Chapter

Rehabilitation of Lateral Ankle Sprains in Sports

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Abstract

Lateral ankle sprains are one of the most common injuries in athletes. The rate of injury is as high as 70%. The most commonly involved ligament is the anterior talofibular ligament (ATFL), followed by the calcaneofibular (CFL) and posterior talofibular ligament (PTFL). The common mechanism of injury is inversion with excessive ankle supination in forced plantarflexion when the ankle joint is in its most unstable position. There are three grades of ankle sprains: Grade I, mild with an incomplete tear of ATFL; Grade II, moderate with a complete tear of ATFL with or without an incomplete tear of CFL; and Grade III, severe with complete tear of ATFL and CFL. Grades I and II respond well to functional treatment. Functional treatment includes RICE protocol, i.e., rest, ice, compression, and elevation. It also includes range of motion and strengthening exercises, proprioceptive training, and sports-specific exercises. Bracing and taping of the ankle joint help in preventing the sprains and also reduce the recurrence of the injury. Grade III ankle injury may be treated with surgery if the symptoms persist post functional treatment. The guidelines provided for the treatment of ankle sprains are of general validity, but each athlete is different with different needs. Hence, a personalized exercise protocol should be followed to achieve best results.

Keywords: lateral ankle sprains, athlete, sports, rehabilitation, exercise

1. Introduction

The ankle joint is the most commonly affected joint in sports of which lateral ankle sprains are the most common. The sports in which lateral ankle sprains are a frequent occurrence are football, basketball, running, volleyball, tennis, badminton, ballet/dance, etc. In many sports the rate of injury is as high as 70%. Unilateral ankle sprains are reported in 52%, whereas for bilateral ankle sprains, the number is 48%. The recurrence rate of ankle injury in athletes is 73% [1]. The incidence is high between 15 and 19 years of age with no significant difference in the gender [2].

2. Biomechanics

The lateral ankle compartment comprises the anterior talofibular ligament (ATFL), the calcaneofibular ligament (CFL), and the posterior talofibular ligament (PTFL). The most commonly injured ligament is the ATFL as it is the weakest of all three ligaments. In frequency of injury, the ATFL is followed by the calcaneofibular ligament CFL [3]. The PTFL is rarely injured as it is the strongest of all the three

ligaments. The most common mechanism of injury in lateral ankle sprains is when, in forced plantar flexion, inversion occurs with excessive ankle supination. In that position the ankle joint is the most unstable. In the course of the inversion, the body's center of gravity moves over the ankle leading to ankle sprains [2]. There are three clinical grades of lateral ankle sprains [4–6].

Grade I—Mild. There is an incomplete tear of ATFL with little swelling and tenderness, minimal or no functional loss, and no mechanical joint instability.

Grade II—Moderate. Complete tear of ATFL with or without an incomplete tear of CFL with moderate pain, swelling, and tenderness over the involved structures; some joint motion is lost, and joint instability is mild to moderate.

Grade III—Severe. Complete tears of ATFL and CFL with marked swelling, hemorrhage, and tenderness. There is loss of function, and joint motion and instability are markedly abnormal.

3. Chronic ankle instability (CAI)

Athletes with chronic ankle instability give a history of two or three severe ankle sprains with the main complaint being intermittent giving out of the ankle. The athlete often complains of difficulty and apprehension on uneven surfaces. Even mild exacerbations lead to short-term dysfunction. It is characterized by residual ankle instability as a result of either mechanical ankle stability or functional ankle instability or a combination of both [6].

4. Mechanical and functional instability

Mechanical instability (MI) and functional instability (FI) are both due to recurrent lateral ankle sprains. Mechanical instability is defined as an increase in the accessory movements in the joint leading to hypermobility. Residual MI usually results from a tear or lengthening of one of the ligamentous structures supporting the joint and suggests a suboptimal healing process after injury. A lesser known phenomenon is hypomobility leading to ankle instability. Joint hypomobility can be intra-articular or extra-articular, giving rise to restricted range of motion at the ankle. Hypomobility occurs at the subtalar, talocrural joint, distal tibiofibular joint, and proximal tibiofibular joint [7, 8].

