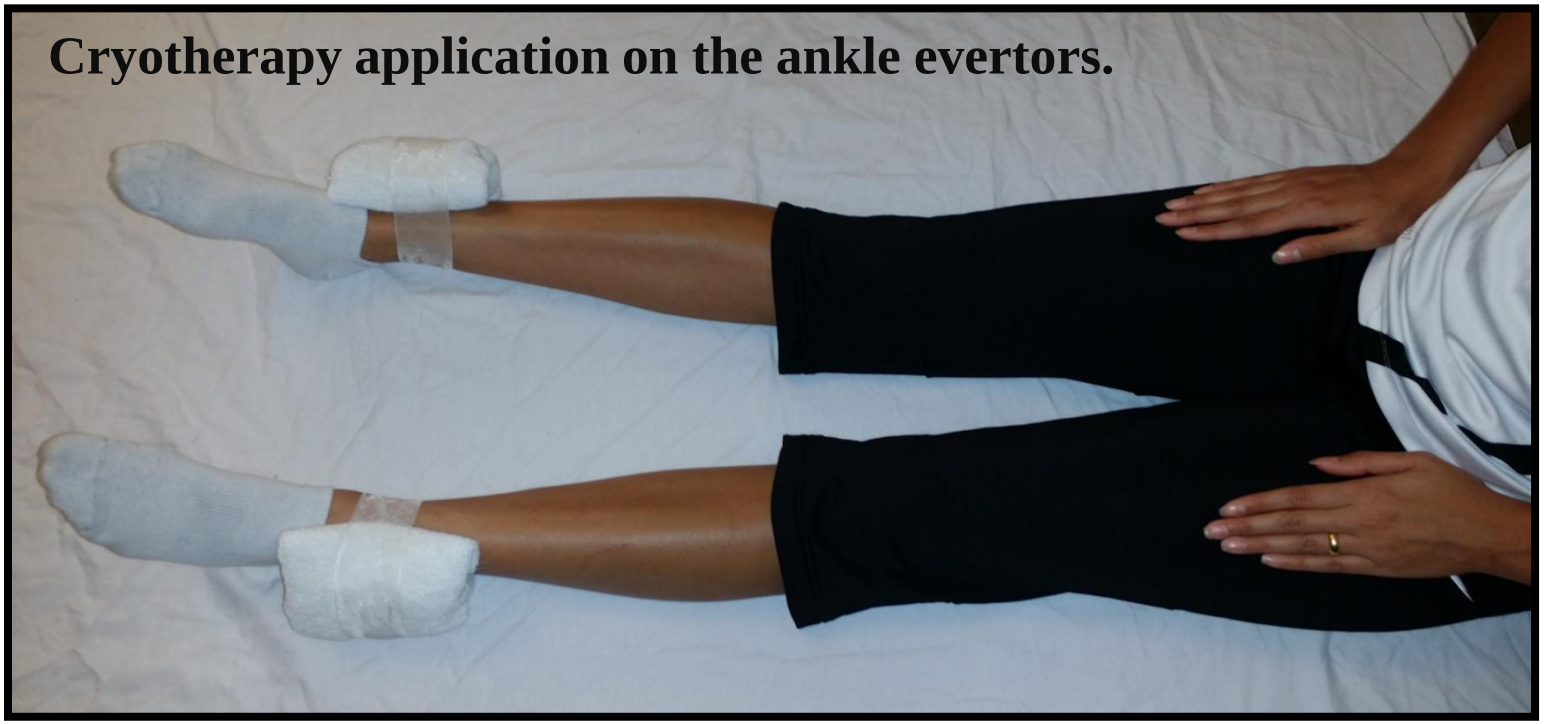






A high score is indicative of poor balance

B- Cryotherapy Session



Balance Re-test

The same whole procedure was repeated again

30 minutes later

Application of cryotherapy on muscle 2

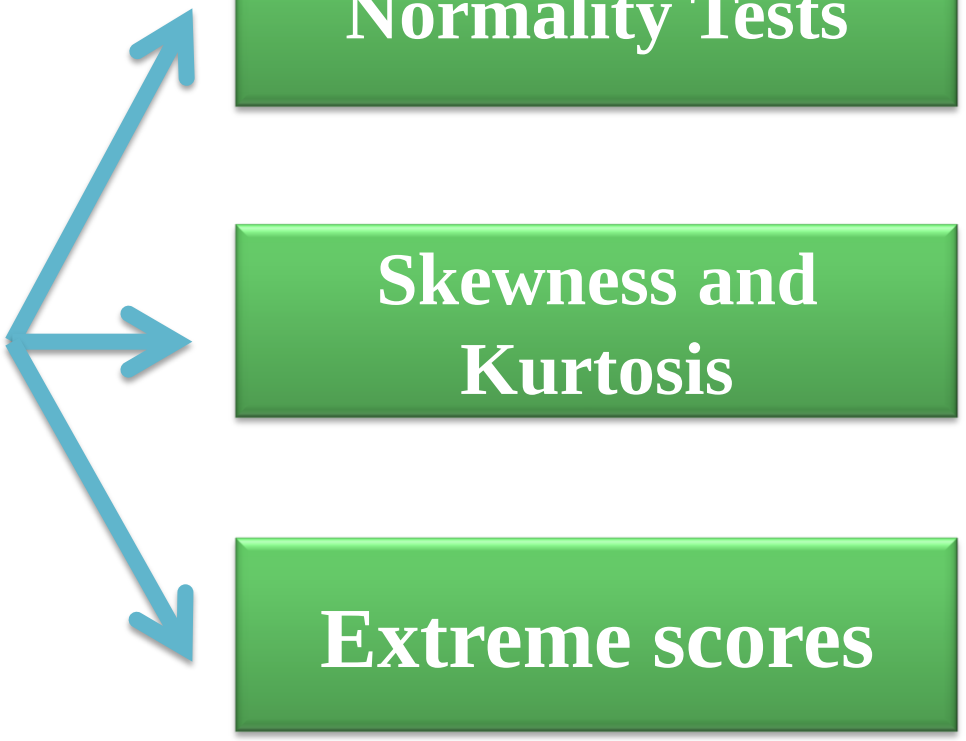
Cryotherapy application on the hip adductors.

