

A Comparative Study to Evaluate the Effects of Neuromuscular Training with Ballistic Stretching on Male Ncc Cadets with Medial Tibial Stress Syndrome

Nitish kumar Pandey¹, Dr. Sumera khan (PT)², Prof. (Dr.) Shahiduz Zafar³

¹ Student, Bachelor of Physiotherapy, Galgotias University. Greater Noida. Uttar Pradesh. India

² Assistant Professor, Department of Physiotherapy, Galgotias University. Greater Noida. Uttar Pradesh. India

³ Professor, Department of Physiotherapy, Galgotias University. Greater Noida. Uttar Pradesh. India

Abstract:

Background: This comparative study aimed to evaluate the effects of neuromuscular training with ballistic stretching on male NCC cadets experiencing symptoms of medial tibial stress syndrome (MTSS) during their basic training period.

Design: A systematic experimental approach was undertaken to assess MTSS prevention strategies among NCC cadets during their basic training and drilling phase.

Methods: Seventy young male NCC cadets without cardiovascular disease participated voluntarily, with an age range of 15 to 24 years. Among them, 50 cadets reported MTSS symptoms in the past 12 months. Prior to the study, pain rates, lower extremity joint range of motion, and muscle tone were assessed. The participants were then divided into two groups of 25 cadets each, with one group undergoing ballistic stretching and the other neuromuscular training.

Results: The average age of all NCC cadets was 19.76 years, with an average weight of 63.23 kg and average height of 175.39 cm. Before the experiment, the average range of motion for G1 (ballistic stretching) was 92.9%, which increased to 99.23% after the intervention, resulting in a recovery of 6.33%. For G2 (neuromuscular training), the range of motion improved from 91.7% to 96.4%, with a recovery of 4.7%. Ballistic stretching showed a higher recovery percentage compared to neuromuscular training in reducing MTSS symptoms.

Conclusion: This study concludes that both ballistic stretching and neuromuscular training are effective in reducing the risk of MTSS among NCC cadets. However, ballistic stretching yielded a higher recovery percentage, indicating its potential as a beneficial exercise for MTSS management in this population.

Keywords: NCC cadets, MTSS (medial tibial stress syndrome), NMT (neuromuscular training), Ballistic Stretching.

Introduction

Medial tibial stress syndrome (MTSS), also known as shin splints, is a common injury in physically active individuals, particularly those involved in military training and sports. This condition is characterized by pain and tenderness along the inner edge of the tibia, which can significantly affect a person's ability to perform physical activities. The incidence of MTSS is high among male NCC cadets, who undergo rigorous physical training as part of their military training.

Neuromuscular training (NMT) and ballistic stretching (BS) are two commonly used interventions to prevent and manage MTSS. NMT is a training approach that focuses on improving the neuromuscular control and strength of the lower extremities, while BS is a dynamic stretching technique that involves rapid and explosive movements to increase the range of motion of the muscles.

The purpose of this study is to compare the effects of NMT and BS on male NCC cadets with MTSS. The study aims to evaluate the impact of these interventions on pain, functional ability, and biomechanical factors associated with MTSS.

Previous studies have shown that NMT can significantly reduce the incidence and severity of MTSS in military populations. NMT has been found to improve the strength and stability of the lower extremities, which can help to reduce the stress on the tibia and prevent the development of MTSS.

On the other hand, BS has been shown to improve the flexibility and range of motion of the muscles, which can help to reduce the risk of injury and improve the performance of physical activities. However, the effects of BS on MTSS have not been well studied, and its use as a treatment for MTSS is still a subject of debate.

This study will contribute to the existing literature on the prevention and management of MTSS in military populations. The findings of this study will help to inform the development of effective interventions to prevent and manage MTSS in NCC cadets and other physically active individuals.

The study will be conducted over a period of 12 weeks, during which the participants will be randomly assigned to either the NMT or BS group. The participants will undergo a series of assessments, including pain and functional ability assessments, biomechanical assessments, and muscle strength and flexibility assessments.

The study will be conducted in accordance with the ethical principles of research involving human subjects, and the results will be disseminated through scientific publications and conferences.