As the joint develops MI, proprioceptive changes occur, which result in alterations in defense mechanism to prevent injuries, thus leading to CAI. FI can result in balance deficits, joint position sense deficits, delayed peroneal muscle reaction time, altered common peroneal nerve function, strength deficits, a decreased range of motion (ROM), sinus tarsi syndrome, and anterolateral impingement syndrome.

5. Rehabilitation

Early mobilization of ankle sprains as compared with cast immobilization has been shown to be more comfortable as it results in less pain and provides for an earlier return to work. Cast immobilization does not improve healing compared with an active mobilization rehabilitation program and may have negative implications in relation to muscle wasting and stiffness. Functional treatment is considered better in achieving more effective mobilization and an earlier return to daily activities. Lateral ankle sprains respond well to the conservative treatment which includes initially RICE—rest, ice, compression, and elevation—followed by early

mobilization. Rehabilitation focuses on restoring ROM, strength, balance, and normal gait patterns. Functional rehabilitation begins on the day of injury and continues until pain-free gait and activities are attained. Functional rehabilitation has four aspects: ROM, strengthening, proprioception, and activity-specific training. Ankle joint stability is a prerequisite to the institution of functional rehabilitation. Since Grade I and Grade II injuries are considered stable, functional rehabilitation should begin immediately.

5.1 Reduce pain and swelling

5.1.1 Rest

Rest is prescribed to avoid undue stress on the joint. It is required to reduce the metabolic demands on the injured tissue and thus avoid increased blood flow. It also helps in avoiding stress on the injured tissue that might disrupt the fragile fibrin bond, which is the first element of the repair process. Rest can be applied selectively to allow some general activity, but athletes must avoid stressful activities.

5.1.2 Ice

Cryotherapy involves a nice bath with a temperature of 4°–10°C for 12–20 min, one to three times per day, and applying an ice pack to the injured area for 15–20 min, one to three times per day. Ice therapy should be started immediately after the injury and ice application initiated within day 0 or day 1. Both have shown better results and return to full activity as compared to when the ice was applied after 48 h. Ice application should provide deep penetration to gain full benefits. Also the ice should not be held immobile in one area or frostbites may occur.

Ice application causes vasoconstriction which decreases blood flow and therefore swelling to the injured area. The lowering of tissue temperature decreases the metabolism and the chemical actions of cells and thus lowers the oxygen and nutrient needs in the affected area. Decreased blood flow limits edema; there is less histamine release and therefore less capillary breakdown than would normally be present after injury. There is better lymphatic drainage from the injured area because of the lower pressure on the extravascular fluid (**Table 1**).

Hence, the rationale of minimum 15 min of cryotherapy per treatment.

5.1.3 Compression and elevation

Compression and elevation work better in combination with cryotherapy. Compression with an adhesive bandage and a foot elevation of more than 45° is the standard prescribed treatment for lateral ankle sprains. Compression can also be

Stage	Duration (min)	Sensation
Stage 1	1–3	A cold feeling is noted
Stage 2	2–7	Burning or aching
Stage 3	5–12	Local numbness and anesthesia (decreased conductivity of regional nerve fibers)
Stage 4	12–15	Reflex deep tissue vasodilation without an increase in metabolism

Table 1.
Cryotherapy generates four stages of sensation [9].

achieved by both adhesive and nonadhesive tapes, but it is important to renew them timely as the compression wears off with time. Normally a nonadhesive tape should be renewed after 3 days, and an adhesive tape should be renewed after 5 days [10]. This prevents swelling and immobilizes the injured area which prevents further injury and thus promotes healing. Passive exercises can be started in stage 3 which is the local numbness stage in which the athlete experiences less discomfort when exercising.