Balance Re-test

Statistical Analysis

In the current study, two independent variables and three dependent variables were tested.

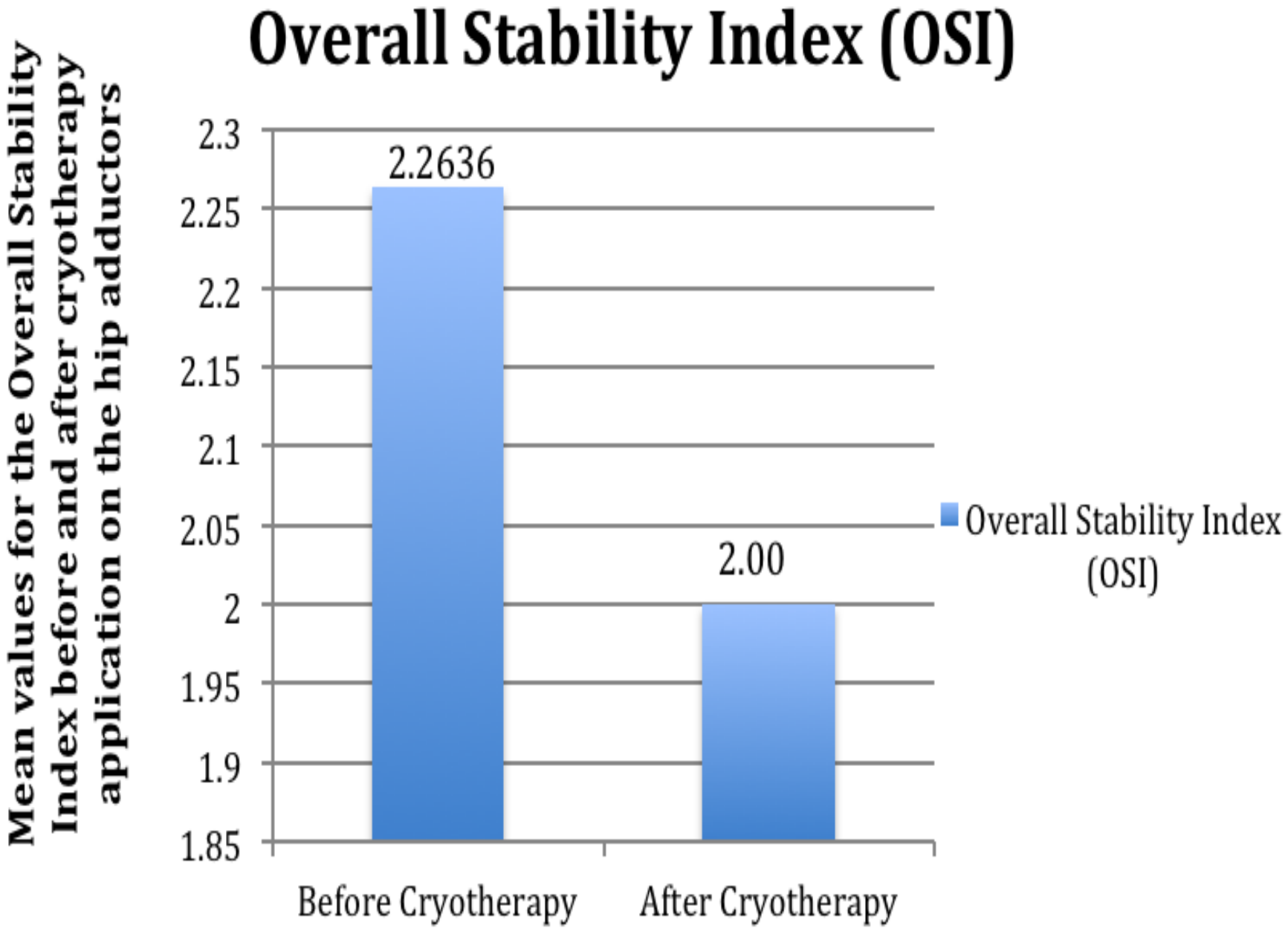
Data were initially screened for normality assumption as a prerequisite for parametric analysis.



