

## Fatigue resistance

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### Clinical problem:

Internal fixation (IF) is mandatory for fractures of the adult femur shaft.

Nails are the implants most frequently used. Rotational mal-alignments and delayed or non-unions are possible complications.

Plates are an additional option for IF, e.g. when knee or hip prosthesis do not allow the use of nails. IF with plates are at risk of implant failure (plate stripping screw breakage or fatigue), if the fracture is under persistent excessive load and does not consolidate within the usual time frame. Multi-fragmentary fractures with lack of bony buttress opposite to the plate are particularly at risk. (cf. case 32-CO-111, 75 year-old patient in the ICUC app). Necessary reoperations are often technically demanding and induce an important systemic response of the patients.

### The concept of the helical plate

The use of an additional plate has been proposed: a second plate with a helical shape [1] can be introduced with minimally invasive technique and can be added to the standard lateral plate. Such a construct helps to avoid fatigue [2, 3]. We call such a construct “prosthetic osteosynthesis” or “fatigue resistant internal fixation”.

Such constructs were first used for re-operations ([Figure 1](#): 32-CO-538, 25 year-old patient). Positive experiences stimulated us to use it also as primary treatment in cases of segmental comminution ([Figure 2](#): 32-CO-456, 50 year-old patient).

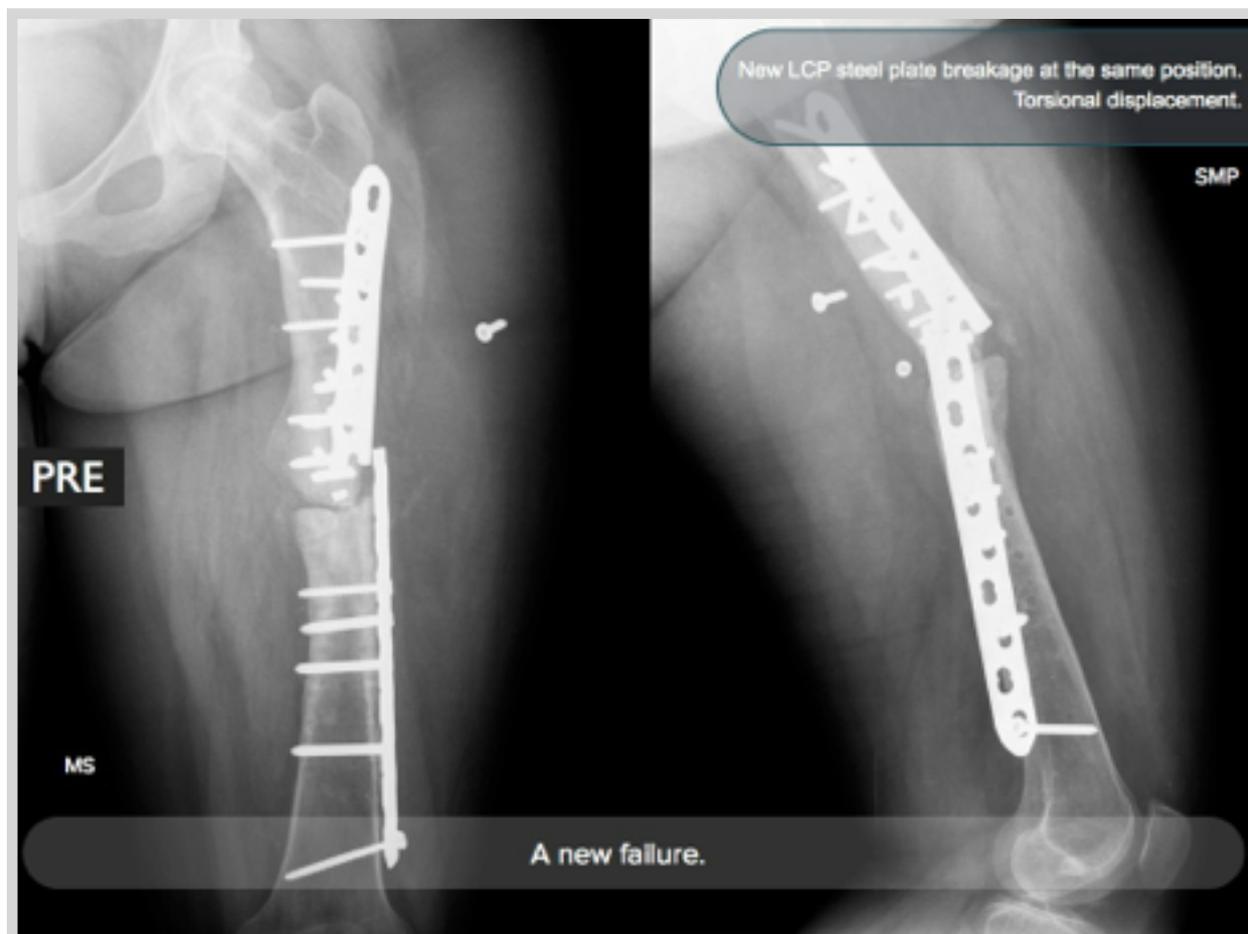


Figure 1: 32-CO-538, 25 year-old patient.



Figure 2: 32-CO-456, 50 year-old patient.

**Conclusions:**

The presented type of double plating (using a lateral plate and a minimally invasive **helical plate**) avoids fatigue and difficult reoperations and allows immediate painless function (weight bearing) as relevant clinical advantages.

The concepts of **fatigue resistance** and **double implants** are illustrated by 17 cases documented in detail and accessible in the ICUC app. On the next page you will find the case ID numbers of these cases:



32-CO-456 \*  
33-EA-272 \*



32-CO-580 \*



32-CO-538 \*



32-CO-111 \*



32-SI-436



32-SI-985



32-SI-022



32-SI-372



32-SI-236



32-SI-449



32-SI-328



32-SI-250



32-WE-087



33-EA-729



33-EA-563 \*  
Right and Left



33-EA-436

\* Cases commented by members of the ICUC expert board. These comments can be found in the [ICUC app](#)

#### Literature Cited:

1. FERNÁNDEZ DELL'OCA AA. THE PRINCIPLE OF HELICAL IMPLANTS. UNUSUAL IDEAS WORTH CONSIDERING. INJURY 2002; 33 SUPPL 1: 1-27.
2. PERREN, S. M. 1, 2, FERNANDEZ, A. 3, REGAZZONI, P. 4, UNDERSTANDING FRACTURE HEALING BIOMECHANICS BASED ON THE "STRAIN" CONCEPT AND ITS CLINICAL APPLICATIONS. ACTA CHIR. ORTHOP. TRAUM CECH 82, 253-260, 2015
3. PERREN, S. M., REGAZZONI, P., FERNANDEZ, A. BIOMECHANICAL AND BIOLOGICAL ASPECTS OF DEFECT TREATMENT IN FRACTURES USING HELICAL PLATES. ACTA CHIR. ORTHOP. TRAUM. ČECH., 81: 267-271, 2014.