External fixation is one of the mainstays of surgical fracture management. This type of osteosynthesis allows for “local” and “general” damage-control procedures. It also permits correction of deformities, bone lengthening and segmental bone transport, arthrodesis, as well as joint contractions and bone infection treatment. The following articles give an overview on the various applications of external fixation. They have been assembled and edited by the members of the ExFix working group (EFWG) of the AOTK and other recognized experts.

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Principles of the application, design, and assembly of external fixators

Why external fixation?
External fixation is recommended when the local or general condition of the patient is compromised or when logistic circumstances make external fixation the obvious choice.

External fixation:
• Is a minimally invasive, versatile method for any type of fracture.
• Has a short application time.
• Is applicable in open and closed fractures of any configuration.
• Allows for bridging of periarticular fractures.
• Allows for secondary corrections and lengthening.
• Can be used both as a temporary or definitive treatment.
• Can be exchanged for internal fixation.
• Has an easy-removal technique.

External fixation components
The components of external fixators consist of screws, pins, or wires (into the bone); tubes or rings; and, clamps (connection of pins to tubes or rings) (Fig 1a-c.)

Biomechanical principles of assembly
The external fixator must guarantee adequate stability to maintain reduction under different loading conditions. As a rule, at least two pins or tensioned wires are inserted into each fragment or segment. Placement of the pins and/or wires must take into account the injury pattern of the bone and, above all, of the soft tissues. The pins should be placed in the anatomically safe zones. Proper assembly also makes adequate provision for secondary internal osteosynthesis later.

Principles of assembly
There is a basic differentiation between unilateral and bilateral frame assemblies and ring fixators. Hybrid and ring fixators are multiplanar constructions. External fixators can be constructed in a static or dynamic mode. Observations have shown that additional dynamization elements within the fixator are not necessary with weight bearing.
Temporary or definitive treatment method?

There are basically three treatment concepts:

1. A definitive treatment with the external fixator until bone consolidation is completed
2. An early change of management to internal fixation
3. Conversion to a nonsurgical treatment, eg, plaster cast, brace, etc.

The concept of damage-control orthopedics (DCO), relative to limb surgery in patients with severe multiple injuries, is an attempt to minimize the “second hit” of an emergency procedure of pelvic and long bone stabilization that is performed rapidly and atraumatically, mostly using methods of unilateral external fracture fixation, and releasing of compartment syndromes. Vital for achieving this goal are minimizing the duration of initial surgery, avoiding additional blood loss, and performing only life- and limb-saving procedures.

Fig 1a  Schanz screws with standard trochanter or self-drilling tips.
Fig 1b  Stainless steel tubes and carbon fiber rods for the large system.
Fig 1c  Sample of clamps for different usages.
There are 3 sizes (small: 4 mm, medium: 8 mm, large: 11 mm) with the same design and function and compatible to each other.