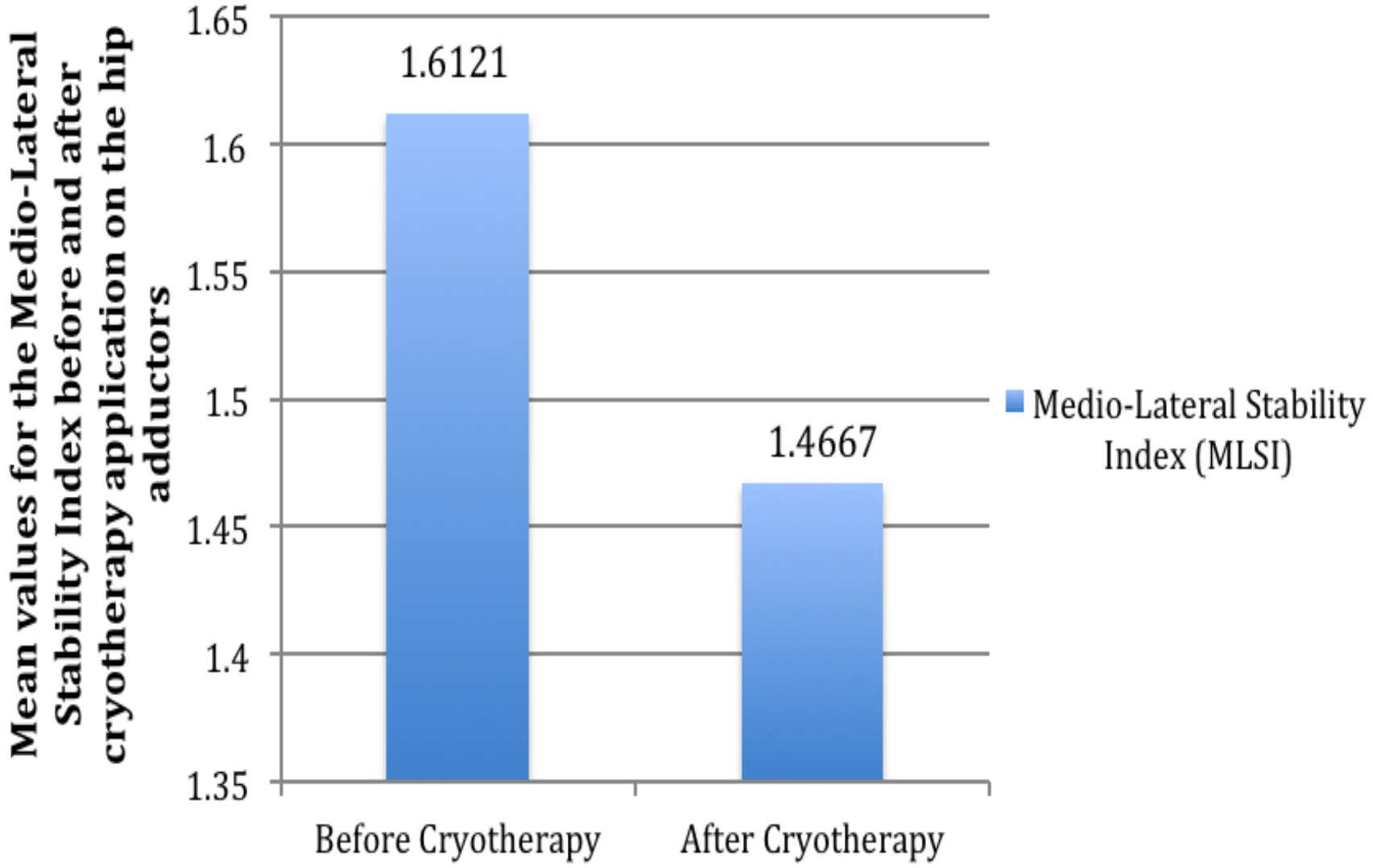
Once data were found not to violate the normality assumption

- ✧**Two-way repeated measure MANOVA.**
- ✧**Multiple pairwise comparison tests.**
- ✧**P<0.05**

