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Treatment of chronic lateral instability of the ankle with the Colville technique: a prospective analysis with minimum five years of follow-up

Ayak bileği kronik lateral instabilitesinin Colville tekniği ile tedavisi: En az beş yıl takipli prospektif çalışma

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Objectives: This study aims to prospectively analyze of the long-term results of the Colville's technique for the treatment of chronic lateral ankle instabilities.

Patients and methods: Twenty-eight ankles of 28 male patients (mean age 24.6 years; range 20 to 35 years) which were treated using Colville's technique were evaluated with a mean follow-up of 76.1 months (range 60 to 106 months). Ankle instability, ankle functions and outcomes in the last visit were assessed and statistically compared. Stress radiographs with the TELOS device were repeated at six-months and five-years after surgery and compared with the stability of the uninjured ankle.

Results: Twenty-three of the results were excellent and five were good according to the criteria of Chrisman and Snook. All patients returned to normal daily activity levels at an average of eight months following surgery. Radiographic analysis revealed the significant preservation of stability at least five years after surgery with no sign of arthritis. The difference between preoperative and sixth-months postoperative values of both the talar tilt and the anterior draw tests were found statistically significant, indicating significant correction of the laxity. On contrary, difference between sixth months and five year values were not statistically significant, indicating the preservation of the correction.

Conclusion: Anatomical augmented reconstruction procedure of Colville's is a long-lasting and good alternative compared to other more complex techniques of reconstruction with minimum long-term complications.

Key words: Ankle; biomechanics; joint instability; surgery; treatment outcome.

Amaç: Bu çalışmada kronik lateral ayak bilek instabilitesinin tedavisinde Colville tekniğinin uzun dönem prospektif takip sonuçları araştırıldı.

Hastalar ve yöntemler: Colville tekniği ile tedavi edilen 28 erkek hastanın (ort. yaş 24.6 yıl; dağılım 20-35 yıl) 28 ayak bileği ortalama 76.1 ay (dağılım 60-106 ay) takip ile değerlendirildi. Ayak instabilitesi, ayak bileği fonksiyonları ve son kontrol sonuçları değerlendirilerek istatistiksel olarak karşılaştırıldı. Stres radyografileri TELOS cihazı kullanılarak cerrahi sonrası altıncı ay ve beşinci yılda tekrar edildi ve yaralanma olmayan ayak bileğin stabilitesi ile karşılaştırıldı.

Bulgular: Chrisman ve Snook kriterlerine göre 23 sonuç mükemmel ve beş sonuç iyi olarak belirlendi. Bütün hastalar cerrahi sonrası ortalama sekiz ayda normal günlük aktivite seviyelerine ulaştı. Radyografik analizde, cerrahi sonrası beşinci yılda ayak bileği stabilitesinin belirgin olarak korunduğu ve artrit bulgusu gelişmediği görüldü. Ameliyat öncesi ve ameliyat sonrası altıncı aydaki talar tilt ve anteriyor çekmece testi bulguları arasında laksitenin belirgin olarak düzeldiğini gösteren farklılık istatistiksel olarak anlamlı bulundu. Buna karşın, altıncı ay ve beş yıl sonraki değerlerde anlamlı fark olmaması yapılan düzeltmenin korunduğunu gösterdi.

Sonuç: Colville'in güçlendirilmiş rekonstrüksiyon yöntemi uzun süre etkili ve en az uzun dönem komplikasyonları ile diğer daha kompleks tamir yöntemlerine iyi bir alternatiftir.

Anahtar sözcükler: Ayak bileği; biyomekanik; eklem instabilitesi; cerrahi; tedavi sonucu.

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More than 50 surgical techniques have been described for reconstructing ankle ligaments and correcting ankle instability.[1-3] Augmented repairs can be either anatomic such as the Colville technique[4] or non-anatomic such as the Chrisman and Snook[5] or Evans[6] techniques. Non-anatomical techniques limit subtalar joint movements.[4] But with the reconstruction technique described by Colville, in which the split tendon of the peroneus brevis muscle is advanced through the anatomical attachment sites of the calcaneofibular ligament (CFL) and the anterior talofibular ligament (ATFL), stability can be maintained without causing any loss of subtalar joint movements.[4,7,8]

In the literature, there are very limited long-term prospective studies analyzing the outcome of the Colville technique.[9] The purpose of this study is to prospectively analyze the long-term results of the Colville technique for the treatment of chronic lateral ankle instabilities and discuss the possible treatment alternatives.