5.2 Improve range of motion (ROM)

5.2.1 Range of motion exercises

Range of motion exercises include both active and passive exercises. Achilles tendon stretching should be started within 48–72 h in a pain-free range irrespective of weight-bearing status of the athlete to avoid the tissue from contracting. Self-passive stretches can also be given with the help of a towel. Next, the stretches should be extended to weight-bearing position, which can be done by standing on an inclined surface and asking the athlete to shift his/her weight forward. The stretches should be maintained 15–30 s, repeated 10 times, and should be done 3–5 times per day. Passive exercises are followed by active ROM exercises whereby the athlete can do alphabet letter exercises, i.e., drawing letters in the air both in upper and lower cases. The exercises should be done 2–3 times per hour, 4–5 times per day. Stationary biking can also be included to improve dorsiflexion and plantar flexion motion in a controlled environment while providing a cardiovascular workout for the athlete.

5.2.2 Manual therapy

Manual therapy is started within 48 h after the injury when ankle dorsiflexion is restricted. To improve range, a gentle oscillating passive joint mobilization is given. Here the talus is moved posteriorly. By the convex concave rule, when the talus is moved posteriorly, the convex talus rolls upward and slides posteriorly on the concave surface of the crux, thus improving the dorsiflexion range. In a technique described by Maitland [11], with the athlete in supine position, the affected foot is taken in the available pain-free ROM in dorsiflexion. Gentle oscillations are then given to the joint to avoid pain and spasm. The oscillations are given for 60 s, 2 or more times with a rest of 10 s taken in between.

Mobilization with movement is another technique of manual therapy suggested by Mulligan [12] which helps with increasing the ROM actively. In this technique the athlete position is high kneeling with weight-bearing on the affected limb or standing with the affected foot placed forward. In both positions the ankle is in neutral position. A padded belt is used for mobilization and is placed in such a way that the bottom of the belt is leveled with the inferior margin of the medial malleolus. The position of the mobilization belt allows the examiner to fix the talus and calcaneus with his/her hands and draws the tibia forward on the talus, thereby creating a relative posterior talar glide. Once the glide is given, the athlete actively dorsiflexes the ankle in a pain-free range. The glide should be maintained throughout the movement. Two sets of 10 repetitions, separated by a 2-min rest, are performed. Once ROM is achieved and swelling and pain are controlled, the athlete is ready to proceed to the strengthening phase of rehabilitation. Guidelines suggest that a normal ROM should be achieved within 2 weeks after injury [13].

5.3 Improve strength

Strengthening of weakened muscles is essential for a quick recovery and thus helps in preventing re-injury. An eversion to inversion strength ratio >1.0 is an important indicator of ankle sprain injury [14, 15]. Exercises should focus on strengthening the peroneal muscles because insufficient strength in this group of muscles has been associated with CAI and recurrent injury. However, all muscles of the ankle should be targeted, and all exercises should be performed bilaterally. When the training is performed bilaterally, we can expect substantial strength gains in both extremities. Strengthening begins with isometric exercises performed against an immovable object in four directions of ankle movement and is progressed to dynamic resistive exercises (isotonic exercises) using ankle weights, surgical tubing, or resistance bands.

With a structured rehabilitation program, the athlete can create continuous goals and more easily appreciate improvements. A daily adjustable progressive resistance exercise (DAPRE) strength progression, originally described by Knight [16] and later modified by Perrin and Gieck [17], can be used to create a structured progression of exercises for the athletes. The strengthening exercises should be performed with an emphasis on the eccentric component. Athletes should be instructed to pause 1 s between the concentric and eccentric phases of exercise and perform the eccentric component over a 4-s period. Concentric contraction refers to the active shortening of the muscle with resultant lengthening of the resistance band, while eccentric contraction involves the passive lengthening of the muscle by the elastic pull of the band. Resistive exercises should be performed (2–3 sets of 10–12 repetitions) in all four directions twice a day. As weight-bearing strengthening exercises, toe raises, heel walks, and toe walks should be incorporated to regain strength and coordination. Toe curling exercises with paper or towel and marble picking should also be included for strengthening of the foot musculature (**Table 2**).