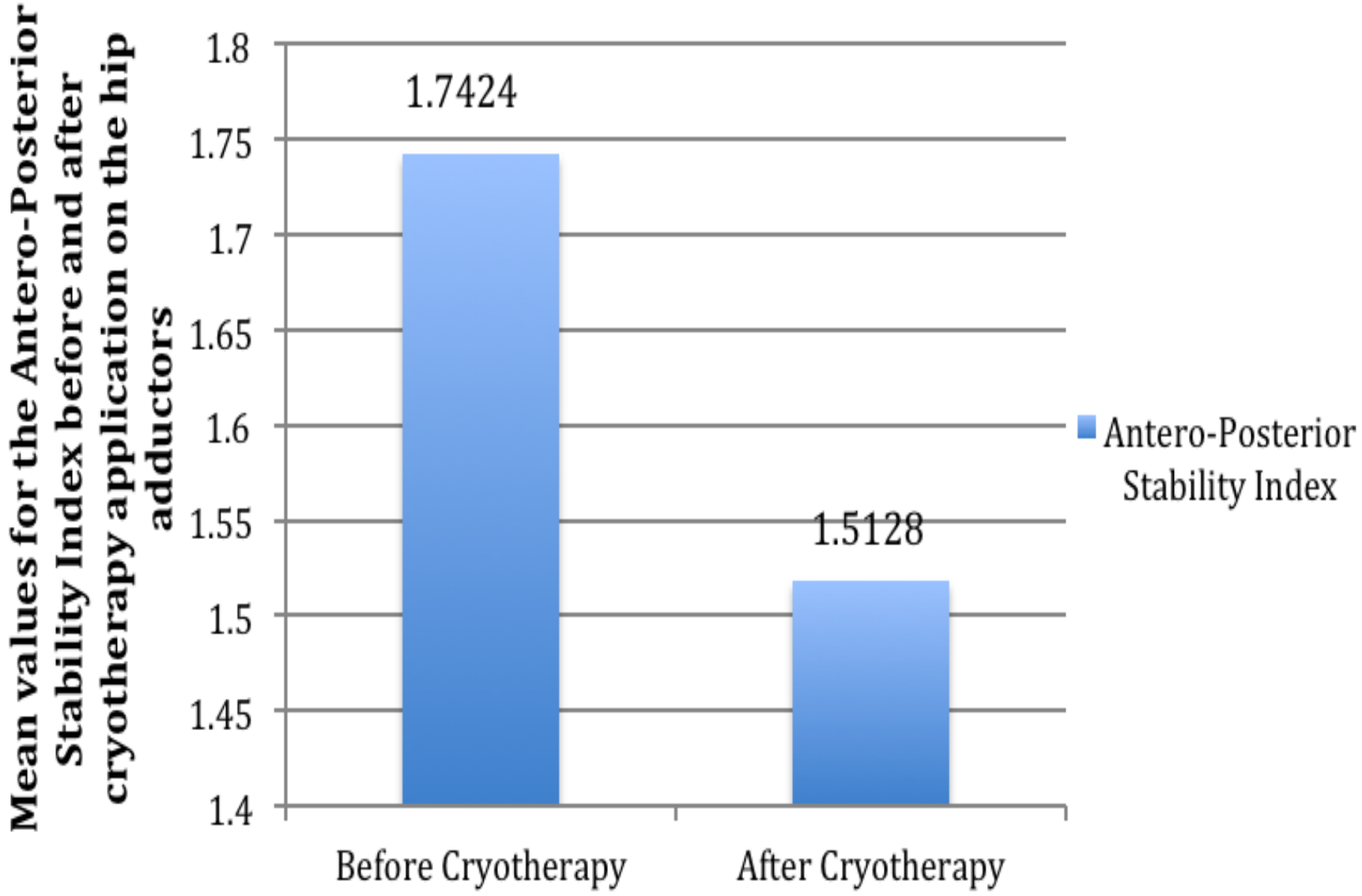
Results

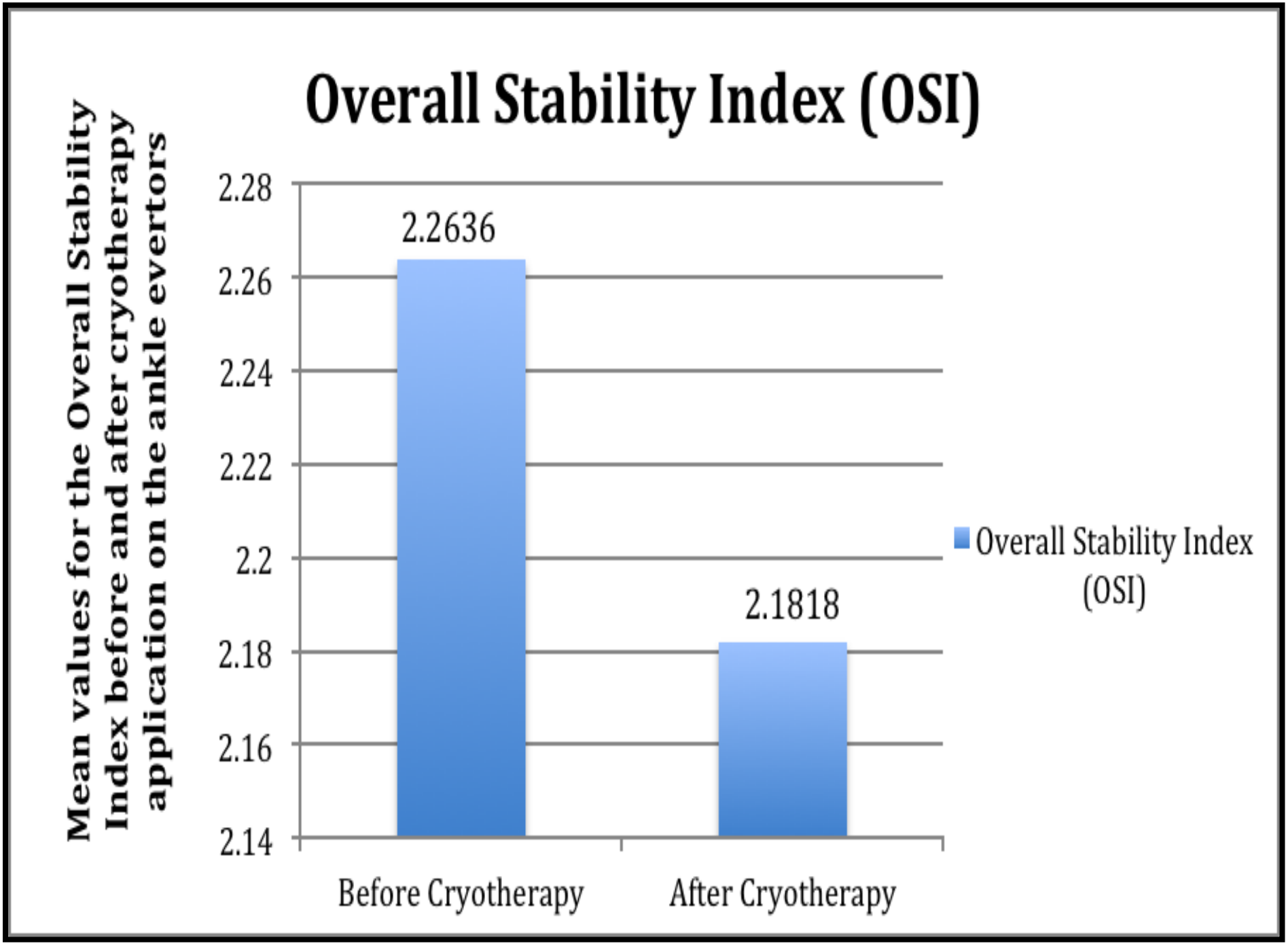

Overall Stability Index (OSI)
Mean values for the Overall Stability Index before and after cryotherapy application on the hip adductors
