Acta orthop. scand. *53*, 355–360, 1982

NON-SLIDING PINS IN TRACTION ABSORBING WIRING OF FRACTURES: A MODIFIED TECHNIQUE

P. NETZ & L. STRÖMBERG

Departments of Orthopaedic and General Surgery, Karolinska Hospital, Stockholm, and Department of Orthopaedic Surgery, Danderyd Hospital, Danderyd, Sweden

By using a newly constructed pin instead of Kirschner wires in the traction absorbing wire (TAW) technique, the clinically observed sliding of the Kirschner wires and resulting skin problems are avoided. The pins and the internal fixation technique are described. In order to demonstrate the simplicity and reliability of the technique a follow-up study 7 years after performed surgery is presented. The late results are given of a series comprising the authors' first 10 consecutive cases of closed transverse olecranon fractures treated by this new technique of internal fixation.

Key words: fractures; internal fracture fixation; olecranon

Accepted 10.viii.81

The tension band principle in orthopaedic surgery was defined by Pauwels (1935). Adopting the same principles, Weber modified the method by combining the tension band and wiring with Kirschner wires in order to improve rotational stability and achieve a lasting accurate reduction of the fractured fragments (Weber 1963).

This technique is now in common use under the name "traction absorbing wire" (TAW) technique and is mainly reserved for fractures of the ulnar olecranon, greater trochanter and patella, and selected cases of medial and lateral malleolus fractures not suitable for internal screw fixation. The technique has its obvious advantages documented by the reported results (Szyszkowitz & Tscherne 1968, Kouwenhoven & Weber 1969, Müller et al. 1970). However, it is not free from drawbacks. Among these are the relatively extensive exposure of the fracture site which has to be repeated on removal of the metal implants, and the fact that the operative technique is more complicated than several other described methods. Furthermore, there is a risk of the Kirschner wires sliding and causing skin problems, as reported by Wenzel (1968). In order to prevent this we replaced the Kirschner wires with specially designed non-sliding pins.

The purpose of this report is to present the new pins and their advantages in the TAW-technique as reflected in the results of a short follow-up series of patients treated by the authors.

The "Netz pin" (Figure 1)

The pin is made of stainless steel of the SIS 2330 type (Ericsson Kirurgiska Instrument, S-413 11 Gothenburg, Sweden). It has a diameter of 2.0 mm and is available in different lengths (60, 80, 100 and 120 mm) with a highly polished surface. Its point is lancet-shaped and at its base a hole with a diameter of 1.1 mm is drilled perpendicular to the long axis of the pin.

0001-6470/82/030355-06 $02.50/0

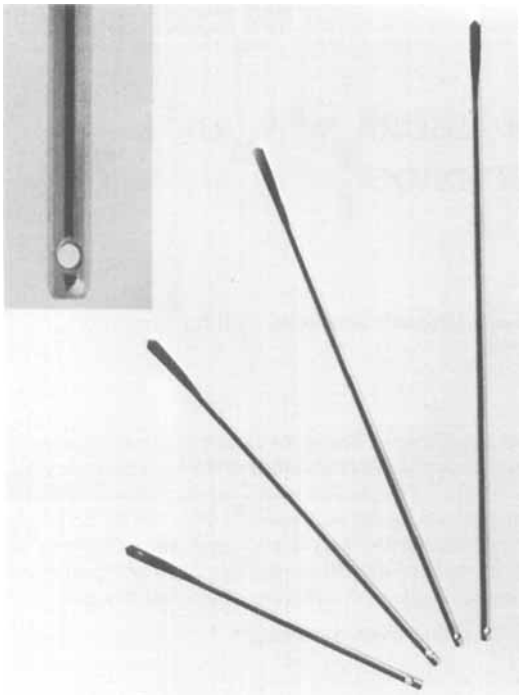

Figure 1. The Netz pin made from stainless steel shown in various lengths with a hole in the base.

