J.S. de Vries, R. Krips, C.N. van Dijk

Dr. J.S. de Vries, MD, Research fellow
Dr. R. Krips, MD, PhD, Orthopaedic resident
Prof. Dr. C.N. van Dijk, MD, PhD, Head of Orthopaedic Department, Academic Medical Center, Amsterdam

Treatment of chronic anterolateral ankle instability in athletes

Summary

An inversion trauma with damage to the anterolateral ankle ligaments is one of the most common injuries in athletes, especially in high risk sports like volleyball, basketball and soccer. Treatment is functional, leading to full recovery in the majority of athletes. Approximately 20% suffer from recurrent instability and require further treatment. Chronic anterolateral ankle instability is often caused by disturbed proprioception of ankle joint. Increased ligament laxity is present in a number of patients. Initial treatment of chronic anterolateral ankle instability in athletes is functional, consisting of proprioceptive training and prevention of recurrent sprains by taping or bracing of the ankle. When functional treatment fails and increased laxity of the ligaments is present, surgical treatment is warranted. Surgical treatment can be divided in anatomical and non-anatomical reconstructions. Recent literature has shown that an anatomical reconstruction leads to better long-term results in athletes than non-anatomical reconstructions. Anatomical reconstruction is therefore the surgical treatment of choice in patients with chronic anterolateral ankle instability.

Schweizerische Zeitschrift für «Sportmedizin und Sporttraumatologie» 51 (2), 100–105, 2003

1. Introduction

An inversion trauma is one of the most common injuries in the general population, and is seen even more frequently in athletes [1]. The risk of sustaining an inversion trauma is high in sports which involve cutting maneuvers, such as jumping and direct body contact (e.g. volleyball, basketball, and soccer). Residual problems are more disabling for athletes than for people with a more sedentary lifestyle.

With an inversion trauma the anterolateral ankle ligaments are strained and in severe cases ruptured. The Anterior TaloFibular Ligament (ATFL) is the most frequently ruptured, followed by the CalcaneoFibular Ligament (CFL). Rarely the Posterior TaloFibular Ligament (PTFL) is completely torn [2].

Treatment of a lesion of the anterolateral ankle ligaments in athletes, independent of its severity is preferably conservative [3]. Although in most athletes rehabilitation is successful, approximately 20% of the patients suffer from recurrent sprains, requiring further evaluation and treatment [1]. When recurrent instability persists for more than 6 months, a chronic anterolateral ankle instability is thought to be present [4].

Recurrent episodes of giving way occur in patients with and without increased laxity of anterolateral ankle ligaments. Patients who have increased ligament laxity after an inversion trauma are not always symptomatic [5]. Therefore, it is believed that chronic anterolateral ankle instability is only partially caused by increased laxity. The main cause of recurrent sprains is a disturbed coordination of muscles steering and protecting the ankle joint, resulting from muscle weakness and a disturbed propriocepsis [6].

Other causes for recurrent sprains include tendinosis of the peroneal tendons and the sinus tarsi syndrome [7]. Both disorders may occur after a severe inversion trauma and recurrent instability is sometimes present, but pain is usually the main symptom.

In this article we focus both on chronic ankle instability due to propriocepsis disturbance and on increased ligament laxity.

2. Diagnosis

The diagnosis «chronic anterolateral ankle instability» is primarily based on history and physical examination of the patient. Standard radiographs of both ankles are made in every patient, and additional (radiological) tests are only performed when indicated.

2.1 History

Chronic anterolateral ankle instability most often starts after an initial severe inversion trauma, but may also start gradually with increasing severity of recurrent sprains. Most patients have additional symptoms like pain and swelling of the ankle, which may occur after a trauma or may be present after (strenuous) activity [7]. Persistent pain or swelling suggest internal derangement of the

joint, e.g. synovitis, osteochondral lesions, or osteoarthritis. Deep ankle pain is more specifically associated with an osteochondral lesion, while superficial (anteromedial) pain refers to degenerative changes or osteophytes on the anterior aspect of the ankle joint.

It is important to assess to what extent the instability and accompanying symptoms limit the patient's sports performance. The number of sprains per month provides an indication for the severity, but fear for recurrent injuries can limit both the number of sprains and the level of sports participation.

The mechanism that leads to a sprain in the individual patient may give a clue for treatment or prevention.