PATIENTS AND METHODS

Between January 1996 and December 2005, 28 male patients (mean age 24.6 years; range 20 to 35 years) with chronic lateral instability of the ankle (no bilateral cases), scheduled to undergo the Colville technique, were considered for this study. Inclusion criteria were patients who had not previously suffered from this injury and did not have any other fractures, had a history of either recurrent ankle sprains or chronic post-traumatic ankle instability, failed conservative therapy that included immobilization and early aggressive rehabilitation. For the standardized evaluation of instability, a TELOS device (Austin and Associates, Fallston, Maryland, USA) was used to obtain identical pre- and postoperative stress radiographs.

For the classification of ankle instability, Trevino's grading system was used.[10] In this classification system, four grades were defined from simple stretching (grade I) to complete ATFL and CFL rupture (grade IV). Ankle functions were classified using the Ahlgren and Larsson,[11] and final results were assessed according to the criteria of Chrisman and Snook.[5] For the functional classification, five physical levels were used including level I (instability walking on smooth ground), level II (instability running on smooth ground), level III (instability walking on rough ground), level IV (instability running on rough ground) and level V (stable) activities. According to the rating system used by Chrisman and Snook,[5] a stable ankle that was functioning well, with no more than a 20-degree loss of inversion and no permanent sensory defect, was rated excellent; one with mild but definite functional limitations such as those just described or with persistent sural-nerve symptoms was rated good; and an ankle with instability was rated fair or poor, depending on the severity of the disability.

For radiographic evaluation, anterior talar displacement on lateral radiographs and talar tilt on anteroposterior radiographs were obtained. The measurements were repeated at six months and five years after surgery and statistically compared by Wilcoxon and Mann-Whitney U-tests, using the Statistical Package for the Social Sciences (SPSS Inc., Chicago, Illinois, USA) 11.0 software package and the significance level was set at $p<0.01$ with 95% of confidence interval.

RESULTS

The mean follow-up was 76.1 months (range 60-106 months) and the mean time to surgery was 23.8 months (range 14-32 months). According to Trevino's classification, 16 patients had grade IIIB and 12 patients had grade IIIC type II ankle instability. The mean dorsiflexion and plantar flexion of the surgically treated ankles were 15.6° (range 10-21°) and 54.2° (range 45-65°), respectively. These values were 15.7° (range 11-21°) dorsiflexion and 56.2° (45-70°) plantar flexion for the uninjured ankles. At the final control, according to Chrisman and Snook, there were 5 good and 23 excellent results (Table 1). The difference between postoperative ranges of motion and ranges of motion of the uninjured side was not statistically significant indicating no significant loss of ankle motion ($p=0.947$ for dorsiflexion and $p=0.299$ for plantar flexion).

Mean talar tilt was 15.7° (range 12-20°) preoperatively (Figure 1). In the post-operative period, mean talar tilt was 1.6° (range 0-3°) and 1.8° (range 0-3°) respectively at six months and five years follow-up. On the uninjured side, mean talar tilt was 2.1° (range 1-4°). Mean anterior talar displacement was 12 mm (range 10-15 mm) preoperatively. In the postoperative period, mean anterior talar displacement was 1.4 mm (range 0-3 mm) and 1.1 mm (range 0-3 mm) respectively at six months and five years follow-up. On the uninjured side, mean anterior talar displacement was 3.5 mm (range 2-5 mm). The difference between the preoperative and sixth month postoperative values of both the talar tilt and the anterior draw tests was statistically significant thus indicating significant correction of the laxity ($p<0.001$ for both). On the contrary, the difference between sixth month and five year values was not statistically significant indicating preservation of the correction ($p=0.167$ for talar tilt and $p=0.143$ for anterior talar displacement).

TABLE I

Summary of the results for ankle range of motion and final outcome

No	Follow-up	Dorsiflexion		Plantarflexion		Outcome*	Functional level$^{\beta}$	
		Operative	Nonoperative	Operative	Nonoperative		Preoperative	Postoperative
1	65	11	12	45	50	Excellent	2	5
2	74	17	15	55	55	Excellent	1	5
3	84	13	14	55	55	Excellent	1	5
4	96	11	11	50	50	Excellent	2	5
5	96	10	14	65	70	Excellent	1	5
6	102	15	14	60	60	Good	1	5
7	72	11	13	55	50	Excellent	1	5
8	94	10	11	50	55	Excellent	1	5
9	106	17	16	55	50	Excellent	1	5
10	65	20	21	60	60	Excellent	2	5
11	72	19	17	45	55	Good	1	5
12	73	17	17	65	65	Excellent	2	5
13	87	15	14	50	60	Excellent	1	5
14	70	16	16	55	60	Excellent	2	5
15	72	21	20	50	55	Excellent	1	5
16	60	20	18	50	45	Excellent	1	5
17	65	17	19	65	60	Excellent	1	5
18	67	14	16	60	65	Excellent	2	5
19	60	14	15	45	45	Good	1	5
20	72	17	17	50	55	Excellent	2	5
21	73	13	15	45	45	Excellent	2	5
22	72	19	18	50	55	Excellent	1	5
23	65	15	15	55	60	Excellent	1	5
24	60	21	18	45	50	Excellent	2	5
25	80	20	19	60	65	Good	2	5
26	72	18	17	65	65	Excellent	2	5
27	79	15	16	60	65	Good	1	5
28	78	11	12	55	50	Excellent	1	5