2.3
2.25
2.2
2.15
2.1
2.05
2
1.95
1.9
1.85
2.2636
2.00
Before Cryotherapy
After Cryotherapy
Overall Stability Index (OSI)

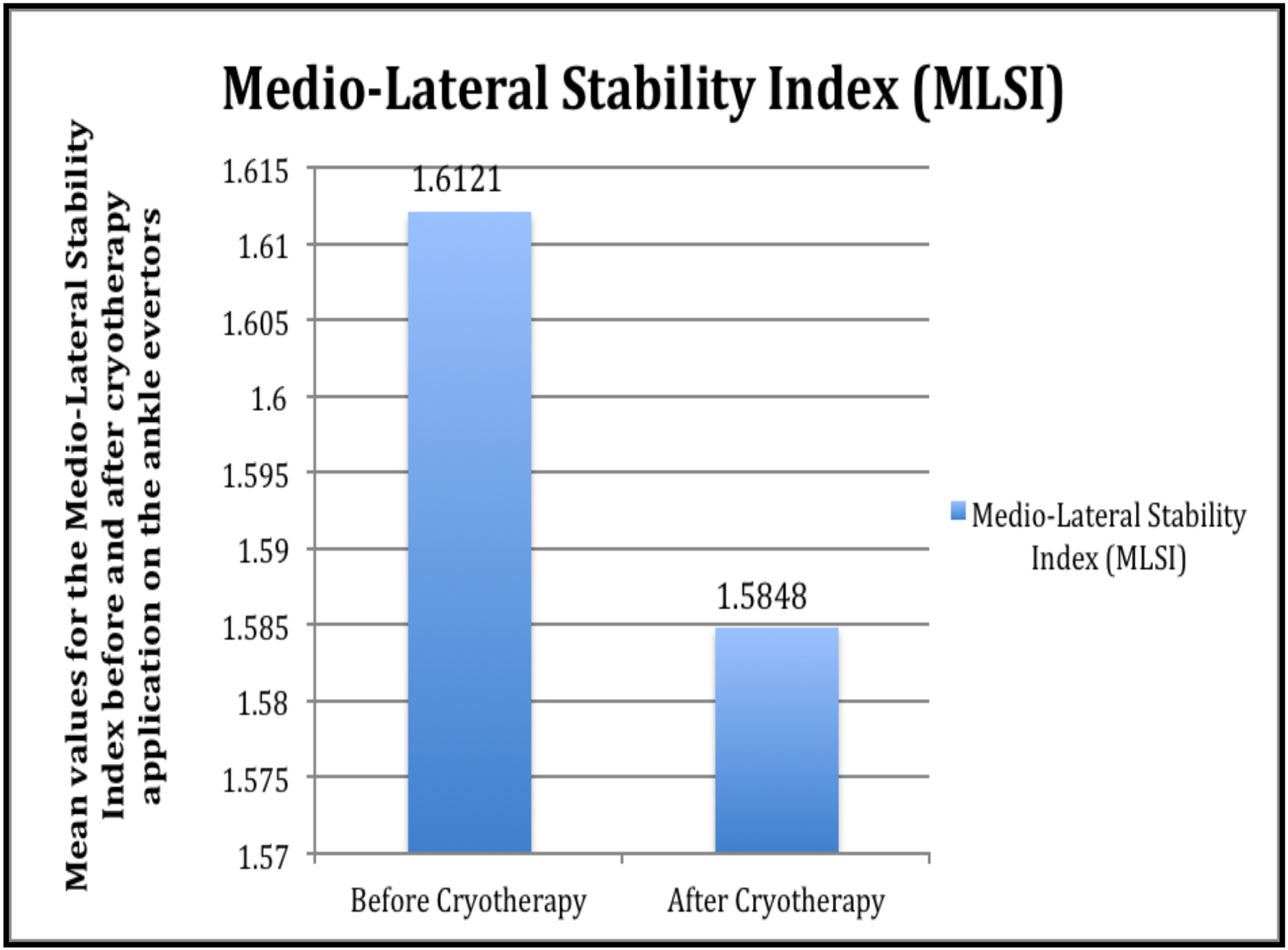
Medio-Lateral Stability Index (MLSI)