2.2 Physical examination

Routine physical examination of both talocrural and subtalar joint are performed. Varus alignment of the ankle can predispose to inversion trauma. Swelling of the joint indicates intra-articular pathology such as synovitis, scar tissue or bony impingement.

Palpation is performed to detect any area of localized pain. Pain over the anterolateral ligaments may be present in case of ligament damage. Palpation distinguishes peroneal tendinosis, sinus tarsi syndrome from an anterior impingement syndrome.

Restricted and painful range of motion indicates osteoarthritis or anterior impingement. Peroneal muscle strength is tested to assess its contribution to ankle instability. The manual anterior drawer test is performed to detect increased laxity of the ATFL *(figure 1)* [8].

2.3 Radiological evaluation

Standard anterior-posterior and lateral radiographs serve to detect the presence of loose bodies, spurs or ossicles, as well as to determine the degree of osteoarthritis.

Ankle stress radiographs are performed to quantify the degree of ligament laxity [8]. Since chronic anterolateral ankle instability is clinical diagnosis, they are mainly used for research purposes.

3. Treatment

Treatment is started after identifying the underlying cause of the recurrent giving way. Since chronic ankle instability, independent of the presence of increased ligament laxity, is always (partially) caused by proprioceptive disturbance, the initial treatment is conservative [6, 9].

Figure 1: Manual anterior drawer test

3.1 Conservative treatment and prevention

The two options for conservative treatment of chronic anterolateral ankle instability are proprioceptive training and external ankle support. Most reports have been published about prevention of recurrent injury, with a mixed population of non-injured and previously injured subjects [9, 10, 11].

3.1.1 Proprioceptive training

Proprioceptive training seems essential. In general, rehabilitation programs are directed at improvement of balance and strength of the muscles crossing the ankle joint, in particular the peroneal muscles. However, the Cochrane systematic review, level I evidence according to the criteria of Evidence Based Medicine, about prevention of ankle ligament injuries did not provide evidence for a beneficial effect of training [10]. Although mainly studies about athlete populations are included, this may also be the consequence of addressing only well conducted randomized controlled trials (RCT) and including studies with a mixed population of healthy athletes and athletes with chronic ankle instability. Still, several reports of a lower level of evidence give support to a positive effect of proprioceptive training.

Safran [9] recommends a supervised rehabilitation program for athletes with recurrent sprain, in which the required activities for specific sports are progressively simulated until the level for return to sport is reached. During early comeback attention is directed at prevention of recurrence, mainly by multidirectional balance and muscle strength training. In a review from a physiotherapeutic point of view, Chun et al. [12] emphasized the importance of peroneal muscle strengthening and balance training for chronic ankle instability. In a randomized controlled trial, Tropp [13] found a significant lower injury rate in athletes with recurrent sprains after ankle disk training compared to controls without training. With another RCT, Oostendorp [14] found an earlier return to sport for patients treated with tape combined with physiotherapy compared to treatment with ankle tape alone. Ekstrand [15] with a RCT and later Bahr [16] with a prospective cohort study, reported a reduction of ankle sprains with an intensive prevention program, including training and supervision. The population consisted respectively of soccer players, with or without previous injuries, and volleyball players with a history of ankle sprains.

3.1.2 External ankle support

There are three types of external ankle support: tape, adjusted shoes and braces. Ankle tape or braces are thought to provide both mechanical support and enhancement of propriocepsis through skin pressure [6, 17].

3.1.2.1 Tape

Although ankle taping is meant to limit the extremes of range of motion in order to prevent for traumatic ankle inversion, its restricting effect is strongly reduced after a short period of time (10–15 minutes), even when it is correctly applied [18].

Therefore, the reported beneficial effect is probably better explained by enhancement of proprioceptive control through compression of soft-tissues surrounding the ankle [11, 17, 19]. Karlsson et al. [20] proved that taping of an unstable ankle led to shorter peroneal reaction time compared to untaped unstable ankles. Additional to this physiologic mechanism, the psychological effect of applying and wearing a tape, reminding the athlete of the vulnerability of the ankle, may help to reduce the rate of ankle sprains.