5.4 Improve proprioception and balance

Once the athlete achieves full weight-bearing without pain, proprioceptive training is started for the recovery of balance and postural control. Various devices have been designed for this phase of rehabilitation. Their use in performance with a series of progressive drills has effectively returned athletes to a high functional level. As somatosensory and visual feedback is altered, the athlete must develop consistent motor patterns even with inconsistent feedback. Furthermore, the athlete can be tested under various visual and support conditions. The simplest device for proprioceptive training is the wobble board. The athlete is instructed to stand on the wobble board on one foot and shift his or her weight, causing the disc's edge to scribe a continuous circular path. These exercises can be progressed by having the athlete use different-sized hemispheres and by varying visual input. A common progression when performing balance exercise is to move from a position of non-weight-bearing to weight-bearing, bilateral stance to unilateral stance, eyes open to eyes closed, firm surface to soft surface, uneven or moving surface. Another variant is when the therapist manually moves the ankle and foot through various positions and then asks the athlete to actively and passively replicate the joint angles. This helps improving joint position sense. As the body is trained to sense directions from perturbation, sensory input is received from all parts of the body and sent to the central nervous system via afferent pathways. Therefore, conscious and unconscious appreciation is important to protect functional joint stability. Proprioception

1st set: 10 repetitions	2nd set: 10 repetitions	3rd set: 10 repetitions	4th set: 10 repetitions*
0 lbs (0 kg)	5 lbs (0.23 kg)	1 lbs (0.45 kg)	1.5 lbs (0.68 kg)
1(0.45)	1.5 (0.68)	2 (0.91)	3 (1.36)
2 (0.91)	3 (1.36)	4 (1.81)	5 (2.27)
3 (1.36)	4.5 (2.04)	6 (2.72)	8 (3.63)
4 (1.81)	6 (2.72)	8 (3.63)	10 (4.54)
5 (2.27)	7.5 (3.40)	10 (4.54)	15 (6.80)
7.5 (3.40)	11.25 (5.10)	15 (6.80)	20 (9.07)
10 (4.54)	15 (6.80)	20 (9.07)	25 (11.34)
12.5 (5.67)	18.75 (8.51)	25 (11.34)	30 (13.61)
15 (6.80)	22.5 (10.21)	30 (13.61)	35 (15.88)
17.5 (7.94)	26.25 (11.91)	35 (15.88)	40 (18.14)
20 (9.07)	30 (13.61)	40 (18.14)	45 (20.41)
22.5 (10.21)	33.75 (15.31)	45 (20.41)	50 (22.68)
25 (11.34)	37.5 (17.01)	50 (22.68)	55 (24.95)
27.5 (12.47)	41.25 (18.71)	55 (24.95)	60 (27.22)
30 (13.61)	45 (20.41)	60 (27.22)	65 (29.48)
32.5 (14.74)	48.75 (22.11)	65 (29.48)	70 (31.75)

**The athlete should proceed to the next line when he/she can lock out (complete with correct form) the 4th set 10 times.*

Table 2.
Structured strength training progression.

is useful for preventing injury in slow, moderately quick, or even quick tasks; however, it may not be adequate for forces that challenge the neuromuscular system at the highest levels. The therapist should also focus on variability of speed and intensity while training proprioception and balance (**Table 3**).

5.5 Sports-specific training

Once the distance walked by the athlete is no longer limited by pain, he/she can be put on sports-specific training or advanced training. The use of sports-specific means of training, parallel to general conditioning training, leads to considerable improvement of performance among athletes. The sports-specific training includes intricate activities like jogging which eventually progresses to running, backward running, and pattern running. Circles and figure of 8 are commonly employed patterns. These activities can also be done using ankle weight to increase the difficulty level. Star excursion balance training can also be used in which the athlete stands on the sprained ankle while using another foot to reach as far as possible in eight directions as outlined in the Star Excursion Balance Test. The exercise can consist of 8–10 rounds clockwise and counterclockwise foot reach with 3 s rest between each direction. The difficulty level can be increased by adding variations to the exercise such as with the sprained ankle (affected leg's knee) flexed, eyes opened, followed by eyes closed. At higher speed, i.e., at an angular velocity of 120°/s, the eversion to inversion ratio is >1.0, adding to the risk of injuries [19]. Hence, resistance bands can be used to strengthen the ankle musculature, i.e., training an athlete on an isokinetic machine while tying the band on the affected ankle and with the therapist holding the other end and maintaining the resistance through the movement.