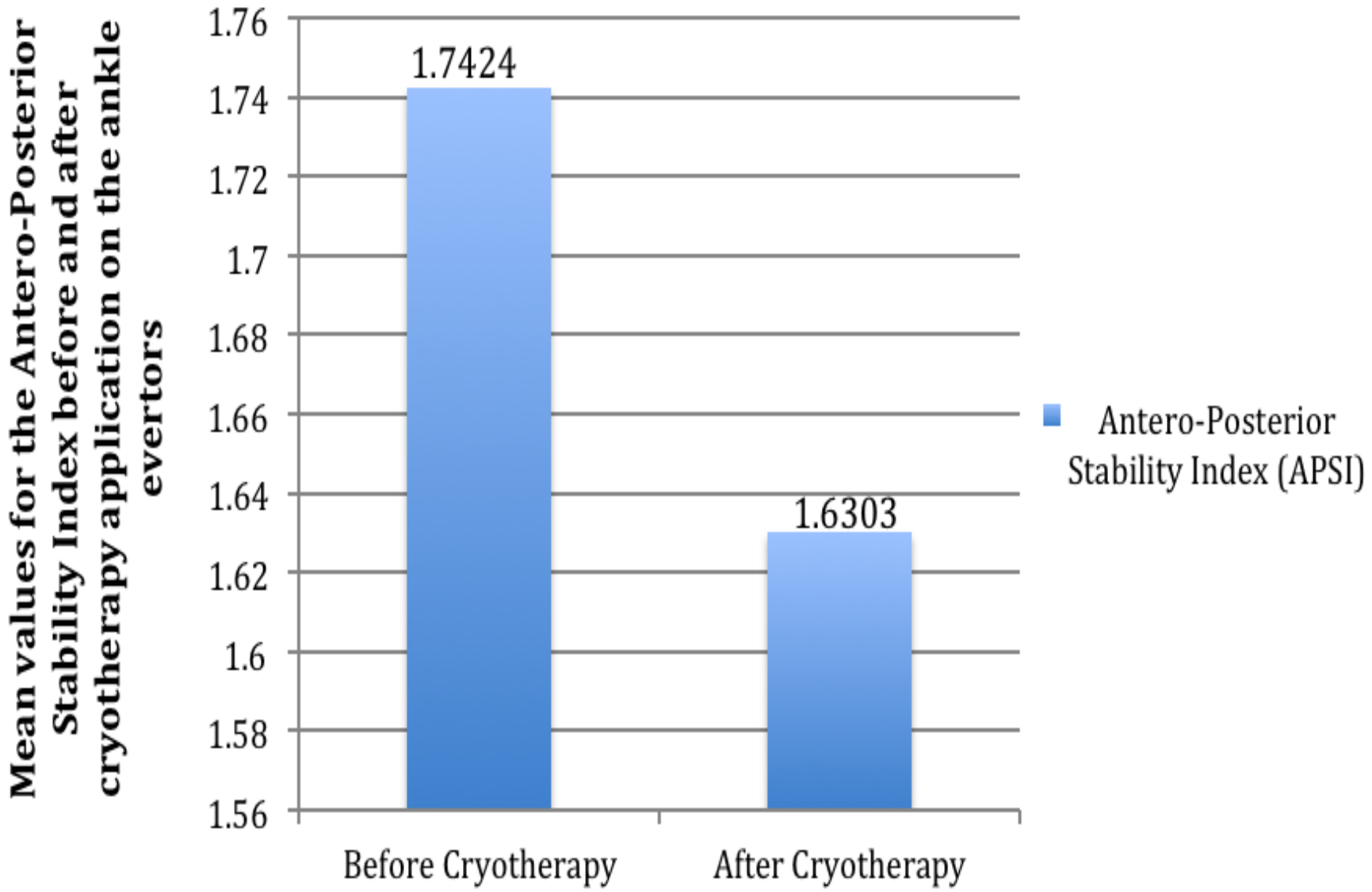
Antero-Posterior Stability Index (APSI)