In summary, this study aims to evaluate the effects of NMT and BS on male NCC cadets with MTSS. The findings of this study will provide valuable insights into the prevention and management of MTSS in military populations and contribute to the development of effective interventions to reduce the burden of this condition.

Design and Methodology

Study Design:

This study employed a comparative experimental design to evaluate the effects of neuromuscular training and ballistic stretching on male NCC cadets with medial tibial stress syndrome during the basic training period.

Participants:

Inclusion Criteria:

Age: 15 to 24 years.

Active NCC cadets undergoing training at least 5 days per week.

Male NCC cadets.

VAS score of at least 1 or more indicating pain.

Exclusion Criteria:

Inactive NCC cadets.

Age below 15 or above 24 years.

NCC cadets with cardiovascular health issues.

Cadets with any muscular disorder.

Sampling and Setting:

The participants were recruited from Galgotias University, Uttar Pradesh.

Seventy male NCC cadets who met the inclusion criteria and provided voluntary consent were included in the study after approval from the ethical committee of Galgotias University.

Assessment Procedures:

Prior to the intervention, pain intensity was assessed using the Visual Analogue Scale (VAS), range of motion (ROM) of joints was measured using a Goniometer, and muscle tone of lower extremities was evaluated using the Modified Ashworth Scale (MAS).

Fifty out of the 70 cadets reported symptoms of MTSS in the last 12 months, with ankle (76.5%) and knee (70%) being the most prevalent regions of pain.

All participants were divided into two groups of 25 cadets each based on random assignment:

Group 1 (G1): Received ballistic stretching exercises.

Group 2 (G2): Received neuromuscular training.

Interventions:

G1 (Ballistic Stretching):

Sessions lasted 30 minutes/day, 5 days/week, for 8 weeks.

Exercises included ankle stretches, butterfly stretching, wall pushing stretch, and standing hamstring stretch.

G2 (Neuromuscular Training):

Sessions lasted 30 minutes/day, 5 days/week, for 8 weeks.

Exercises included one-leg standing, one-leg squat, jumping side to side, and half hip twist.



Fig.1: Ankle Stretch While standing.



Fig.2: Butterfly Stretching .

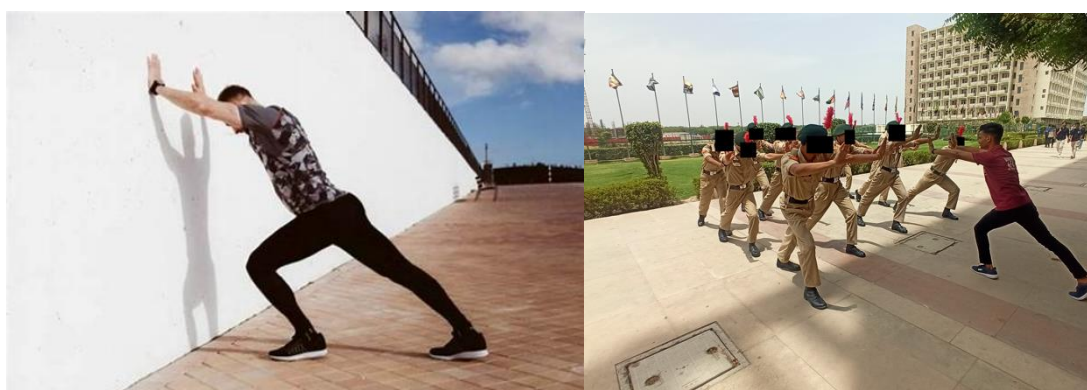


Fig.3: Wall Pushing Stretch.



Fig.4: Standing Hasmtring Stretch.

