



SuperCable® System
Summary of Clinical Studies
(As of October 2017)

References

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14. Sutphen, Adams, Lombardi (2016) Treatment of the failed modular neck stems: tips and tricks. *J Arthroplasty* 31:1390-1394
15. Ting, Wera, Levine, and Della Valle (2010) Early experience with a novel non-metallic cable in reconstructive hip surgery. *Clinical Orthopaedics and Related Research* 468:2382-2386.
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Brief Summaries

1. Barlow et al (2016) presented their experience revising a recalled modular total hip arthroplasty stem. They retrospectively studied 92 patients who required revision secondary to a recalled modular stem. Five patients experienced an inter-operative fracture of the greater trochanter and 3 patients sustained a post-operative greater trochanter fracture secondary to trauma. These 8 patients required fixation with a claw-plate and SuperCables (readily apparent from radiograph) and went on to bony union. Due to the challenging nature of this type of revision surgery, the authors conclude that patients should expect a modest functional improvement and frequency of complication.
2. Berend et al (2014) retrospectively evaluated their experience using SuperCable in highly complex revision total hip arthroplasty. Twenty six patients underwent revision hip reconstruction with the SuperCable system, including both Kinamed cables and Kinamed grip-plates. There were 14 women and 12 men. Age averaged 63.2 years and BMI averaged 29.4 kg/m². At an average 2.5 year follow-up, fixation was considered successful in 22 hips (81%) with five failures. In this extremely challenging clinical environment, the authors stated that the SuperCable system provided reliable fixation for adequate healing of difficult fractures with radiographic and clinical healing observed.
3. Edwards et al (2011) conducted a retrospective review of revision shoulder arthroplasty in which humeral osteotomy was used for stem extraction. The review was performed on 13 patients who underwent shoulder arthroplasty in which SuperCables were used. Clinical and radiographic data were examined regarding patient age, procedure performed, indication for cerclage cabling, time to healing of osteotomy or fracture, and any complications associated with the use of these cerclage cables. Minimum follow-up was 1 year. Twelve patients underwent reverse total shoulder arthroplasty, and 1 patient underwent revision unconstrained total shoulder arthroplasty. Mean follow-up was 20.5 months. Ten patients required humeral osteotomy for stem or cement removal. Allograft augmentation was performed in 7 patients. Mean time to healing was 3.2 months. No patients experienced loosening or migration of hardware or allograft, and no complications directly related to the use of nonmetallic cerclage cables were identified. These results suggest that SuperCable fixation is a viable alternative to traditional metallic or wire cerclage in complex total shoulder arthroplasty.
4. Gartsman and Edwards (2009) described successful use of the SuperCable system in revision shoulder arthroplasty. They report on their technique for humeral stem removal and proximal humeral reconstruction with allograft strut that incorporates the use of the SuperCable system. The authors recommended the use of SuperCable for fixation of humeral osteotomy and for reconstruction of the proximal humerus in complex shoulder arthroplasty based on their experiences with the system. No complications directly related to the cables were reported.
5. Hak et al (2014) reviewed the use of carbon-fiber-reinforced composite fracture implants in several different clinical applications: spine surgery, long bone trauma (including femur, wrist, and humerus fractures), high tibial osteotomy, sports medicine, musculoskeletal oncology and infections. The review includes a case report of two SuperCables (readily apparent from radiograph), an allograft strut, and an intramedullary nail used to treat metastatic malignant



melanoma of the humeral shaft. The authors state that radiolucency of the plate and cables permits improved radiographic evaluation of fracture union and allograft incorporation.