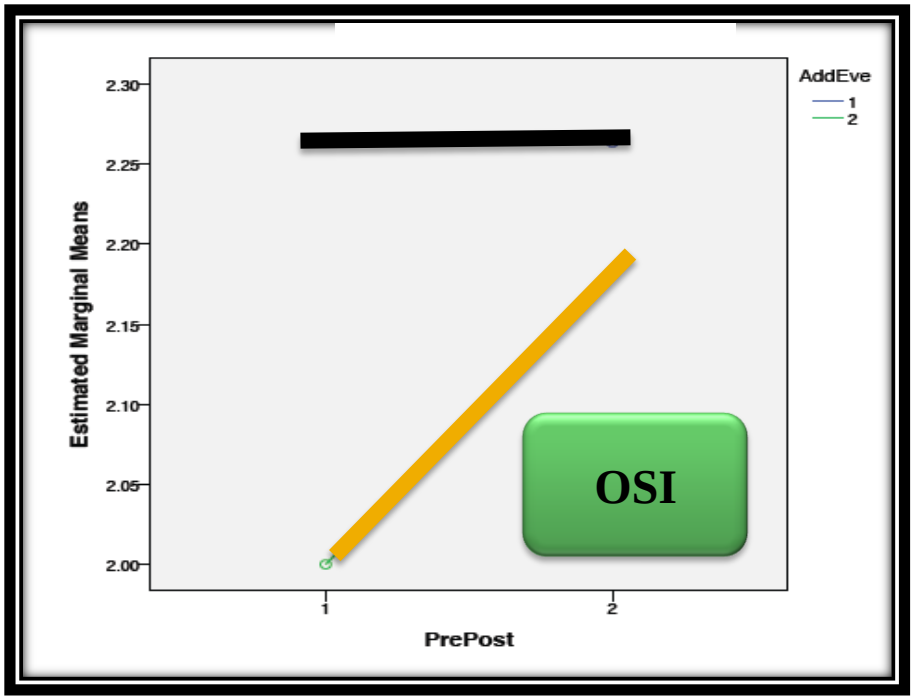

Overall Stability Index (OSI)
Mean values for the Overall Stability Index before and after cryotherapy application on the ankle evertors
2.28
2.26
2.24
2.22
2.2
2.18
2.16
2.14
2.2636
2.1818
Before Cryotherapy
After Cryotherapy
Overall Stability Index (OSI)

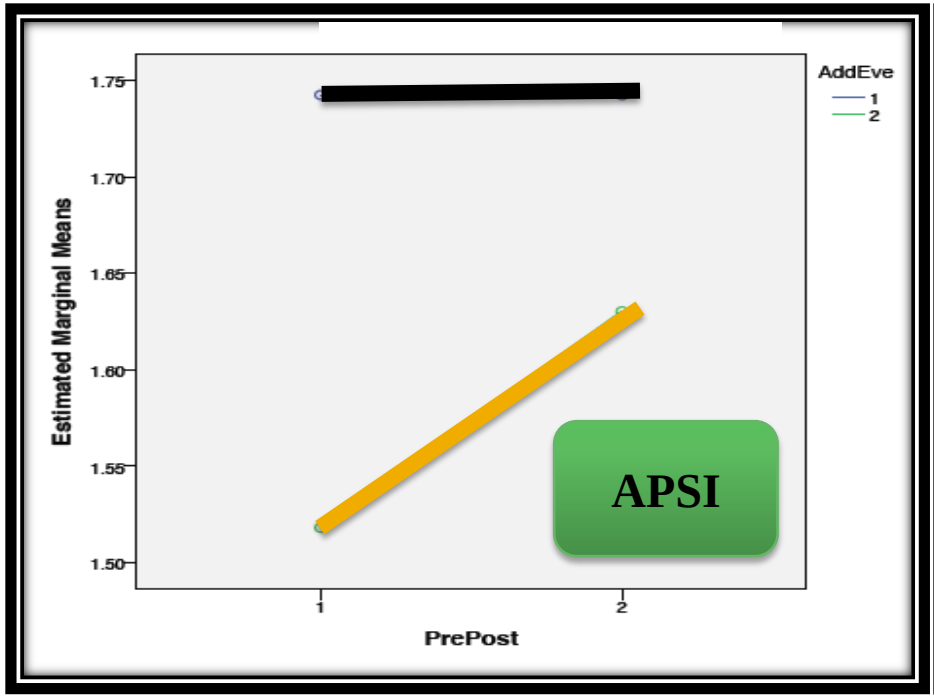

Medio-Lateral Stability Index (MLSI)
Mean values for the Medio-Lateral Stability Index before and after cryotherapy application on the ankle evertors
1.615
1.61
1.605
1.6
1.595
1.59
1.585
1.58
1.575
1.57
1.6121
1.5848
Before Cryotherapy
After Cryotherapy
Medio-Lateral Stability Index (MLSI)