* Chrisman and Snook classification (5). β: Ahlgren and Larsson functional classification.

According to the Ahlgren and Larsson functional classification, all ankles had level five functionality and all were free of pain and swelling. After five years follow-up, there was neither recurrence of instability nor any sign of arthritis (Figure 2). Five patients developed a sural nerve injury with permanent paresthesia, and we included these in the good result group. All patients returned to their amateur level of sports activities and their basic military training at an average of eight months (range 6-10 months) after surgical repair.

DISCUSSION

Treatment choice

None of the surgical techniques defined in the literature can maintain the mechanical strength of healthy lateral ligaments.[12] Anatomic repair methods, which reconstruct both ATFL and/or CFL, became more popular in the last few years. Hence, in our study, we preferred the anatomic, augmented reconstruction technique of Colville for two major reasons. First, with this technique, a split peroneus brevis tendon graft was used to reinforce both the ATFL and CFL anatomically. Avoiding complete sacrifice of the peroneus brevis tendon via splitting is important because it has a role in the dynamic stability of the ankle.[13] Second, we believe that it is very important to reconstruct the CFL in association with ATFL in order to have the stabilization effect of CFL and prevent the development of arthroses and recurrent instability in the long-term follow-up.

Long-term clinical results of the Colville technique

In the literature, studies concerning the long-term result of the Colville technique were scare and inconclusive. These studies were also limited to Colville's personal

Figure 1. Preoperative stress radiographs. Note the talar tilt and anterior displacement of talus with instability of ankle.

Figure 2. Postoperative stress radiograghs after five years of follow-up. Note that there is no recurrence of talar tilt or displacement nor there is no sign of ankle arthritis.

analysis. On long-term follow-up, the most commonly encountered problems have been reported as pain after heavy activities and moderate swelling.[8] This was believed to be the result of recurrent ankle instability causing degenerative ankle arthritis. Harrington[14] noted degenerative changes at the time of arthroscopy in 36 patients who had long-standing instability of the ankle and reported improvement in symptoms following stabilization. Colville[8] reported that augmented reconstruction gave good functional results in all his patients while preserving subtalar motion and eversion strength of the ankle. In one of the studies of Colville and Grondel,[4] patients with chronic lateral ankle instability were analyzed and stress radiographic examination at follow-up confirmed that mechanical stability had been restored in all ankles.[4] In the study by Solakoglu et al.[9] patients were evaluated. Ankle movements returned to normal and pain had subsided by the end of the fifth month postoperatively in all patients.[9] In our study, which is the sequel of Solakoglu's, we expanded our series and kept our existing patients under review so as to assess the late results with minimum five years of follow-up. In our study, there was no pain or limitation of range of motion in any of the patients. In addition, all patients had normal physical findings excluding any recurrent inversion instability and arthritis of the ankle. Hence we believe that in the long-term, the Colville technique is safe and functionally stable with satisfactory clinical outcomes.

Long-term biomechanical results of the Colville technique

In the literature, there are also several studies evaluating the biomechanical strength of different treatment methods via radiographic stress analysis. In the study by Solakoglu et al.,[9] the differences between the preoperative and postoperative values at the sixth-month of TELOS control were found statistically significant, indicating significant correction of the laxity. But after six months, if there was a change in the strength of this correction, it has not been additionally analyzed. On contrary, in our study, we performed biomechanical evaluation at six months and repeated it five years after surgery in order to analyze the possible changes in the strength of the repair. As a result, we have found that there was no statistically significant change in the talar tilt and the anterior draw tests, indicating the long-term biomechanical effectiveness of the Colville technique.

Colville's technique can be successfully used for the treatment of chronic lateral ankle instabilities with satisfactory long-term outcomes. At a minimum five years of follow-up, all our patients were pain free with no signs of osteoarthritis and all had stable ankle joints at stress testing follow-ups. Hence, we believe that Colville's technique is a long-lasting and good alternative to other more complex techniques of ligament reconstruction with minimum long-term complications.

Declaration of conflicting interests

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