No material	Ball	Balance board	Ball + balance board
Exercise 1 One-legged stance with the knee flexed. Step out on the other leg with the knee flexed, and keep balance for 5 s. Repeat 10 times for both legs **Variations** 1 2 3 4	**Exercise 3** *Make pairs. Both stand in one-legged stance with the knee flexed. Keep a distance of 5 m. Throw and/or catch a ball 5 times while maintaining balance. Repeat 10 times for both legs **Variations** 1 2	**Exercise 5** One legged stance on the balance board with the knee flexed. Maintain balance for 30 s and change stance leg. Repeat twice for both legs **Variations** 1 2 3 4	**Exercise 10** Athlete stands with both feet on the balance board. Throw and/or catch a ball 10 times with one hand while maintaining balance. Repeat twice
Exercise 2 One-legged stance with the hip and the knee flexed. Step out on the other leg with the hip and knee flexed, and keep balance for 5 s. Repeat 10 times for both legs **Variations** 1 2 3 4	**Exercise 4** *Make pairs. Stand both in one-legged stance with the hip and knee flexed. Keep a distance of 5 m. Throw and/or catch a ball 5 times while maintaining balance. Repeat 10 times for both legs **Variations** 1 2	**Exercise 6** One-legged stance on the balance board with the hip and knee flexed. Maintain balance for 30 s and change stance leg. Repeat twice for both legs **Variations** 1 2 3 4	**Exercise 11** Athlete stands in one-legged stance with the knee flexed on the balance board. Throw and/or catch a ball 10 times with one hand while maintaining balance. Repeat twice for both legs **Variations** 1 2
Variations on basic exercises: 1. The standing leg is stretched 2. The standing leg is flexed 3. The standing is stretched and first eyes are opened, followed by eyes closed 4. The standing leg is flexed and first eyes are open followed by eyes closed 5. The standing leg is stretched and upper hand technique (throwing the ball from above the head) 6. The standing leg is flexed and upper hand technique 7. The standing leg is stretched and lower hand technique (throwing the ball while keeping the hand below the waist) 8. The standing leg is flexed and lower hand technique *This can be done by the therapist, and the athlete or the athlete can stand opposite to the wall at a distance of 5 m		**Exercise 7** Step slowly over the balance board with one foot on the balance board. Maintain the balance board in a horizontal position while stepping over. Repeat 10 times for both legs	**Exercise 12** Athlete stands in one-legged stance with the hip and knee flexed on the balance board; the other has the same position on the floor. Throw and/or catch a ball 10 times with one hand while maintaining balance. Repeat twice for both legs **Variations** 1 2
		Exercise 8 Stand with both feet on the balance board. Make 10 knee flexions while maintaining balance	**Exercise 13** Athlete stands with both feet on the balance board. Throw the ball with an upper hand technique 10 times while maintaining balance. Repeat twice for both legs **Variations** 5 6 7 8
		Exercise 9 One-legged stance on the balance board with the knee flexed. Make 10 knee flexions while maintaining balance. Repeat twice for both legs	**Exercise 14** Athlete stands in one-legged stance with the knee flexed on the balance board. Throw the ball with an upper hand technique 10 times while maintaining balance. Repeat twice for both legs **Variations** 5 6 7 8

Adapted from: The Effect of a Proprioceptive Balance Board Training Program for the Prevention of Ankle Sprains: A Prospective Controlled Trial [18].
**All the exercises done by the Athlete, can be done in pairs or the athlete can stand opposite to a wall at distance of 5 m*

Table 3.
Proprioceptive exercises (the variation and changes should be according to the athlete's requirements).