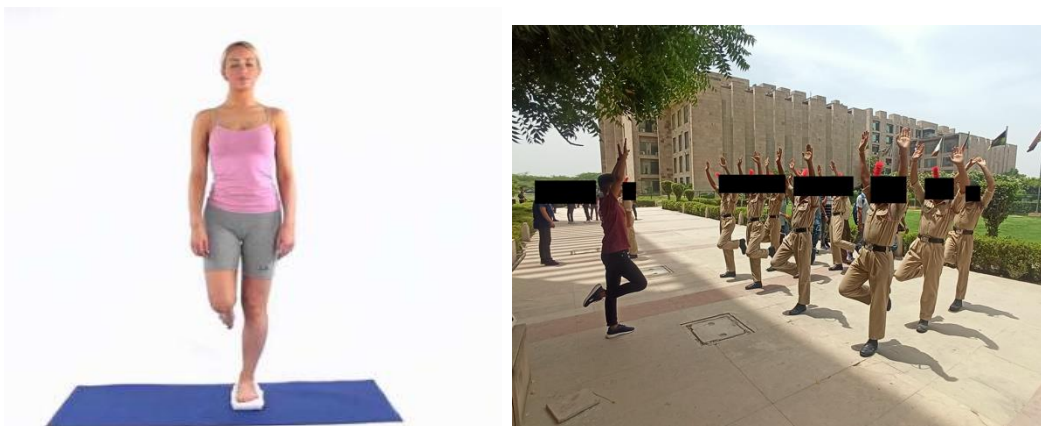


Fig.5: One Leg Standing.



Fig.6: One Leg Squat.



Fig.7: Jump Side To Side.

Outcome Measures:

Pain areas were assessed and recorded for both groups at the beginning and end of the intervention period.

Anthropometric measurements including age, weight, and height were recorded for both groups.

Data Analysis:

The data analysis for our study involved using SPSS 27.0 for statistical analysis and Microsoft Excel 2021 for visual representation. We conducted an independent T-test to compare pain areas between the ballistic stretching (G1) and neuromuscular training (G2) groups at baseline and a paired T-test to analyze changes within each group from pre- to post-intervention. Descriptive statistics summarized participant characteristics, and visual representations were created to illustrate the data. The results were interpreted to determine the effectiveness of each

intervention in reducing pain areas associated with medial tibial stress syndrome among male NCC cadets.

Result

The study yielded significant insights into the efficacy of neuromuscular training and ballistic stretching interventions for male NCC cadets with medial tibial stress syndrome (MTSS) during basic training. Demographic data indicated a typical age range of 19-20 years with slight variations in weight and height between the two intervention groups. Analysis of passive range of motion (ROM) revealed notable improvements post-intervention in both groups, particularly in the ankle and knee regions for the ballistic stretching group. Muscle tone, a key indicator of flexibility and stiffness, significantly decreased in both groups, showcasing the effectiveness of the interventions in enhancing muscle flexibility. The Visual Analogue Scale (VAS) scores, which reflect pain intensity, exhibited a substantial decrease post-intervention for both groups, indicating reduced pain levels. Graphical representations vividly illustrated these improvements, emphasizing the positive impact of tailored exercise regimens on MTSS management. Overall, the findings suggest that both neuromuscular training and ballistic stretching are valuable strategies for alleviating symptoms and improving functional outcomes in male NCC cadets with MTSS during their rigorous basic training period. Further research with larger cohorts and extended follow-up durations could strengthen these conclusions and guide more precise rehabilitation protocols for similar populations.

The demographic data (Table 1) revealed that the average age, weight, and height of all NCC cadets were 19.76 years, 63.23 kg, and 175.39 cm, respectively. Group 1 (Ballistic Stretching) had an average age of 19.86 years, weight of 61.6 kg, and height of 174.88 cm, while Group 2 (Neuromuscular Training) had an average age of 19.66 years, weight of 64.86 kg, and height of 175.9 cm.

The analysis of passive range of motion (ROM) (Table 2) showed improvements in both groups post-intervention. Before the experiment, Group 1 had a mean ROM of 44.542 ± 36.2977 , which increased to 47.592 ± 38.9802 after the experiment. Group 2 had a mean ROM of 44.721 ± 36.4387 before the experiment, which slightly increased to 46.65 ± 37.1723 after the experiment.