3.1.2.2 Adjusted shoes

The positive effect of adjusted shoes remains unclear [10]. One RCT, performed by Garrick et al. [21], showed a positive effect of high top shoes compared to low top shoes in reducing the number of sprains in basketball. However, the effect was largely attributed to the ankle tape that was applied in addition to the shoes and to

the newness of footwear used in the study. Furthermore, Barrett et al. [22], in another RCT, found no reduction in the number of sprains with high top shoes compared to low top shoes. Although Cameron [23] reported a positive effect of specially designed swivel shoes in soccer players in a cohort study, the design was never widely used.

3.1.2.3 Braces

Ankle braces have been developed as an alternative to ankle taping. The numerous different ankle orthoses that have been designed to prevent ankle sprains during sports activity can be divided into two types: soft lace-up braces and semi-rigid braces. Some semi-rigid braces are lined with inflatable air sacs that provide for a more equal distribution of compression. Rigid braces are not usable during sports practice, since they unacceptably limit performance [24].

Braces have the advantage over tape in being easily self-applied, re-adjustable, reusable and more cost effective [17, 19]. In four recent review articles about prevention of ankle sprains, it is concluded that (semi-rigid) ankle orthoses are effective in reducing the number of sprains, they are superior to ankle tape and the effectiveness is higher in athletes with history of sprains [10, 11, 17, 19]. Verhagen et al. also conclude that the use of braces leads to less severe ankle sprains [19]. However, three of the four reviews question the quality of most studies due to weak study design or unclear data reporting [10, 11, 17].

Two other points of interest are the potentially detrimental effect of braces on athletic performance and the possible higher rate of injuries to other joints, especially the knee and foot joints. However, according to Callaghan and Handoll performance is not worse and no clear evidence for an increasing rate of injuries other than ankle sprains was found [10, 17].

Two experimental studies showed that lace-up braces give more restriction of plantar- and dorsiflexion than semi-rigid braces [24, 25]. It was concluded that the semi-rigid design is potentially more appropriate for athletic use, because it gives less limitation to performance. However, semi-rigid braces tend to wear out shoes and are often not compatible to other equipment like shin guards [24]. Furthermore, the increased laxity of the anterolateral capsule that is often present in patients with chronic ankle instability, allows for anterior translation of the lateral talus relative to the tibia during re-injury [26]. Since braces theoretically should restrict this movement as well, presently, the lace-up brace is probably the best option for treatment of chronic ankle instability.

3.2 Surgical treatment

When conservative treatment fails and ligament laxity is present, surgical treatment is warranted. A variety of surgical procedures have been described to improve anterolateral ankle stability [4]. They can be divided into two main categories: non-anatomical and anatomical reconstructions.

3.2.1 Non-anatomical reconstructions

In a non-anatomical reconstruction, a tendon, usually the peroneus tendon, is used to make a construction that replaces the lateral ankle ligaments. The Watson-Jones [17], Evans [28], and Chrisman-Snook *(figure 2)* tenodeses [29] are the best known representatives of this category. Watson-Jones developed a technique in which the peroneus brevis tendon is used to reconstruct the ATFL. The tendon is cut loose proximally from the muscle, then guided through drill holes in the distal fibula and talus neck and sutured to the distal fibula. Evans simplified the technique by guiding the peroneus brevis only through the distal fibula. Thus the direction of the reconstruction lies between the direction of the ATFL and the CFL. In the Chrisman-Snook procedure the peroneus brevis tendon is split longitudinally. The anterior part is cut loose proximally from the muscle, then guided through drill holes in the talus neck, distal fibula and the calcaneus and is finally sutured to its insertion at the fifth metatarsal or to itself. According to non-comparative studies acceptable long-term results have been reported for all three reconstructions [30, 31, 32].