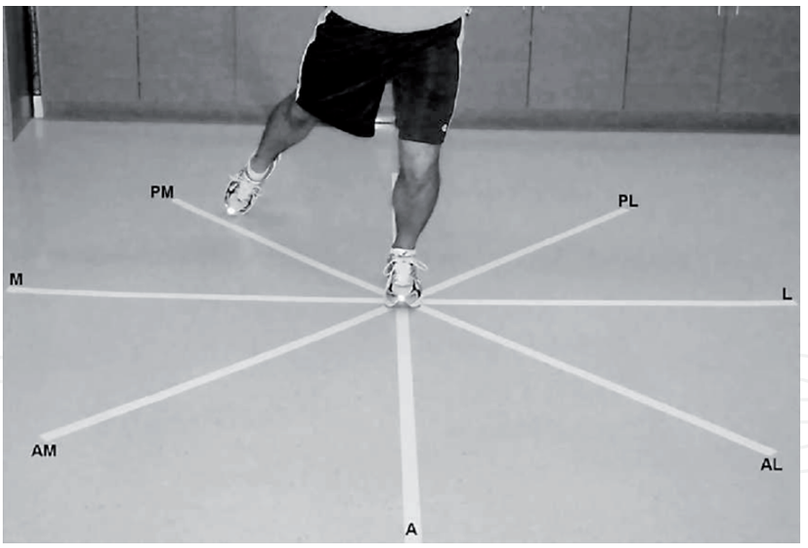

Figure 1.
Star excursion balance test [20]. Note: Star Excursion Balance Test for left-leg dominant participants (Posterior direction is behind athlete's right leg). Abbreviations: A, anterior; AM, anterior-medial; M, medial; PM, posterior-medial; P, posterior; PL, posterior-lateral; L, lateral; AL, anterior-lateral.

This should be done for 15–20 repetitions 1–2 times/day and with increasing progression. Specific training can include functional activities on various surfaces, e.g., trampoline and foam, and in water with weights. Repetitions should be 5–20, 1–2 times/day (**Figure 1**).

5.6 Criteria for return to sports

The athlete can participate fully in the sporting activity once the pain has been reduced completely. The progression should be gradual in order to stress the ligaments without causing further harm. Full participation should be allowed once the athlete has complete range of motion, 80–90% of preinjury strength and a normal gait pattern including the ability to perform sports-specific activities such as cutting and landing without any compensation due to the injury. The athlete should be able to complete a full practice without pain or swelling.

5.7 Taping and bracing

Taping and bracing the ankle can be used for prevention as well as for rehabilitation. Application of tapes and braces is helpful in the prevention of lateral ankle sprains and in the recurrence of injuries. Application of a tape or a brace increases the afferent feedback from cutaneous receptors, which lead to improved ankle joint position sense. This increased stimulation results in a more appropriate positioning of the unstable ankle and protects it from re-injury. Hence it helps improve joint position sense through proprioceptive mechanism.

a. Taping: The major role of taping is to prevent extreme range of movements and to reduce abnormal patterns of movements of the ankle. Various techniques are in use, but the most common techniques are basket weave with stirrup and heel lock and basket weave and heel lock techniques. Taping has mechanical effects: it decreases movement of inversion and plantar flexion and increases the force required for a specific displacement in inversion and plantar flexion. Taping helps in decreasing the extent of non-weight-bearing talar tilt. It also limits the full weight-bearing talar tilt. Athletes with the greatest instability benefit most

from the tape. Although taping does improve mechanical instability, the restricting effect is lost after varying periods of exercise. About 40% of taping effect is lost after 10 min of vigorous exercise like jumping, pivoting, running, etc.

b. Kinesio™ taping: Unlike structurally supportive tape, such as white athletic tape, Kinesio™ tape is therapeutic in nature. It differs from the traditional athletic tape with respect to its elasticity, i.e., it can be stretched up to 140% of its original length before applying it on the skin. It provides a constant pulling (shear) force to the skin unlike traditional white athletic tape. The fabric of this tape is air permeable and water resistant and can be worn for repetitive days. The proposed mechanisms in which the Kinesio™ tape works are:

   i. It corrects muscle function by strengthening weakened muscles.