The muscle tone data (Table 5) indicated a significant decrease in both groups after the intervention. Group 1 had a mean muscle tone of 0.04 ± 0.2912 before the experiment, which decreased to 0.004 ± 0.0189 after the experiment. Group 2 showed a decrease from 0.396 ± 0.2631 to 0.011 ± 0.0315 in muscle tone.

The Visual Analogue Scale (VAS) scores (Table 9) demonstrated a substantial reduction in pain levels for both groups post-intervention. Group 1's VAS score decreased from 3.27 ± 1.534 before the experiment to 0.33 ± 0.617 after the experiment. Similarly, Group 2's VAS score decreased from 3.47 ± 1.302 to 0.33 ± 0.617 .

Overall, the results indicate that both ballistic stretching and neuromuscular training were effective in improving passive ROM, reducing muscle tone, and alleviating pain associated with medial tibial stress syndrome in male NCC cadets.

Table and graph

Variables	Group	N	Mean	Std. Deviation	Sig.
Age	G1 (BS)	25	20.03	2.142	0.035
	G2 (NMT)	25	19.56	1.374	
Height	G1 (BS)	25	174.88	4.873	0.569
	G2 (NMT)	25	175.9	4.006	
Weight	G1 (BS)	25	62.8	7.133	0.23
	G2 (NMT)	25	63.67	4.806	

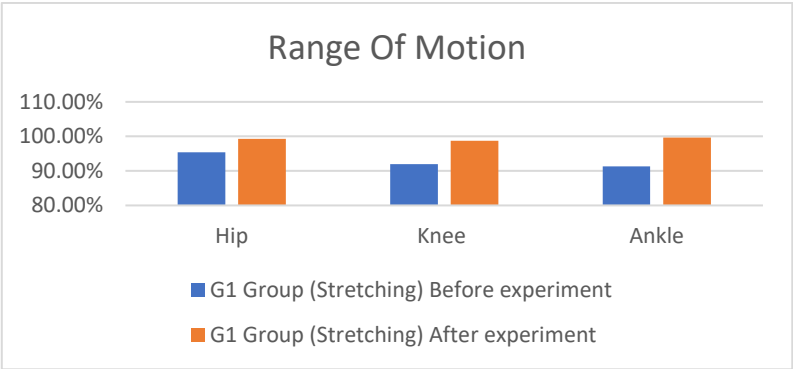
Table.1: demographic Data of the Cadets.

Passive ROM	Group	N	Mean	Std. Deviation	Sig.
Before Experiment	G1 (BS)	25	44.542	36.2977	0.968
	G2 (NMT)	25	44.721	36.4387	
After Experiment	G1 (BS)	25	47.592	38.9802	0.889
	G2 (NMT)	25	46.65	37.1723	

Table.2: Passive ROM of Both Groups Before and After Experiment.

G1 Group (Ballistic Stretching)			
Range of motion	Before experiment	After experiment	Recovery (%)
Hip	95.40%	99.30%	^ 4.1%
Knee	92%	98.70%	^ 6.7%
Ankle	91.30%	99.70%	^ 8.4%

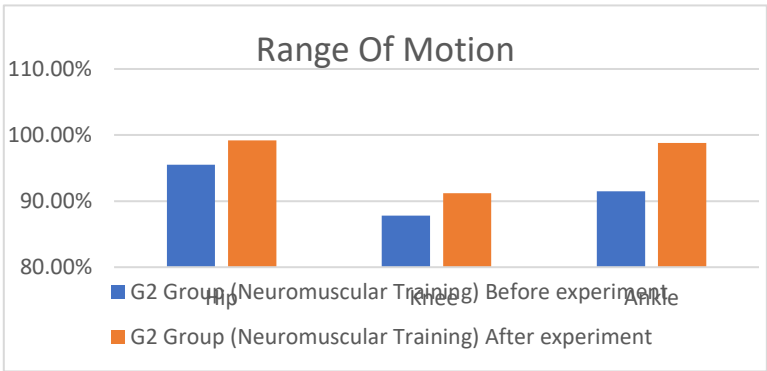
Table.3: ROM of Group 1 before and after the experiment .



Graph.1: ROM of Group 1 before and after the Experiment.