METHOD

Operative procedure

To describe the use of the "Netz pin" in orthopaedic surgery, the internal fixation procedure according to the TAW-technique for ulnar olecranon fractures has been chosen as an illustrative example.

The fracture and joint surface are exposed through a postero-lateral incision and small fragments are excised before rinsing the joint with physiological saline solution. By means of a hook, the sharp claw of which is placed on the tip of the olecranon, the fracture fragments are reduced and kept in an exact anatomical position. The two "Netz pins" are drilled parallel to each other through the olecranon and into the diaphyseal part of the ulna in line with its long axis, thus replacing the Kirschner wires in the original TAW-technique (Figure 2). The base of the pins with the hole should at this stage be left approximately 10 mm outside the olecranon. With a pair of tongs the position of the pins is adjusted so that the pin holes are aligned.

At a distance of approximately 20 mm from the fracture line, in accordance with the original procedure, a 2 mm wide hole is drilled through the cortical wall under the posterior ulnar facet and perpendicular to its long axis. Through the hole a cerclage wire with a preformed loop at one end (diameter 1 mm, type AOI, Switzerland) is inserted. A second cerclage wire of the same type is inserted through the holes in the "Netz pins", leaving the prelooped ends of the wires on the same side of the ulna.

With an impactor the pins are driven further into the bone until arrested by the wire (Figure 3). It is very important to achieve this impaction before the next step of the operation. Using the traditional TAW-technique it is possible to adjust the length of the Kirschner wires after the cerclage wires have been tightened, but this is not recommended for the "Netz pins". It would diminish the interfragmental compression, and the stable fixation of the fracture would be spoilt. The cerclage wires are secured together by threading the free straight ends of the wires through the loops, thus combining the wires into a figure-of-eight. The free end of each wire is fixed into an AOI wire tightener. The wires are put under tension simultaneously, so that the fracture sur-

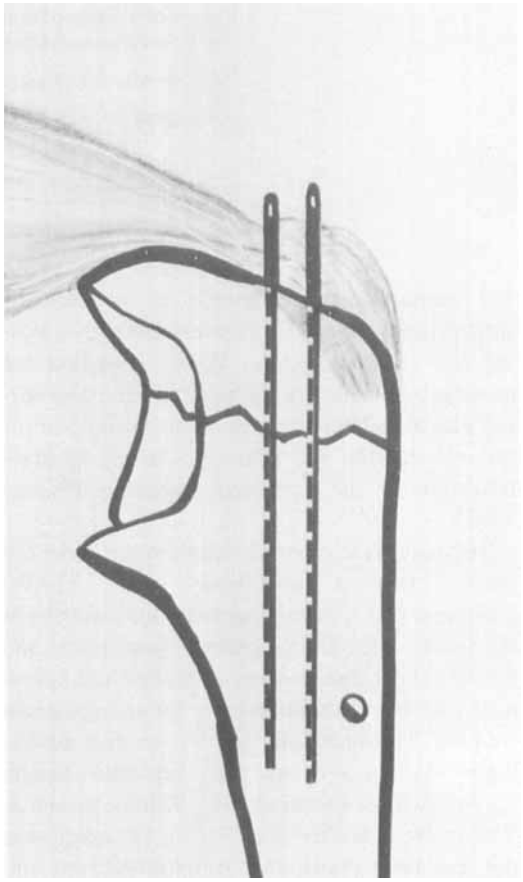

Figure 2. The Netz pins should at first be left approximately 10 mm outside the olecranon and the position of the holes adjusted so that they are aligned.