   ii. It improves circulation of blood and lymph by eliminating tissue fluid or bleeding beneath the skin by moving the muscle.

   iii. It reduces pain through neurological suppression.

   iv. It repositions subluxated joints by relieving abnormal muscle tension, helping to return the function of fascia and muscles [21].

   v. It improves proprioception through increased stimulation to cutaneous mechanoreceptors [22].

c. Bracing: Ankle bracing can make a significant contribution to preventing lateral ankle sprains. It also shows a significant reduction in the frequency of ankle sprain recurrence. Ankle braces have certain advantages over tape allowing self-application without the expertise of qualified personnel. They are convenient to apply and to remove; they are reusable, readjustable, and washable. There are nonrigid and semirigid braces. The nonrigid ones are often made of canvas or a neoprene-type material, which can easily be slipped on and off, and some are with additional lacing. The semirigid braces mostly consist of bimalleolar struts made of thermoplastic materials attached by Velcro straps. Nowadays different braces are used such as lace-up braces and the Swede-O (Swede-O-Universal, North Branch, MN) and multiple models by McDavid Sports Medical Products (Woodridge, IL); lace-up braces with straps such as the ASO (Medical Specialties, Charlotte, NC), the RocketSoc (DonJoy Orthopedics, Inc., Vista, CA), and the Ankle Brace Lock (Breg, Vista, CA); and semirigid plastic braces with strapping configurations such as the Ankle Ligament Protector (DonJoy Orthopedics, Inc.), the Universal Ankle Stirrup (DonJoy Orthopedics, Inc.), the T2 Active Ankle Support (Active Ankle, Louisville, KY) and the Ultra Ankle, and the Guardian Ankle (McDavid Sports Medical Products).

Semirigid brace like Swede-O-Universal and nonrigid brace like subtalar supports provide a better non-weight-bearing restriction in plantar flexion, dorsiflexion, and eversion than taping after 15 min of activity. A strong thermoplastic semirigid ankle brace significantly reduces talar and subtalar motions of plantarflexion, inversion, and adduction. In summary, ankle taping and bracing:

   i. Restrict ankle range of motion.

   ii. Reduce injury and recurrence rate.

iii. Improve proprioception.

iv. Lose limitation of movement after exercise.

v. Have no negative effect on most performance tests.

vi. Have little negative effect on other joints.

6. Grade III lateral ankle sprains

Grade III lateral ankle sprains occur when there is a complete rupture of both ATFL and CFL. Although the initial line of management remains a functional rehabilitation, surgery should be considered if the symptoms persist. The feeling of giving way, defined as functional instability or true mechanical instability, is frequently experienced. This can be demonstrated by provocative tests such as the anterior drawer or talar tilt (either clinically or by stress radiography). Particular attention should be directed at the diagnosis and correction of subtle subtalar instability in individuals with functional instability. Surgical repairs are aimed at the reconstruction of the normal anatomy by overlapping the existing joint capsule and lateral ligaments. The rehabilitation protocol post-surgery remains the same as that of the conservative treatment.

7. Conclusion

The early rehabilitation of lateral ankle ligament sprains focuses on gaining full recovery by starting it within 24–48 h post injury. Most of the sprains respond well to functional treatment. Rehabilitation programs should be structured and individualized. In the acute phase, the focus should be on controlling inflammation, reestablishing full range of motion and gaining strength. Once the athlete achieves a pain-free range of motion and weight-bearing, balance-training exercises should be included to regulate neuromuscular control. Advanced-phase rehabilitation exercises should focus on regaining normal function. These should include sports-specific exercises specific to the particular sport played by the athlete. While having a basic guideline to follow for the rehabilitation of lateral ankle sprains, it is important to remember that individuals respond differently to exercises. Therefore, each program needs to be modified to fit the individual's needs.

