Midcarpal Spider® Plate Arthrodesis

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Purpose. The aim of this study was to assess the effectiveness of Spider™ plates in midcarpal arthrodesis.
Materials and methods. We studied 11 patients with advanced stage II and III degenerative process of the carpus treated by midcarpal arthrodesis with Spider™ plates. Mean followup was 15 months (7-25 months).
Results. A significant decrease in pain was seen in all cases. Postoperative flexion was 33° (12º-37º); extension 29° (12°-33°); there was one postoperative radius deviation of 12° (0°–16°) and one ulnar deviation of 17° (0°-20°). After surgery an increase in grasping strength was seen. Arthrodesis healing was seen in all cases, with a small decrease in the carpal height index.
Conclusions. This surgical technique has allowed us to obtain good clinical and radiological results and early postoperative mobilization.

Key words: *arthrodesis, osteoarthritis, wrist.*

Artrodesis mediocarpiana con placa Spider®

Objetivo. Con este estudio pretendemos valorar la efectividad de la placa Spider® en la artrodesis mediocarpiana
Material y método. Hemos estudiado 11 pacientes intervenidos de artrodesis mediocarpiana con placa Spider® que presentaban un proceso degenerativo avanzado del carpo estadio II o III. El seguimiento medio ha sido de 15 meses (7 a 25 meses).
Resultados. Se observa una importante disminución del dolor en todos los casos, manteniéndose una flexión postquirúrgica de 33° (12° a 37°); una extensión de 29° (12° a 33°); una desviación radial postoperatoria de 12° (0° y 16°) y una desviación cubital de 17° (0° a 20°). Se apreció un aumento de la fuerza de prensión después de la cirugía. Se observó la consolidación de la artrodesis en todos los casos, con una pequeña disminución del índice de la altura del carpo.
Conclusiones. Esta técnica quirúrgica nos ha permitido obtener buenos resultados clínico-radiológicos y una movilización precoz tras la cirugía.

Palabras clave: *artrodesis, artrosis, muñeca.*

The most common degenerative changes in the wrist can be grouped into two Basic groups: the SLAC *(*Scapho-Lunate Advanced collapse*)* and the SNAC *(*Scaphoid Non-union Advanced Collapse*)*[1].

Midcarpal arthrodesis, which includes the lunate, capitate, triquetral and hamate bones, was first described by Watson en 1984[2-4]. It has been indicated in SLAC and SNAC stages II and III, as well as in cases of highly developed midcarpal osteoarthritis[2,4-7]. Internal fixation of the four bones can be performed with Kirschner wires, screws or staples[3]. In an earlier study we proposed the use of a cortico-cancellous graft plate for stabilizing the arthrodesis[2]. The present study seeks to assess the effectiveness of the Spider® Plate in stabilizing the arthrodesis.

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MATERIALS AND METHODS

We studied 8 males and 3 females with a mean age of 59 years (7 to 25 years). Mean time from the onset of symp-

toms to surgery was 17.3 years (1.2 to 30 years). Our series included 11 patients that received a midcarpal arthrodesis with a Spider plate® to address SLAC or SNAC stages II and III and midcarpal osteoarthritis. Mean age was 59 years (range: 26 to 81 years). In 7 cases the dominant hand was involved. In 7 cases the etiological factor was scaphoid pseudoarthrosis, in 3 a scapholunate dissociation, and in one a perilunate carpal dislocation. There was a clear trauma antecedent in 7 of the 11 cases. Ten out of the 11 patients were manual workers.

Of the 11 patients 3 were afflicted with stage II SLAC or SNAC, 7 were stage III and one had early midcarpal osteoarthritis secondary to an operated perilunate dislocation. One case had been subjected to a previous surgery: it was a scaphoid pseudoarthrosis treated with a silicone prosthesis.