6. Hao et al (2008) reported forty-two cases of comminuted long bone fractures treated with an interlocking intramedullary nail, dynamic hip screws, and supplemental fixation using the SuperCable system. Clinical examinations were performed at a follow-up range of 6 to 13 months. Good overall results were achieved, with no loss of fixation, implant breakage, malunions, or bone resorption observed upon clinical examination. No complications directly related to the cables were observed. Hao et al concluded that the use of SuperCable system to aid in the treatment of comminuted long bone fractures is an effective procedure that is not technically demanding.
7. Li et al (2009) reported on 17 patients, aged 81 to 97 years old, who received a total hip prosthesis after suffering an intertrochanteric fracture of the proximal femur. SuperCables were used as adjunct fixation as part of their surgical technique. The patients were followed for an average of 13.7 months (4.5 to 36 months). Hip range of motion post-operatively was 90 to 110 degrees. The authors conclude that the fixation technique employed (total hip replacement with cable fixation) significantly reduced operative time and decreased bleeding in comparison to internal plate or screw fixation, and should be considered of clinical significance for elderly patients.
8. Ozturk et al (2013) described their preferred technique for scapulothoracic fusion as a salvage procedure to provide a stable base for the scapula on the thorax. The indications for this procedure include refractory pain and limitation in shoulder elevation secondary to scapular winging. Different techniques for scapulothoracic fixation have been described in the literature with favorable outcomes. In the current technique, SuperCables, polyester tapes, and a low-profile plate were used to avoid possible complications associated with scapulothoracic fixation, such as a stress fracture of the ribs and implant cutoff through the scapula. The authors conclude that fixation with these implants is a viable option with a low potential of morbidity.
9. Platt and Waters (2016) presented a novel method for using cerclage to treat iatrogenic calcar cracks that occur secondary to insertion of uncemented hip arthroplasty stems. They recommend SuperCable for their cerclage technique to resist slippage, avoid tendon damage, and reduce the chances of stem subsidence.
10. Rajfer et al (2015) presented their preferred technique for olecranon fracture fixation using SuperCable and described clinical outcomes in 7 patients. The authors reported that anatomical reduction was maintained in all elbows through union. Physical examination measurements indicated nominal side-to-side differences in motion and strength. One patient had a minor degree of hardware irritation at longest follow-up but did not request hardware removal. One patient underwent implant removal for a symptomatic implant 5 years after surgery. The authors concluded "this easily reproducible technique yields excellent physical and functional outcomes."
11. Riansuwan et al (2010) evaluated the SuperCable for fixation of olecranon fractures, a procedure which is historically performed using two k-wires in addition to a stainless steel wire in a loop or figure-of-eight configuration. The SuperCable has been proposed for use in the fixation of these types of fractures as an alternative to stainless steel wire, which may cause irritation of the soft tissues surrounding the elbow. A series of tests was performed using two k-wires with stainless



wire or the SuperCable in a loop or figure-of-eight configuration for fixation of this type of fracture in cadaveric bones. Cyclic loading as would be experienced during daily living was applied to each of the cadaveric elbow specimens, and the resulting motion at the fracture was measured for both the SuperCable and stainless wire constructs. Four loading cycles were performed, and the displacement at the fracture was measured under load at the end of each of the four cycles. The average displacement of the fracture when using a SuperCable in a loop or figure-of-eight configuration was less than the average displacement of the fracture when a stainless steel wire was used in either a loop or figure-of-eight configuration. This study demonstrates that the SuperCable should be considered as an alternative to a stainless wire for fixation of transverse olecranon fractures and may provide better biomechanical performance than a stainless wire for tension band fixation. The study includes a case report in which the SuperCable was used clinically for fixation of an olecranon fracture. The case involved a 73 year old female who suffered an elbow fracture following a ground level fall. The fracture was stabilized using a SuperCable in a figure-of-eight configuration. Post-operative radiographs show reduction of the fracture and demonstrate the transparency of the cable on radiographic imaging. At six-months follow-up, the patient was pain free and had recovered functional use of her arm.

12. Sarin and Hack (2005) presented the first known clinical results using the SuperCable system, a novel elastic, high strength, high fatigue-life cerclage cable that maintains compression across a fracture plane without the inherent mechanical problems of traditional metal cerclage. A prospective study was performed. Patients having fractures across a range of orthopaedic indications were treated and monitored radiographically and clinically. Between August 2004 and April 2005, SuperCables were used to treat fractures in 11 patients (6 males and 5 females having an average age of 66 ± 16 years, range 43 to 87). The following indications were treated: femoral stem revision (n=3), humeral stem revision (n=1), pre-existing humeral nonunion (n=1), midshaft femur fracture (n=1), greater trochanter fracture (n=1), and patella fracture (n=4). Post-operative monitoring included routine radiographic and clinical evaluation. A total of 26 cables were used to treat the 11 fractures. At average follow-up of 20 ± 8 weeks (range 10 to 36), there were no complications related to use of the cable. Three fractures had healed (2 patellae and 1 hip revision); 6 fractures were healing normally; 1 fracture construct failed due to patient noncompliance and was immobilized (patella); and the pre-existing humeral nonunion was approximately 50% healed at 36 weeks although the patient had no pain and was using the arm normally. At most recent follow-up, there was no evidence of necrosis under the cable, cable loosening, or wear-induced osteolysis from the UHMWPE cable sheath. Cables were removed from the two healed patellae. Histological analysis was performed on tissue retrieved from one of these explanted cables and showed no untoward effects. The authors report that SuperCable offers improved fatigue strength and compensates for micro-movement by maintaining a continuous compressive force across the fracture. They conclude that these short-term clinical results suggest that the cable is a safe and effective method for treatment of fractures.
13. Schultzel and Itamura (2016) present their preferred technique for revision shoulder arthroplasty using an osteotomy for extraction of the humeral stem. The authors state that their preferred method for repair of the osteotomy is using a polymer cerclage cable system (SuperCable) with allograft struts to augment the repair. The authors conclude that this method is simple and effective for reducing the risk of humeral fracture; however, they concede that more follow-up data is necessary to determine long-term efficacy.