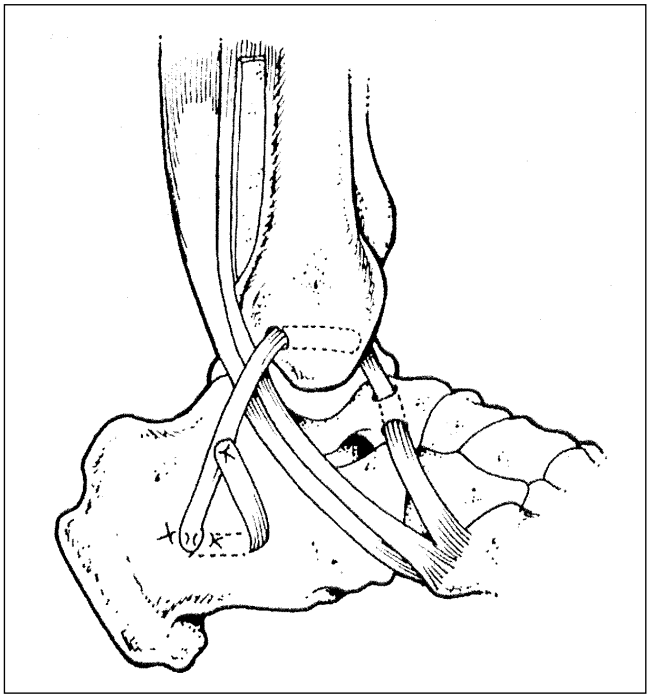

Figure 2: Chrisman-Snook tenodesis

3.2.2 Anatomical reconstructions

The principle of anatomical reconstructions is to restore normal anatomy by suturing the ligament itself [26, 33] *(figure 3)*, sometimes reinforced by a periostal flap [34] or the lower extensor retinaculum [35]. Both ATFL and CFL can be reconstructed leading to restoration of normal ankle kinematics. Good long-term results have been reported for this type of reconstructions [35, 36].

Another example in this category is the technique described by Weber [37]. Although a tendon is used (usually the plantaris), this reconstruction is considered to be an anatomical reconstruction because the ATFL is restored in its original location. In the modification described by Magerl and Marti [38], the remnants of the anterolateral capsule and ligament are integrated in the reconstruction. In other modifications the CFL is reconstructed as well [39]. Good results have been achieved with the Weber procedure in athletes, more specifically: ballet dancers [40].

3.2.3 Anatomical versus non-anatomical reconstructions

Comparative studies point out that anatomical reconstructions show better results in the long-term, both in a general population and in athletes [1, 41]. General disadvantage of non-anatomical procedures is the fact that they sacrifice part of the active stabilizers of the lateral ankle, involve a long scar, extensive soft tissue dissection and reduce ankle motion. For highly active or professional athletes who require extensive ankle balance or kinesthetic sense, these procedures may be career ending.

In a recent comparative study in athletes by Krips et al. [1], both subjective and objective results were better in the anatomical reconstruction group. There were significantly more athletes in the non-anatomical group that reported a reduced activity level due to the operated ankle, whereas in the anatomical group more athletes could maintain their activity level and significantly more athletes had good to excellent results according to the Good-score at follow-up. In the non-anatomical group more athletes suffered from a limited dorsiflexion and reported a limited push-off power in the operated ankle. Stress radiographic examination revealed increased ligament laxity and normal radiographs showed significantly more osteo-arthritis in the medial compartment in the non-anatomical reconstruction group.

Athletes impose heavy functional demands on the ankle joint. When suffering from chronic anterolateral ankle instability, they benefit from restoration of normal joint kinematics. This is better