A Visual Analog Scale (VAS) was used to assess pain; the scores ranged from 0 (no pain) to 10 (maximum pain bearable). ROM was measured with a goniometer (pre – and post-operative flexion, extension and radial and ulnar deviation) and grip strength with a Baseline® dynamometer.

A/P and lateral x-rays were taken of both wrists to determine the degree of healing of the arthrodesis as well as the carpal height ratio (carpal height/ length of the third metacarpal)[8]. In all cases, the surgical indication was the existence of pain.

For the arthrodesis we used the Spider plate® (marketed by MBA), manufactured with stainless steel and incorporates 8 holes. There is also a 6-hole plate initially designed for scapho-trapeze-trapezoidal arthrodesis that may be useful for small carpi. The plate is complemented with a countersink and screws that are 2.4 mm in diameter and 8, 10, 12 and 14 mm in length.

Surgical Technique

A dorsal longitudinal incision of about 7 cm is made between the third and fourth compartments of the extensor retinaculum. A longitudinal incision is made on the joint capsule and the scaphoid and the four bones to be subjected to arthrodesis are exposed. The scaphoid is excised with a countersink, taking care not to damage the radio-scapho-capitate ligament, which prevents ulnar translation[6]. The posterior interosseous nerve is proximally sectioned. The joint surfaces of the bones to be included in the arthrodesis are withdrawn with the forceps.

A specially-designed countersink, included in the instrument set, is centered on the four bones to be subjected to an arthrodesis. The area is refreshed until the cancellous bone is reached so as to prepare the bed where the plate will be placed. A temporary fixation of the carpal bones is performed with 2 or 3 Kirschner wires with the aim of changing the orientation of the lunate bone to a neutral position. A graft is obtained from the scaphoid and introduced between the joint surfaces at the point where the four points come together. Subsequently, the plate is aligned and fixed with screws. Fluoroscopic control is used to check the position of the plate and screws and mobility tests help determine the stability of the plate. The joint capsule is closed, the extensor retinaculum is repaired and the extensor hallucis longus is transferred over it. Patients are immobilized with a splint for three weeks (Figs. 1 y 2).

RESULTS

Flexion went from 33° (15° to 41°) pre-op to 28° (15° to 36°) post-op. Extension went from 33° (12° to 37°) to 29° (12° to 33°), with a pre-op flexo-extension range of 66° (30° to 70°) and a post-op range of 47° (23° to 52°). Pre-op radial deviation was 10° (0° to 15°), with a post-op value of 12° (0° to 16°). Ulnar deviation went from 19° (0° to 23°) pre-op to 17° (0° to 20°) post-op. Mobility on the radio-ulnar plane remained constant at 29° (12° to 30°). After surgery there was an increase in grip strength from an pre-op average of 19 kg (12 to 34 kg) to 24 kg (11 to 38 kg) post-op.

Patient satisfaction after surgery was high or very high. Of the 10patients who were manual workers, 9 returned to their previous job after surgery after a mean of 3.5 months (2 to 6 months). Only one patient changed jobs. VAS scores went from 7.3 pre-op to 3 post-op.

The arthrodesis healed in 100% of cases 2 months after surgery. A slight reduction in the carpal height ratio was observed[6]; its value went from 0.47 (0.35 to 0.51) to 0.45 (0.35 to 0.50) postoperatively.

DISCUSSION

Midcarpal arthrodesis has shown itself to be effective both for midcapal stabilization and pain control. The only two absolute contraindications are ulnar translation and the presence of degenerative changes in the radius/lunate articulation[1].

Earlier publications on this surgical technique report strength preservation and an acceptable ROM[2,4-6,9]. Some authors recommend a pre-op arthroscopy to assess the condition of carpal ligaments and articular surfaces. On the other hand, we do not believe arthroscopy adds much information to plain x-rays; it is only justified when there is suspicion of a pathology associated to the triangular fibrocartilage complex. In these cases, arthroscopy aids diagnosis and treatment and makes it possible to discriminate pain caused by that pathology from that caused by carpal collapse.