14. Sutphen et al (2016) reviewed treatment options failed modular neck stems. As part of the review, they included three case reports. Two of the case reports includes revision hip arthroplasty augmented with SuperCables (readily apparent from radiograph). The authors recommend the use of contemporary extraction techniques and options to enhance stability when this type of difficult and challenging revision is necessary.

15. Ting et al (2009) conducted a retrospective review of complex primary and revision total hip arthroplasties utilizing the SuperCable system in 29 cases. Indications for use included fixation of an extended trochanteric osteotomy (ETO) (22 patients), intraoperative fracture of the proximal femur in the course of a total hip arthroplasty (THA) (4 patients: 3 primary and 1 revision), isolated strut allograft fixation (2 patients) and a Vancouver B1 periprosthetic fracture of the femur (1 patient). All patients underwent both clinical and radiographic evaluations post-operatively at 3 weeks, 6 weeks, 3 months and then annually thereafter. Clinical and radiographic evaluation was performed by observers who were not part of the operating team. Healing was based on bridging bone on orthogonal radiographic views with absence of proximal migration or fixation failure. Femoral component stability was evaluated radiographically using the criteria of Engh. Femoral deficiency was classified according to the Paprosky system. Twenty-nine patients were followed for a mean of 7.4 months (range, 1 to 15 months). The mean age was 63.9 years (range, 34 to 94 years), and the cohort included 18 women and 11 men. The average number of cables utilized was 3.1 (range, 1 to 6 cables). The primary reason for femoral component revision included aseptic femoral component loosening in 12 patients (including 3 patients with a Vancouver B2/3 periprosthetic fracture), 2 femoral component fractures, recurrent instability in 2 patients, and a deep periprosthetic infection in 7 patients (including 1 patient with an infected Vancouver B2 periprosthetic fracture). The cables provided adequate early fixation strength to allow for both osteotomy and fracture healing. There were no complications directly related to the cables. Two patients developed a non-union; one following an ETO and one following fixation of a Vancouver B1 periprosthetic fracture (6.9%). The mean time to union for the remaining 27 patients was 2.7 months (range, 1 to 6 months). Two stems migrated (6 and 11 mm, respectively) in the first 3 weeks postoperatively but subsequently stabilized and showed evidence of bone ingrowth. One of the revision THA's developed a deep infection, which was successfully treated with an irrigation and debridement. Four of the 29 patients (13.8%) dislocated post-operatively; two were treated successfully with closed reduction, while the other two required reoperation. Ting et al reported that the SuperCable provided adequate early fixation strength to allow for both osteotomy and fracture healing. They did not observe any complications directly related to the cables although the complication rate in this series of complex primaries and revisions was high. These results suggest that SuperCable fixation is a viable alternative to traditional metallic or wire cerclage in complex total hip arthroplasty.

16. Wilkerson and Rosenwasser (2014) provided a detailed review of the most common olecranon fixation techniques including pitfalls in cases with positive outcomes and complications. The authors explained that fixation with SuperCable is advantageous because it is much easier to manipulate into a figure-of-eight configuration and the iso-elastic properties allow for malleable tensioning of cables that are less susceptible to kinks. The study includes a case report in which the SuperCable was used clinically for fixation of an olecranon fracture. The case involved a 70 year old female who suffered an elbow fracture when falling on a flexed elbow. The fracture was stabilized using K-wires and a SuperCable in a figure-of-eight configuration. Post-operative radiographs show reduction of the fracture and demonstrate the transparency of the cable on radiographic imaging. The locking clasp was positioned on the proximal-lateral edge of the ulna



to reduce the potential for soft tissue irritation. At six-months follow-up, the patient was pain free and had recovered functional use of her arm.

17. Yi et al (2014) presented a retrospective review of 183 extended trochanteric osteotomy (ETO) cases associated with primary or revision total hip arthroplasty (THA). The study population was broken down into 4 categories representing aseptic revision (n=100), periprosthetic fracture (n=27), periprosthetic joint infection (n=51) and complex primary THA (n=5). The surgical technique demonstrated use of the SuperCable system in an ETO case (their page 3). The overall results of the retrospective study conclude the outcome in 97% of ETO cases was osseointegration with 95% of the revised femoral components with infrequent complications.

Articles that may be of particular interest to Dr. Tesar:

- Berend – hip
- Edwards - shoulder
- Ozturk – scapula
- Rajfer – olecranon fracture
- Sarin and Hack –patella fracture, includes **histological analysis** of explanted cable
- Ting – hip
- Wilkerson and Rosenwasser – olecranon fracture