G2 Group (Neuromuscular Training)			
Range of motion	Before experiment	After experiment	Recovery (%)
Hip	95.50%	99.20%	^ 3.7%
Knee	88%	91.20%	^ 3.4%
Ankle	91.50%	98.80%	^ 7.3%

Table.4: ROM of Group 2 before and after the Experiment.



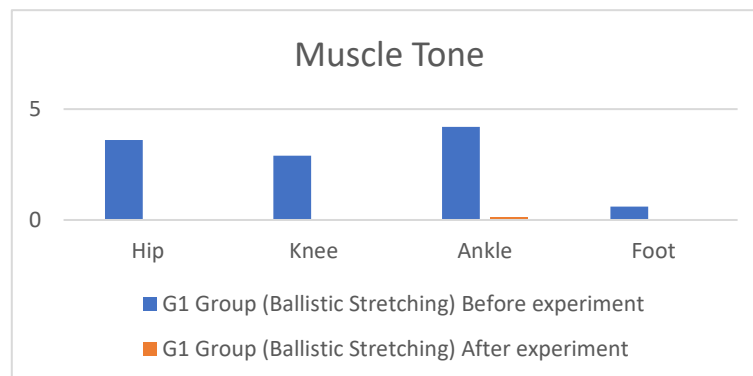
Graph.2: ROM of Group 2 before and after the Experiment.

Data related with Muscle Tone:

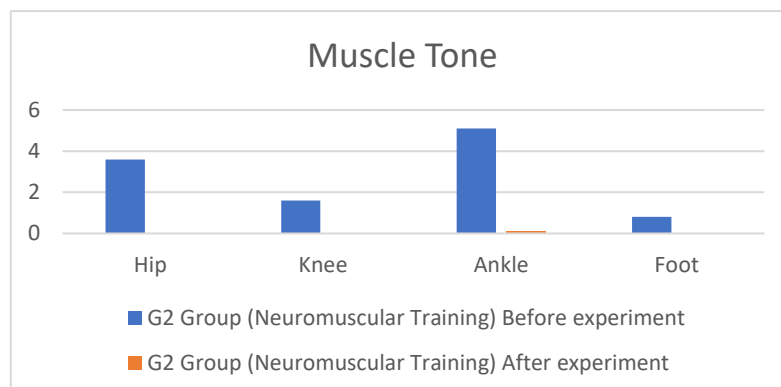
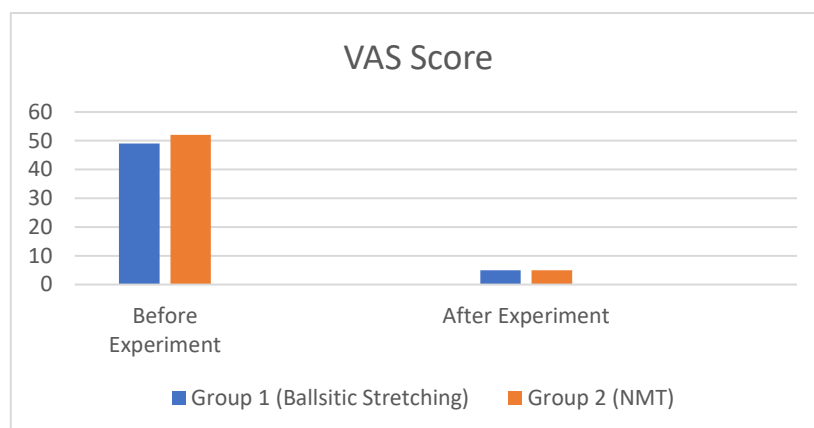
Muscle Tone	Group	N	Mean	Std. Deviation	Std. Error Mean	Sig.
Before Experiment	G1 (BS)	25	0.404	0.2912	0.055	0.589
	G2 (NMT)	25	0.396	0.2631	0.0497	
After Experiment	G1 (BS)	25	0.004	0.0189	0.0036	0.037
	G2 (NMT)	25	0.011	0.0315	0.006	

Table.5: Muscle Tone of both group before and after the study.