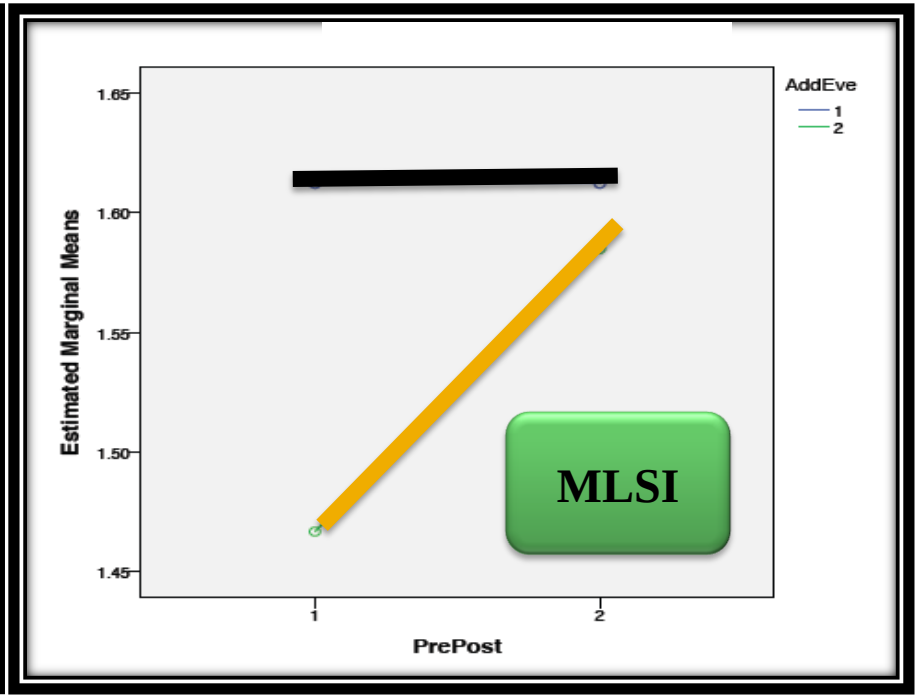
Antero-Posterior Stability Index (APSI)



Interaction





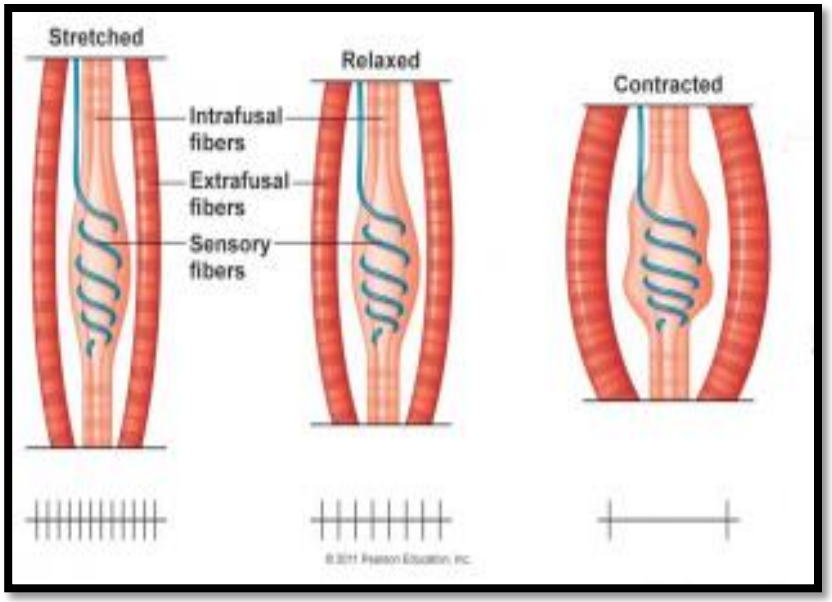


Discussion

The non significant reduction in postural stability indexes following cryotherapy application in both conditions may be attributed to

Cooling might not have reached the deep tissues.

Differential response of primary and secondary spindle.



Using peripheral information from Other mechanoreceptors → **Make up for the lack of proprioceptive information coming from the muscle** → **Maintain adequate joint proprioception and adjust their motor response**

Direct relationship between the decrease in nerve temperature, and the subsequent decrease in NCV

Not equal in nerve fibers with different diameters

Myelinated and small fibers.

Pain-transmitting fibers

Greatly Affected

Unmyelinated and large fibers.

proprioceptive afferent fibers from muscle spindles to the CNS

Mildly Affected

cooling

1- Increase joint and musculotendinous stiffness.
2- Inhibit the golgi tendon organ ability to perform reflexive protection.

increase in muscular performance around a joint as a secondary protective mechanism.

increase in muscle activity and a greater force production

Postural stability has been said to be a combination of three systems

Visual, Vestibular, Proprioceptive

When one system is impaired

Increased contribution from the two other systems is noted to maintain equivalent postural control.

Conclusion

The immediate effects of cryotherapy are not detrimental to lower extremity balance, and can be safely used without fear of re-injury due to decreased proprioception.

Limitations

- **A relatively young participant cohort was studied.**
- **Participants were not active.**
- **The current study was also limited to the immediate effects of crushed ice packs on the dominant leg.**

Recommendations for future studies

- Study the long-term effects of icing muscles.
- Developing modes, durations, and frequencies of ice application.
- Assess how much reduction in temperature is required before the decline in postural stability becomes apparent.
- Study other components (strength and flexibility), which might be affected after ice therapy and in upper extremity dominant sports.


Thank you!

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