Figures 1. *A and B: SNAC (Scaphoid Non-union Advanced Collapse) after a scaphoid fracture. A: Note that there is no involvement of the radio-lunate space. B: View of the scaphoid extension and of the lunate's DISI (Dorsal Intercalated Segmental Instability). C and D: Four-corner fusion with a Spider plate®. Note the repositioning of the lunate in its neutral position.*

Figures 2. *A and B: Perilunate carpal dislocation. The lunate bone maintains its anatomical relationship with the radius. C and D: reduction of the dislocation and fixation with K-wires. A ligamentous suture is applied. E and F: Articular impingement and degenerative changes typical of midcarpal osteoarthritis. G and H: Four-corner arthrodesis with a Spider plate®.*

Success of this surgical technique depends on obtaining a firm fusion between the four bones subjected to arthrodesis, with the lunate in a neutral position. This permits pain suppression as well as the achievement of maximum mobility in the radiocarpal space[4,9,10]. Arthrodesis of the midcarpal joint annuls the movement described as «dart throwing» and turns the wrist into a simple joint of the carpal condyle type[5].

The efficacy of the arthrodesis is based on suppressing the limited painful mobility of the midcarpal joint, allowing a broad pain-free mobility of the radiocarpal joint. In all cases of SLAC and SNAC wrists there is radioscaphoid osteoarthritis, which leads to the excision of the scaphoid bone to suppress pain. In cases of midcarpal osteoarthritis with no radioscaphoid involvement excision is not necessary.

Maintaining a maximum range of movement after this operation depends on a good surgical technique that succeeds in correcting the lunate extension deformity and on an appropriate wrist rehabilitation program. Rehabilitation must be started early and progress over a long period of time.

To be able to start rehabilitation early immediate stabilization is required. With this goal in mind we initially started using a technical modification involving a plate and cortico-cancellous grafting. Encouraged by the results obtained in 1994[2] with a midcarpal arthrodesis performed with iliac crest cortico-cancellous grafting screwed into the bones to be arthrodesed, we introduced the use of the Spider plate®. The goals of this technique are: a) to avoid a decrease in carpal height and hence losses of strength by carrying out an *in situ* fixation of the carpal bones interposing the cancellous graft from the excised scaphoid between them; b) to increase the consolidation rate and obtaining a stable fixation that may allow early rehabilitation and c) facilitate pain relief associating a neurectomy of the posterior interosseous nerve.

The intrinsic stability of the technique described permits a very early rehabilitation that achieves a maximum level of mobility and reduces the incidence of reflex sympathetic dystrophy, which is 1.5% in the large series published[2,11]. Internal fixation with a Spider plate® prevents the patient discomfort caused by the withdrawal of the wires.

Results show the preservation of mobility[11]. The loss of extension is compensated for by an increase in flexion. The reduction of ulnar deviation is offset by an increase in radial deviation.

Dorsal impingement, which required the use of a prosthesis in other series, reached an average 13%[11]. In our previous series the incidence was similar (12.5%); the problem was solved simply by withdrawing the protruding screws[2,12]. In the patients that received the Spider plate® we paid special attention to this issue and took care to avoid any dorsal protrusion of the hardware, placing the plate beeper and using a short screw attached to the triquetral to avoid affecting the pisotriquetral joint.

A comparison of our results with those of other series underscores our success as regards pain relief[3,6,9-11,13]. This depends mainly on achieving bone healing[13], excising the deteriorated scaphoid, associating a neurectomy of the posterior interosseous nerve and of course selecting the most symptomatic patients[14-16].

We can conclude that four-corner arthrodesis is indicated in symptomatic cases of grade II and II SLAC o SNAC wrists and midcarpal osteoarthritis, and that the use of a Spider plate® meets the previously outlined goals in terms of a stable fixation, early mobilization, high consolidation rate and carpal height preservation.

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