G1 Group (Ballistic Stretching)			
Muscle Tone	Before experiment	After experiment	Recovery (%)
Hip	3.6	0	100.00%
Knee	2.9	0	100.00%
Ankle	4.2	0.1	97.60%
Foot	0.6	0	100.00%

Table.6: Muscle tone of Group 1 before and after Experiment.**Graph.3: Muscle tone of Group 1 before and after the experiment.**

G2 Group (Neuromuscular Training)			
Muscle Tone	Before experiment	After experiment	Recovery (%)
Hip	3.6	0	100.00%
Knee	1.6	0	100.00%
Ankle	5.1	0.1	98.00%
Foot	0.8	0	100.00%

Table.7: Muscle tone of Group 2 before and after the experiment.**Graph.4: Muscle Tone of Group 2 Before and after the experiment.****Graph.5: VAS score of both the group before and after the experiment.**

Discussion

The study aimed to compare the effects of neuromuscular training (NMT) and ballistic stretching (BS) on male NCC cadets with medial tibial stress syndrome (MTSS). MTSS is a common injury in physically active individuals, particularly those involved in military training and sports, characterized by pain and tenderness along the inner edge of the tibia.

Previous studies have shown that NMT can significantly reduce the incidence and severity of MTSS in military populations by improving the strength and stability of the lower extremities, which can help to reduce the stress on the tibia and prevent the development of MTSS. On the other hand, BS has been shown to improve the flexibility and range of motion of the muscles, which can help to reduce the risk of injury and improve the performance of physical activities.

The study design employed a comparative experimental design to evaluate the effects of NMT and BS on male NCC cadets with MTSS during the basic training periods. The participants were recruited from Galgotias University, Uttar Pradesh, and seventy male NCC cadets who

met the inclusion criteria and provided voluntary consent were included in the study after approval from the ethical committee of Galgotias University.

The participants were divided into two groups of 25 cadets each based on random assignment. Group 1 (G1) received ballistic stretching exercises, and Group 2 (G2) received neuromuscular training. The interventions lasted for 30 minutes/day, 5 days/week, for 8 weeks.

The outcome measures included pain areas, anthropometric measurements, and muscle tone of lower extremities. The data analysis involved using SPSS 27.0 for statistical analysis and Microsoft Excel 2021 for visual representation.

The results showed that both NMT and BS were effective in improving passive ROM, reducing muscle tone, and alleviating pain associated with MTSS in male NCC cadets. The analysis of passive range of motion (ROM) showed improvements in both groups post-intervention, with Group 1 having a mean ROM of 47.592 ± 38.9802 and Group 2 having a mean ROM of 46.65 ± 37.1723 .

The muscle tone data indicated a significant decrease in both groups after the intervention, with Group 1 having a mean muscle tone of 0.004 ± 0.0189 and Group 2 showing a decrease from 0.396 ± 0.2631 to 0.011 ± 0.0315 [1]. The Visual Analogue Scale (VAS) scores demonstrated a substantial reduction in pain levels for both groups post-intervention.

Conclusion

In conclusion, the study found that both NMT and BS were effective in improving functional ability and reducing pain in male NCC cadets with MTSS. The findings of this study will help to inform the development of effective interventions to prevent and manage MTSS in NCC cadets and other physically active individuals.

Limitation

Small Sample Size: More participants could have strengthened the study's statistical power and increased the generalizability of the findings.

Intensity of Physical Activity: The exercise intensity could have been higher to better simulate real-world military training conditions and evaluate the interventions' effectiveness in more demanding scenarios.