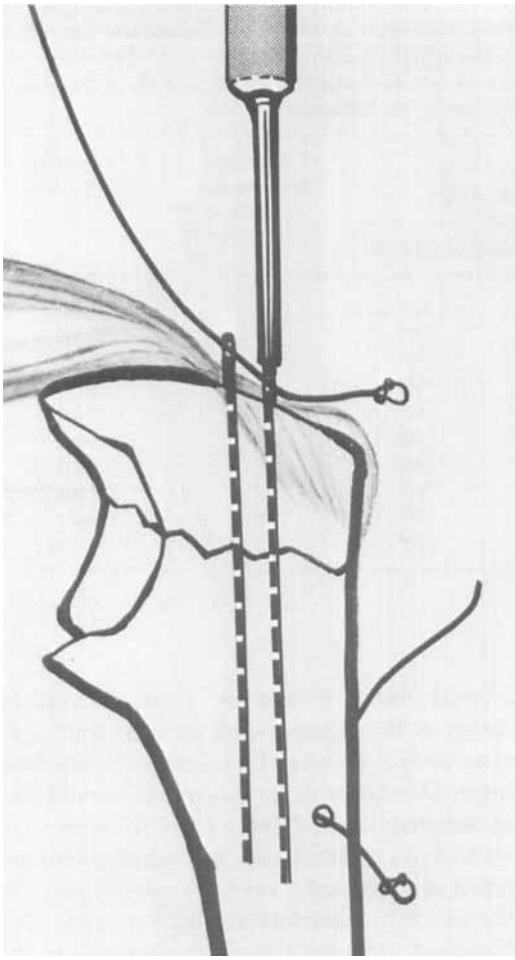

Figure 3. With an impactor the pins are driven further into the bone until arrested by the cerclage wire.

faces are pressed together without disturbing the previously achieved exact anatomical reduction of the temporarily stabilized fracture ends (Figure 4). The wires are bent over by means of tongs to form hooks gripping into the loops. The tension in the wires will thus be maintained after the wire tighteners are loosened. The excess wire is cut off.

Postoperative regime

After surgery with this modified operative technique, the elbow should be held in a semi-rigid bandage of soft dressings for 5 or 6 days postoperatively. As soon as the swelling and the oedema have disappeared the patient should start active mobilization. The fracture can be considered as healed after 6 weeks.

PATIENTS

Follow-up series

The good results of the original TAW-technique for fractures of the ulnar olecranon have earlier been reported by several authors. However, in order to prove that the introduction of the "Netz pins" has not complicated the TAW-technique procedure, we present the first 10 consecutive cases of closed ulnar olecranon fractures treated with the modified TAW-technique described above. The cases have been analysed and re-examined 7 years after the operations.

The patients were between 20 and 83 years of age and all were injured by direct trauma to the ulnar olecranon. The patient material and the late results in terms of subjective discomfort, objectively measured mobility at the elbow joint, and pronation and supination of the forearm are presented in Table 1.

All patients but one had regained full function with normal flexion and extension of the elbow, and pronation and supination of the forearm. According to Kouwenhoven & Weber (1969) a deficit of less than 5 degrees is classified as normal. The one patient with restricted function had an extension deficit of 15 degrees at the elbow and a non-disabling limitation of supination of the forearm. Analysis of this patient's radiograms disclosed a minor compression fracture in

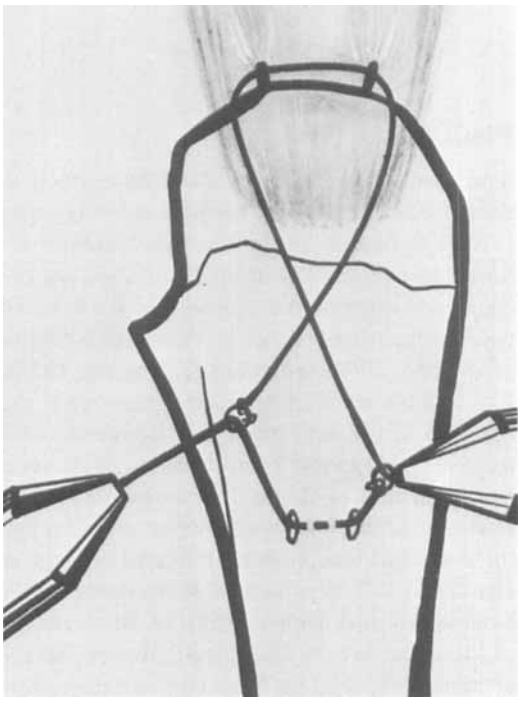

Figure 4. The wires are put under tension simultaneously.