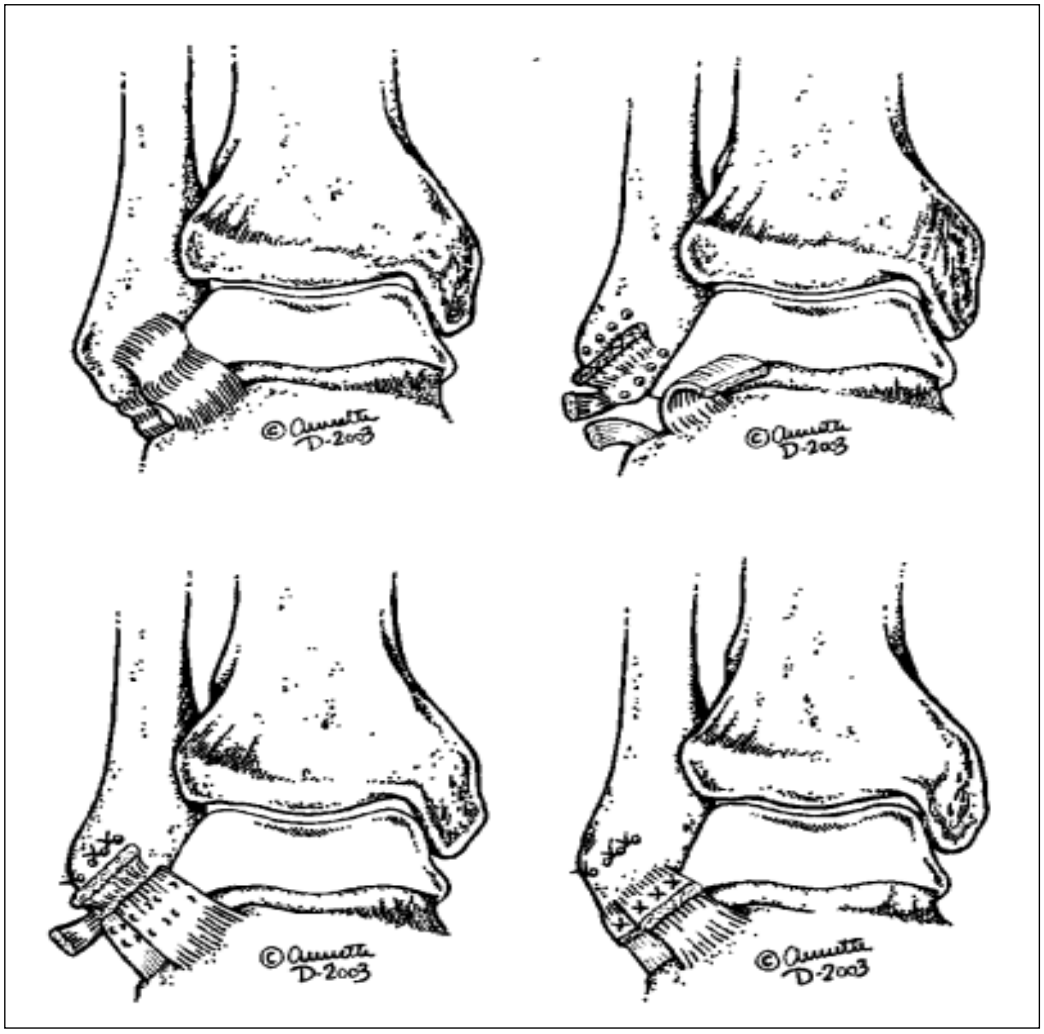

Figure 3: Anatomical reconstruction

provided by an anatomical reconstruction than by a non-anatomical reconstruction. An anatomical reconstruction is therefore the surgical treatment of choice in athletes with chronic anterolateral ankle instability with increased mechanical laxity. The Weber procedure should probably be considered as an alternative, when a standard anatomical reconstruction is not feasible, or when a reconstruction has failed and re-operation is necessary.

3.2.4 Arthroscopic capsular shrinkage

Recently, arthroscopic thermal capsular shrinkage has been introduced as treatment for chronic ankle instability. Most experience has been obtained in shoulder instability, with variable results so far [42]. With thermal energy shrinkage of the capsule and ligaments can be achieved, leading to better mechanical stability. Initially, laser was used as thermal source, but recently radiofrequency has shown to provide better temperature control and is used more frequently.

Advantage of arthroscopic treatment is the possibility of inspection and debridement of the ankle joint. Synovitis and scar tissue, that is often present, can easily be removed, probably improving the result of the shrinkage itself. Application in chronic anterolateral ankle instability has only been reported in small series [43, 44]. Results are promising, but application in athletes remains to be evaluated.

Address for correspondence:

G4-259, Department of Orthopedics & Orthotrauma Research Center Amsterdam, Academic Medical Center, PO Box 22660, 1100 DD Amsterdam, Phone: +31 20 5669111, Pager: 58308, Fax: +31 20 5669117, E-mail: j.s.devries@amc.uva.nl