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References

[1] Yeung M, Chan K, So C, Yuan W. An epidemiological survey on ankle sprain. British Journal of Sports Medicine. 1994;**28**(2):112-116

[2] Kobayashi T, Gamada K. Lateral ankle sprain and chronic ankle instability. Foot & Ankle Specialist. 2014;**7**(4):298-326

[3] Chan KW, Ding BC, Mroczek KJ. Acute and chronic lateral ankle instability in the athlete. Bulletin of the NYU Hospital for Joint Diseases. 2011;**69**(1):17-26

[4] Lynch SA. Assessment of injured ankle in the athletes. Journal of Athletic Training. 2002;**37**(4):406-412

[5] Ferran N, Maffulli N. Epidemiology of sprains of the lateral ankle ligament complex. Foot and Ankle Clinics. 2006;**11**(3):659-662

[6] Alanen V, Taimela S, Kinnunen J, Koskinen S, Karaharju E. Incidence and clinical significance of bone bruises after supination injury of the ankle. The Journal of Bone and Joint Surgery British. 1998;**80-B**(3):513-515

[7] Dananberg H, Shearstone J, Guillano M. Manipulation method for the treatment of ankle equinus. Journal of the American Podiatric Medical Association. 2000;**90**(8):385-389

[8] Hetherington B. Lateral ligament strains of the ankle, do they exist? Manual Therapy. 1996;**1**(5):274-275

[9] Hocutt J, Jaffe R, Rylander C, Beebe J. Cryotherapy in ankle sprains. The American Journal of Sports Medicine. 1982;**10**(5):316-319

[10] Capasso G, Maffulli N, Testa V. Ankle taping: Support given by different materials. British Journal of Sports Medicine. 1989;**23**(4):239-240

[11] Maitland GD. Peripheral Manipulation. 2nd ed. Sydney, New South Wales, Australia: Butterworths; 1977. p. 282

[12] Mulligan B. "NAGS", "SNAGS", "MWMS", etc. Wellington, NZ: Plane View Press; 1995

[13] Van Dijk CN. CBO-guideline for diagnosis and treatment of the acute ankle injury. National Organization for Quality Assurance in Hospitals. Nederlands Tijdschrift voor Geneeskunde. 1999;**143**(42):2097-2101

[14] Wilkerson GB, Pinerola JJ, Caturano RW. Invertor vs. evertor peak torque and power deficiencies associated with lateral ankle ligament injury. The Journal of Orthopaedic and Sports Physical Therapy. 1997;**26**:78-86

[15] Baumhauer JF, Alosa DM, Renström FH, Trevino S, Beynnon B. A prospective study of ankle injury risk factors. American Journal of Sports Medicine. 1995;**223**:564-570

[16] Knight KL. Knee rehabilitation by the daily adjustable progressive resistive exercise technique. The American Journal of Sports Medicine. 1979;7:336-337

[17] Perrin DH, Gieck JH. Principles of therapeutic exercise. In: Perrin DH, editor. The Injured Athlete. 3rd ed. Philadelphia, PA: Lippincott-Raven; 1999. pp. 123-139

[18] Verhagen E, van der Beek A, Twisk J, Bouter L, Bahr R, van Mechelen W. The effect of a proprioceptive balance board training program for the prevention of ankle sprains. The American Journal of Sports Medicine. 2004;**32**(6):1385-1393

[19] Dabadghav R. Correlation of ankle eversion to inversion strength ratio and static balance in dominant and

non-dominant limbs of basketball players. Journal of Sports Medicine and Physical Fitness. 2016;**56**(4):422-427

[20] Hardy L, Huxel K, Brucker J, Nesser T. Prophylactic ankle braces and star excursion balance measures in healthy volunteers. Journal of Athletic Training. 2008;**43**(4):347-351

[21] Kase K, Tatsuyuki H, Tomoki O. Development of Kinesio™ tape Kinesio™ taping perfect manual. Kinesio Taping Association. 1996;**6-10**:117-118

[22] Murray H. Effects of Kinesio™ Taping on Muscle Strength After ACL-Repair. Journal of Orthopaedic and Sports Physical Therapy. 2000;**30**:1-3. Available from: https://performance.nd.edu/assets/114689/kinesio_study_acl_repair.pdf [Accessed: 31 July 2019]