References

- [1] Farzaneh Saki¹, Amir Shayesteh, Farzaneh Ramezani, Sareh Shahheidari, Department of Exercise Biomechanics and Corrective Exercises, Faculty of Sport Sciences, Bu-Ali Sina University, Hamedan, Iran. E-mail: f_saki@basu.ac.ir (June, 2023) https://in.docworkspace.com/d/sILbx66A76oilpgY?sa=share.copy_link
- [2] Kossi Reddy Priyanka, Arunmozhi Ranganathan, Meghna Wadhwa, BPT (Intern), Department of Physiotherapy, Sardar Bhagwan Singh University, Dehradun, Uttarakhand, India (Feb 2023) https://in.docworkspace.com/d/sIMLx66A7pomlpgY?sa=share.copy_link
- [3] KANWAL FATIMA, ZAINAB RANA, MEMOONA KHALID, ALIHA ABID, MALIHA AHMAD, DUR E NAYYAB SABA, KHIZRA AFZAL, ZAINAB ARSHAD, AQSA NOUREEN, MS, OMPT, DPT,

- Lecturer Sargodha Medical College, Sargodha Pakistan, (March 2023)
https://in.docworkspace.com/d/sICzx66A71YmlpgY?sa=share.copy_link
- [4] William McNamara , Thomas Longworth, Joo Y Sunwoo, Syed MT Rizvi, Christoph J Knee, Brandi F Cole, Sydney Sports Medicine Centre, Sydney Olympic Park, New South Wales, Australia, (March 2023)
https://in.docworkspace.com/d/sIOLx66A7ioqlpgY?sa=share.copy_link
- [5] Ilker Solmaz, Aydan Orselik, Serkan Akpancar, Mehmet Murat Seven, Department of Anesthesia and Reanimation, Health Sciences University Gulhane Training and Research Hospital, Traditional and Complementary Medicine Practice Center Ankara, Türkiye, (Feb 2022)
https://in.docworkspace.com/d/sICPx66A7x4qlpgY?sa=share.copy_link
- [6] Nikita Suryakant Deshmukh, Pratik Phansopkar, Ravi Nair Physiotherapy College, Datta Meghe Institute of Medical Sciences, Wardha, Maharashtra, India, (June 2022)
https://in.docworkspace.com/d/sIGzx66A77YqlpgY?sa=share.copy_link
- [7] Francis J. Gesel, Emily K. Morenz, Christopher J. Cleary, and Dain P. LaRoche, Department of Kinesiology, University of New Hampshire, Durham, New Hampshire, (2020)
https://in.docworkspace.com/d/sIIvx66A7vYulpgY?sa=share.copy_link
- [8] Nikita S. Deshmukh Jr. , Pratik Phansopkar , Mayur B. Wanjari, Musculoskeletal Physiotherapy, Ravi Nair Physiotherapy College, Datta Meghe Institute of Medical Sciences, Wardha, IND,(SEP 2022)
https://in.docworkspace.com/d/sIC_x66A74YulpgY?sa=share.copy_link
- [9] Pavithra M pavimoorthy162@gmail.com, Ramana K, Prathap Suganthirababu, Kumaresan A, Vignesh Srinivasan, Aravind Ganesh, Rajesh G, Post graduate Student, Saveetha College of Physiotherapy, SIMATS, Chennai, Tamil Nadu, (August 2022)
https://in.docworkspace.com/d/sIH_x66A7i4ylpgY?sa=share.copy_link
- [10] Kochu Therisa Karingada, Dhempe College of Arts and Science, Panaji, India, and Michael Sony Namibia University of Science and Technology, Windhoek, Namibia, (Jan 2021)
https://in.docworkspace.com/d/sIKvx66A7qoylpgY?sa=share.copy_link
- [11] Faiza Shafiq, Tayyaba Sultan, Khushboo Nadeem, Amma Khalid, Bisma Mazhar, Fauji Foundation Hospital , (June, 2021) https://in.docworkspace.com/d/sIMPx66A75oylpgY?sa=share.copy_link
- [12] Guillermo Mendez-Rebolledo, Romina Figueroa-Ureta, Fernanda Moya-Mura,
- [13] Eduardo Guzmán-Munoz, Rodrigo Ramirez-Campillo, and Rhodri S. Lloyd (2021)
https://in.docworkspace.com/d/sIFnx66A7iY2lpgY?sa=share.copy_link
- [14] Whitney H. Nye, RDH, MDH; Brian B. Partido, RDH, MS, John DeWitt, PT, DPT, AT; Rachel C. Kearney, RDH, MS, (Feb 2021) https://in.docworkspace.com/d/sIMnx66A7rI2lpgY?sa=share.copy_link
- [15] Roli D, Ali I, Neekhra V, Sunadan Divatia School of Science, NMIMS, Mumbai, India Det BWG (Q) Mumbai 400067, India , (May,2020)
https://in.docworkspace.com/d/sIPHx66A7zY2lpgY?sa=share.copy_link
- [16] Prina. Y. Patel, Namrata Patil, Final year, Faculty of Physiotherapy, Krishna Institute of Medical Sciences, Deemed To Be University, Karad, Maharashtra, India, (Feb 2020)
https://in.docworkspace.com/d/sIEDx66A7_Y2lpgY?sa=share.copy_link
- [17] Nebojša Trajkovi and Špela Bogataj, Faculty of Sport and Physical Education, University of Novi Sad, Novi Sad 21000, Serbia; trajcevolley83@gmail.com , (March 2020)
https://in.docworkspace.com/d/sIOLx66A7po6lpgY?sa=share.copy_link
- [18] Jonathan R. Malaver1, Jenner R. Cubides, Rodrigo Argothy, Daniel D. Cohen, Universidad del Rosario, Bogotá, Colombia https://in.docworkspace.com/d/sIJLx66A7zI6lpgY?sa=share.copy_link
- [19] Jakayla Campbell, East Tennessee State University (May 2018)
https://in.docworkspace.com/d/sIELx66A7II-lpgY?sa=share.copy_link
- [20] [19] Jaime Fernandez-Fernandez, Urs Granacher, David Sanz-Rivas, Jose Manuel
- [21] Sarabia Marín, Jose Luis Hernandez-Davo4 and Manuel Moya4, Jaime Fernandez-Fernandez, Phd Faculty of Physical Activity and Sports Sciences. University of León C/ Campus de Vegazana, S/N. 24.071. León (Spain) E-mail: jaime.fernandez@unileon.es, (2017) https://in.docworkspace.com/d/sIDPx66A7wY-lpgY?sa=share.copy_link