Table 1. The first 10 consecutive patients with closed transverse olecranon fractures treated by means of the modified TAW-technique using the "Netz pins". Follow-up examination took place approximately 7 years after operation. Mean age (at operation) was 56.5 years. All patients but one regained full mobility of the elbow and the forearm. No rigid external fixation, such as a cast or a splint has been used postoperatively in any of the cases. None of the patients reported any discomfort at the time of the follow-up

Patient	Age	Sex	Mobility				Years elapsed from internal fixation to follow-up	Subjective discomfort
			Elbow		Forearm			
			Extension	Flexion	Pronation	Supination		
1 LL	49	F	0°	140°	80°	80°	7.7	None
2 BP	33	F	0°	135°	90°	80°	7.2	None
3 RL	38	M	5°	145°	90°	70°	7.1	None*
4 EO	83	F	15°	135°	90°	55°	7.0	None
5 FN	20	M	0°	130°	90°	85°	7.4	None*
6 MV	68	F	5°	130°	90°	80°	7.6	None
7 SH	67	F	5°	140°	60°	90°	7.7	None
8 SL	61	M	0°	135°	90°	80°	6.3	None
9 KS	76	F	5°	130°	80°	90°	6.6	None
10 GT	60	F	0°	135°	90°	90°	6.7	None

* Implant removed

the head of the radius and poor compression between the fracture fragments that might have contributed to the less than perfect result (Figure 5).

DISCUSSION

Since Weber in 1963 launched the method in orthopaedic surgery, the traction absorbing wire (TAW) technique, in the German literature referred to as the Zuggurtung technique, has become well documented as a method for selected types of fractures (Weber & Vasey 1963, Müller et al. 1965, 1970, Scharplatz & Allgöwer 1975). It is suitable chiefly for avulsion fractures at the insertion of muscles, tendons or ligaments (Colton 1971). However, it has its widest application as the method of choice for internal fixation of fractures of the ulnar olecranon even though these are not true avulsion fractures (Bürger & Henkert 1967, Szyszkowitz & Tscherne 1968, Kouwenhoven & Weber 1969). In the treatment of these fractures it allows exact anatomical reduction of the fracture fragments and the reconstructed congruence of the joint can be preserved in spite of early mobilization. The stability of this internal fixation is superior to that achieved by means of the figure-of-eight tension band wire alone or by a screw inserted through the proximal fragment in line with the long axis of the ulna into its medullary cavity (Weber 1963). However, the method has its drawbacks and complications are reported (Wentzel 1968, Kouwenhoven & Weber 1969, Scharplatz & Allgöwer 1975). The Kirschner wires are not stably anchored in the bone and the tension on the cerclage wires varies during active mobilization of the joint. This constitutes a considerable risk of sliding of the Kirschner wires, which may result in skin trouble and/or deterioration of the stability of the fracture fixation. In order to prevent sliding of the Kirschner wires we replaced them by a newly designed type of pin, which is firmly anchored by the tensioned cerclage wire running through the hole in the distal end of the pin, instead of being passed round the end of the Kirschner wire, thus preventing slippage.

The quality of the stainless steel chosen for the manufacture of the "Netz pins" is equal to that of the cerclage wires (AOI type), in order to diminish the risk of electrolyte activity (Bechtol et al. 1966). The surface of the pins is highly polished so as to have the smallest possible area

Figure 5. Postoperative radiogram of patient 4, after internal fixation by means of two Netz pins and two cerclage wires. A slight compression fracture of the neck of the radial head and the poor compression between the fracture ends may have some bearing on this patient's reduced ability to extend the elbow and supinate the forearm.

against the bone and thus minimize corrosion activity (Müller et al. 1965). As the pins should preferably be drilled into the bone, they have been given a suitable stiffness and lancet-shaped tips.