References

1 *Krips R., van Dijk C.N., Lehtonen H., Halasi T., Moyen B., Karlsson J.:* Sports activity level after surgical treatment for chronic anterolateral ankle instability. A multicenter study. Am. J. Sports Med. 30: 13–19, 2002.
2 *Brostrom L.:* Sprained ankles. V. Treatment and prognosis in recent ligament ruptures. Acta Chir. Scand. 132: 537–550, 1966.
3 *Kerkhoffs G.M., Handoll H.H., de Bie R., Rowe B.H., Struijs P.A.:* Surgical versus conservative treatment for acute injuries of the lateral ligament complex of the ankle in adults. Cochrane. Database. Syst. Rev. CD000380, 2002.
4 *Karlsson J., Eriksson B.I., Bergsten T., Rudholm O., Sward L.:* Comparison of two anatomic reconstructions for chronic lateral instability of the ankle joint. Am. J. Sports Med. 25: 48–53, 1997.
5 *Tropp H., Odenrick P., Gillquist J.:* Stabilometry recordings in functional and mechanical instability of the ankle joint. Int. J. Sports Med. 6: 180–182, 1985.
6 *Becker H.P., Rosenbaum D.:* [Chronic recurrent ligament instability on the lateral ankle]. Orthopade. 28: 483–492, 1999.
7 *Safran M.R., Benedetti R.S., Bartolozzi A.R., III, Mandelbaum B.R.:* Lateral ankle sprains: a comprehensive review: part 1: etiology, pathoanatomy, histopathogenesis, and diagnosis. Med. Sci. Sports Exerc. 31: S429–S437, 1999.
8 *Karlsson J., Lansinger O.:* Lateral instability of the ankle joint. Clin. Orthop. 253–261, 1992.
9 *Safran M.R., Zachazewski J.E., Benedetti R.S., Bartolozzi A.R., III, Mandelbaum R.:* Lateral ankle sprains: a comprehensive review: part 2: treatment and rehabilitation with an emphasis on the athlete. Med. Sci. Sports Exerc. 31: S438–S447, 1999.
10 *Handoll H.H., Rowe B.H., Quinn K.M., de Bie R.:* Interventions for preventing ankle ligament injuries. Cochrane. Database. Syst. Rev. CD000018, 2001.