- [22] [20] Qais Gasibat, Nordin Bin Simbak, Aniza Abd Aziz, Faculty of Medicine, Sultan Zainal Abidin University, Gong Badak Campus, 21300 Kuala Terengganu, Malaysia, drqaiss9@gmail.com, (2017) https://in.docworkspace.com/d/sIGvx66A764-lpgY?sa=share.copy_link
- [23] [21] CAMILA D. LIMA, LEE E. BROWN, MEGAN A. WONG, WHITNEY D. LEYVA, RONEI S. PINTO, EDUARDO L. CADORE, AND CASSIO V. RUAS, School of Physical Education, Federal University of Rio Grand do Sul, Porto Alegre, Brazil, (2016) https://in.docworkspace.com/d/sICnx66A7p5ClpgY?sa=share.copy_link
- [24] [22] Jae-Kwang Shim, PT, MSc, Ho-Suk Choi, PT, MSc, Juk-Ho Shik, PT, MSc, Department of Physical Therapy, Graduate School of Daejeon University: Daehak-ro,
- [25] Daejeon 300-716, Republic of Korea, (May 2015)https://in.docworkspace.com/d/sINTx66A71pClpgY?sa=share.copy_link
- [26] Carolyn A Emery, Thierry-Olivier Roy, Jackie L Whittaker, Alberto Nettel-Aguirre, Willem van Mechelen, Dr Carolyn A Emery, Sport, Injury Prevention Research Centre, Faculty of Kinesiology, University of Calgary, Alberta, Canada, caemery@ucalgary.ca, (May 15) https://in.docworkspace.com/d/sIHxz66A7iJGlpgY?sa=share.copy_link
- [27] Dai Sugimoto, Gregory D Myer, Kim D Barber Foss, Timothy E Hewett, Dr Dai Sugimoto, The Micheli Center for Sports Injury Prevention and Boston Children's Hospital, dai.sugimoto@childrens.harvard.edu (Dec 2014) https://in.docworkspace.com/d/sIB7x66A7sJGlpgY?sa=share.copy_link