The "Netz pins" have not complicated the internal fixation procedure compared with that of the original TAW-technique. This is indicated by the results given in Table 1. We have mainly used the modified TAW-technique in the treatment of fractures of the ulnar olecranon and fractures of the lateral malleolus of the ankle. We have re-examined our 10 first cases of ulnar olecranon fractures treated with this method. We consider it important to limit the material to the first 10 consecutive cases, as during the period they were operated upon we had not yet acquired any extended experience of the use of the "Netz pins" in the TAW-technique.

The increased rigidity of the internal fixation has not negatively affected the results of the fracture treatment in terms of mobility of the treated arm. This statement is not contradicted by the present analysis given in Table 1.

It should be noted that in 8 of the 10 cases in this series the internal fixation material has been left in place, whereas two patients had it removed 2 and 5 months, respectively, after operation. However, no sliding of the pins or any failure of the tension wires had occurred in either case, nor had the implants caused the patients any discomfort. The reason for removal of the implants was subclinical skin problems due to faulty positioning of the sharp cut ends of the cerclage wires. We now recommend that the free ends of the cerclage wires be threaded through the loops either on the medial or on the lateral side of the ulna in order to minimize skin complications.

We have thus described a TAW-technique, modified by means of newly designed internal fixation pins, which from the mechanical point of view forms a better designed and more reliable rigid internal fixation with the implants well anchored in the bone. The simplicity of the procedure in the hands of an orthopaedic surgeon with limited or no experience of the method is demonstrated. We are convinced that the Kirschner wires should be exchanged for "Netz pins" in internal fixation according to the TAW (Zuggurtung) technique.

REFERENCES

Bechtol, C. O., Ferguson, A. B. & Laing, P. G. (1966) *Metals and engineering in bone and joint surgery*. The Williams & Wilkins Company, Baltimore.

Bürger, K. & Henkert, K. (1967) Die methode der Zuggurtungosteosynthese bei der operativen behandlung von Olecranonfrakturen. *Monatsschr. Unfallheilkunde.* **70**, 528–534.

Colton, C. L. (1971) The treatment of Dupuytren's fracture-dislocation of the ankle. *J. Bone Joint Surg.* **53**-B, 63–71.

Kouwenhoven, G. C. & Weber, B. G. (1969) Zuggurtungosteosynthesen bei Olecranonfrakturen. *Arch. Orthop. Unfallchir.* **65,** 244–250.

Müller, M. E., Allgöwer, M. & Willenegger, H. (1965) *Technique of internal fixation of fractures.* Springer Verlag, Berlin, Heidelberg, New York.

Müller, M. E., Allgöwer, M. & Willenegger, H. (1970) *Manual of internal fixation.* Springer Verlag, Berlin, Heidelberg, New York.

Pauwels, F. (1935) *Der Schenkelhalsbruch. Ein Mekanisches Problem.* Enke, Stuttgart.

Scharplatz, D. & Allgöwer, M. (1975) Fracture dislocations of the elbow. *Injury* **7**, 143–169.

Szyszkowitz, R. & Tscherne, H. (1968) Die Zuggurtungosteosynthese bei Olecranonfrakturen. *Monatsschr. Unfallheilkunde.* **71,** 490–493.

Weber, B. G. & Vasey, H. (1963) Osteosynthese bei Olecranonfraktur. *Z. Unfallmed. Berufskr.* **2**, 90–96.

Weber, B. K. (1963) Grundlagen und möglichkeiten der Zuggurtungsosteosynthese. *Chirurg* **35,** 81–86.

Wenzel, K. P. (1968) Behandlungsergebnisse operierter Olecranonfrakturen. *Monatschr. Unfallheilkunde.* **71**, 493–497.

Correspondence to: Pelle Netz, M.D., Department of Orthopaedic Surgery, Danderyds Hospital, S-182 88 Danderyd, Sweden.