11 *Thacker S.B., Stroup D.F., Branche C.M., Gilchrist J., Goodman R.A., Weitman E.A.:* The prevention of ankle sprains in sports. A systematic review of the literature. Am. J. Sports Med. 27: 753–760, 1999.
12 *Chun D.J., Chow F.:* Physical therapy rehabilitation of the ankle. Clin. Podiatr. Med. Surg. 19: 319–334, vii, 2002.
13 *Tropp H., Askling C., Gillquist J.:* Prevention of ankle sprains. Am. J. Sports Med. 13: 259–262, 1985.
14 *Oostendorp R.A.:* (Functional instability after an inversion trauma of ankle and foot: effect study tape versus tape and physiotherapy). Geneeskunde en Sport. 20: 45–55, 1987.
15 *Ekstrand J., Gillquist J., Liljedahl S.O.:* Prevention of soccer injuries. Supervision by doctor and physiotherapist. Am. J. Sports Med. 11: 116–120, 1983.
16 *Bahr R., Lian O., Bahr I.A.:* A twofold reduction in the incidence of acute ankle sprains in volleyball after the introduction of an injury prevention program: a prospective cohort study. Scand. J. Med. Sci. Sports. 7: 172–177, 1997.
17 *Callaghan M.J.:* Role of ankle taping and bracing in the athlete. Br. J. Sports Med. 31: 102–108, 1997.
18 *Frankney J.R., Jewett D.L., Hanks G.A., Sebastianelli W.J.:* A comparison of ankle tape methods. Clin. J. Sport Med. 3: 20–25, 1993.
19 *Verhagen E.A., van Mechelen W., de Vente W.:* The effect of preventive measures on the incidence of ankle sprains. Clin. J. Sport Med. 10: 291–296, 2000.
20 *Karlsson J., Andreasson G.O.:* The effect of external ankle support in chronic lateral ankle joint instability. An electromyographic study. Am. J. Sports Med. 20: 257–261, 1992.
21 *Garrick J.G., Requa R.K.:* Role of external support in the prevention of ankle sprains. Med. Sci. Sports 5: 200–203, 1973.
22 *Barrett J.R., Tanji J.L., Drake C., Fuller D., Kawasaki R.I., Fenton R.M.:* High- versus low-top shoes for the prevention of ankle sprains in basketball players. A prospective randomized study. Am. J. Sports Med. 21: 582–585, 1993.
23 *Cameron B.M., Davis O.:* The swivel football shoe: a controlled study. J. Sports Med. 1: 16–27, 1973.
24 *Eils E., Demming C., Kollmeier G., Thorwesten L., Volker K., Rosenbaum D.:* Comprehensive testing of 10 different ankle braces. Evaluation of passive and rapidly induced stability in subjects with chronic ankle instability. Clin. Biomech. (Bristol, Avon). 17: 526–535, 2002.
25 *Nishikawa T., Kurosaka M., Mizuno K., Grabiner M.:* Protection and performance effects of ankle bracing. Int. Orthop. 24: 285–288, 2000.
26 *Brostrom L.:* Sprained ankles. VI. Surgical treatment of «chronic» ligament ruptures. Acta Chir. Scand. 132: 551, 1966.
27 *Watson-Jones R.:* Recurrent forward dislocation of the ankle joint. J. Bone Joint Surg. [Br]. 34-B: 19–21, 1952.
28 *Evans G.A., Hardcastle P., Frenyo A.D.:* Recurrent instability of the ankle – a method of surgical treatment. Proc. R. Soc. Med. 46: 343, 1953.
29 *Chrisman O.D., Snook G.A.:* Reconstruction of lateral ligament tears of the ankle. J. Bone Joint Surg. [Am]. 51-A: 904, 1969.
30 *van der Rijt A.J., Evans G.A.:* The long-term results of Watson-Jones tenodesis. J. Bone Joint Surg. Br. 66: 371–375, 1984.
31 *Karlsson J., Bergsten T., Lansinger O., Peterson L.:* Lateral instability of the ankle treated by the Evans procedure. A long-term clinical and radiological follow-up. J. Bone Joint Surg. Br. 70: 476–480, 1988.
32 *Snook G.A., Chrisman O.D., Wilson T.C.:* Long-term results of the Chrisman-Snook operation for reconstruction of the lateral ligaments of the ankle. J. Bone Joint Surg. Am. 67: 1–7, 1985.
33 *Karlsson J., Bergsten T., Lansinger O., Peterson L.:* Surgical treatment of chronic lateral instability of the ankle joint. A new procedure. Am. J. Sports Med. 17: 268–273, 1989.
34 *Sjolin S.U., Dons-Jensen H., Simonsen O.:* Reinforced anatomical reconstruction of the anterior talofibular ligament in chronic anterolateral instability using a periosteal flap. Foot Ankle. 12: 15–18, 1991.
35 *Gould N., Seligson D., Gassman J.:* Early and late repair of lateral ligament of the ankle. Foot Ankle. 1: 84–89, 1980.
36 *Karlsson J., Bergsten T., Lansinger O., Peterson L.:* Reconstruction of the lateral ligaments of the ankle for chronic lateral instability. J. Bone Joint Surg. Am. 70: 581–588, 1988.
37 *Weber B.G., Hupfauer W.:* [On the treatment of freshly ruptured fibular collateral ligaments and chronic insufficiency of the fibular collateral ligaments]. Arch. Orthop. Unfallchir. 65: 251–257, 1969.
38 *Magerl F., Marti R.:* [Fibulotalar ligament replacement using the plantaris tendon]. Hefte. Unfallheilkd. 133: 169–174, 1978.
39 *Hintermann B., Renggli P.:* Anatomische Rekonstruktion der lateralen Sprunggelenkbänder mit der Plantarissehne zur Behandlung der chronischen Instabilität. Orthopäde 1999; 28: 778–784.
40 *Veldstra R., Marti R.K.:* Fibulotalare Bandläsionen und Rekonstruktionen bei Ballettänzern. In: George Chapdal (ed.), Sportverletzungen und Sportschäden, 232–233. Stuttgart, Georg Thieme Verlag, 1983.
41 *Krips R., Brandsson S., Swensson C., van Dijk C.N., Karlsson J.:* Anatomical reconstruction and Evans tenodesis of the lateral ligaments of the ankle. Clinical and radiological findings after follow-up for 15 to 30 years. J. Bone Joint Surg. Br. 84: 232–236, 2002.
42 *Anderson K., Warren R.F., Altchek D.W., Craig E.V., O'Brien S.J.:* Risk factors for early failure after thermal capsulorrhaphy. Am. J. Sports Med. 30: 103–107, 2002.
43 *Berlet G.C., Saar W.E., Ryan A., Lee T.H.:* Thermal-assisted capsular modification for functional ankle instability. Foot Ankle Clin. 7: 567–76, ix, 2002.
44 *Oloff L.M., Bocko A.P., Fanton G.:* Arthroscopic monopolar radiofrequency thermal stabilization for chronic lateral ankle instability: a preliminary report on 10 cases. J. Foot Ankle Surg. 39: 144–153, 2000.