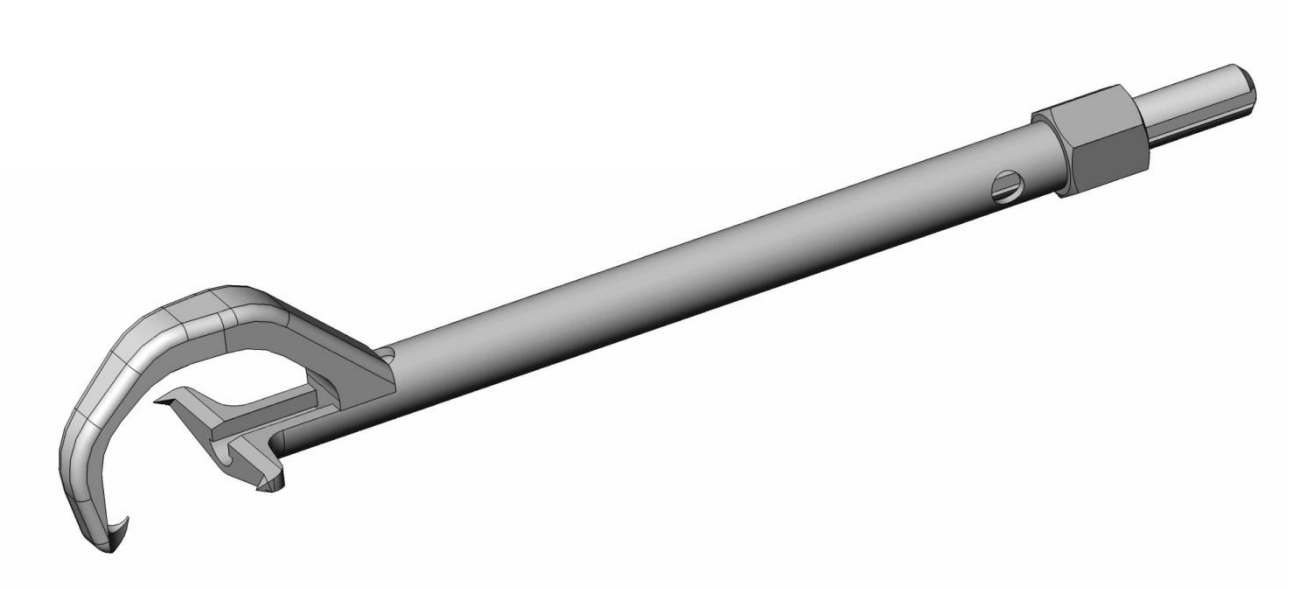
**Ortho-SUV Ltd.**
**S. H. Pitkar Orthotools Pvt. Ltd.**

# SUV-clamp
## (Extracortical Clamp Device)

***User Manual***



**Saint-Petersburg - Pune, 2020**

# Contents

**SUV-clamp** (Fig. 1) is a special device that provides fixation of bone fragment to the ring of ExFix frame without necessity to perforate cortices and bone cavity (as it's necessary while using conventional K-wires and half-pins).

**Indications** for SUV-clamp application:

- Massive foreign body in bone cavity (spacer, nail), when there are indications for Lengthening over the nail (LON) and Bone transport over the nail (BTON);
- Periprosthetic deformities and malunions;
- Periprosthetic femur fractures (Types B1 and C according to Vancouver classification);
- Infection in bone cavity.

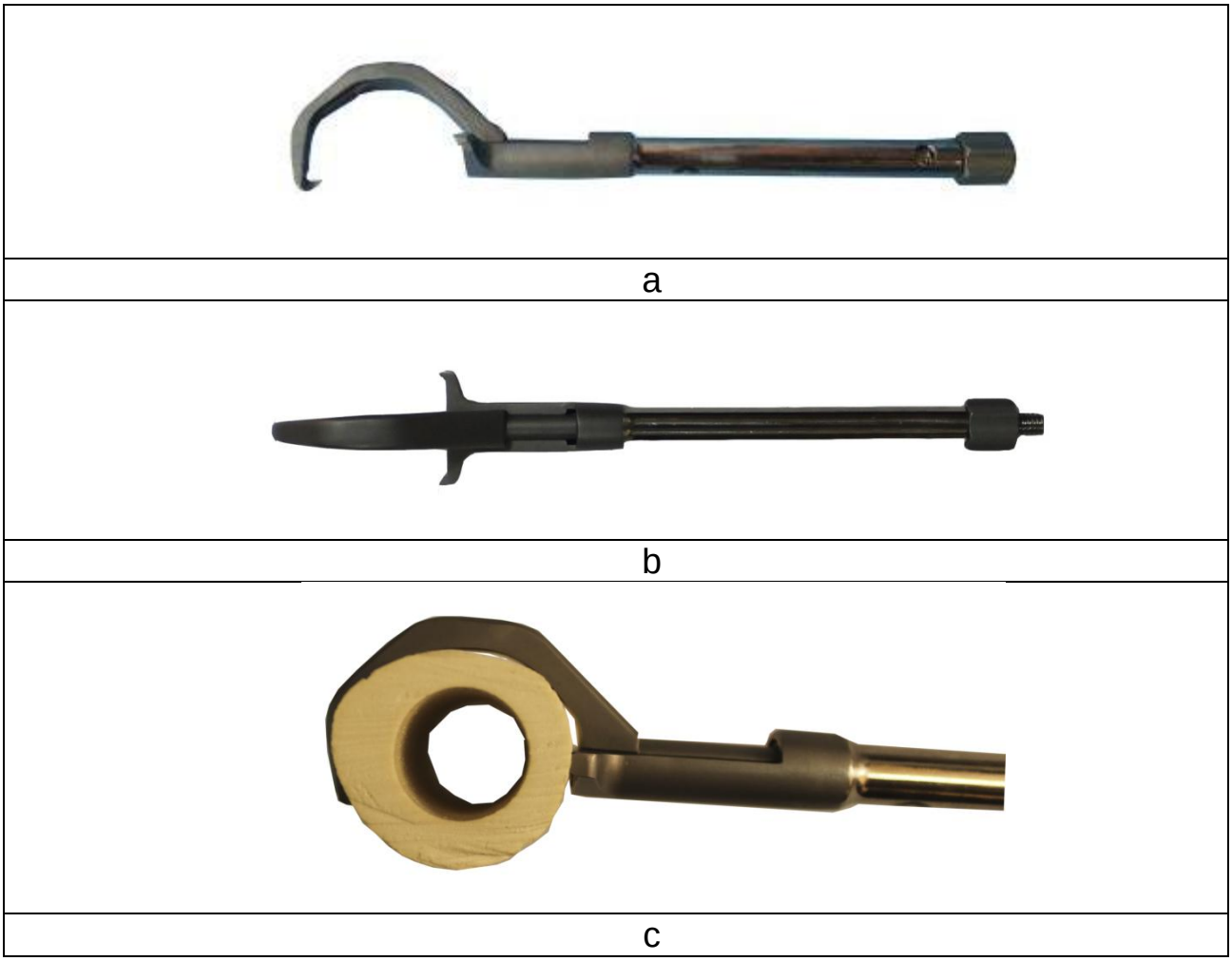



Fig. 1. SUV-clamp: a – lateral view; b – view from above; c – bone fixation

SUV-clamp (Fig. 2) consists of two main parts that can be designated as: "hook-shaped" and "T-shaped".

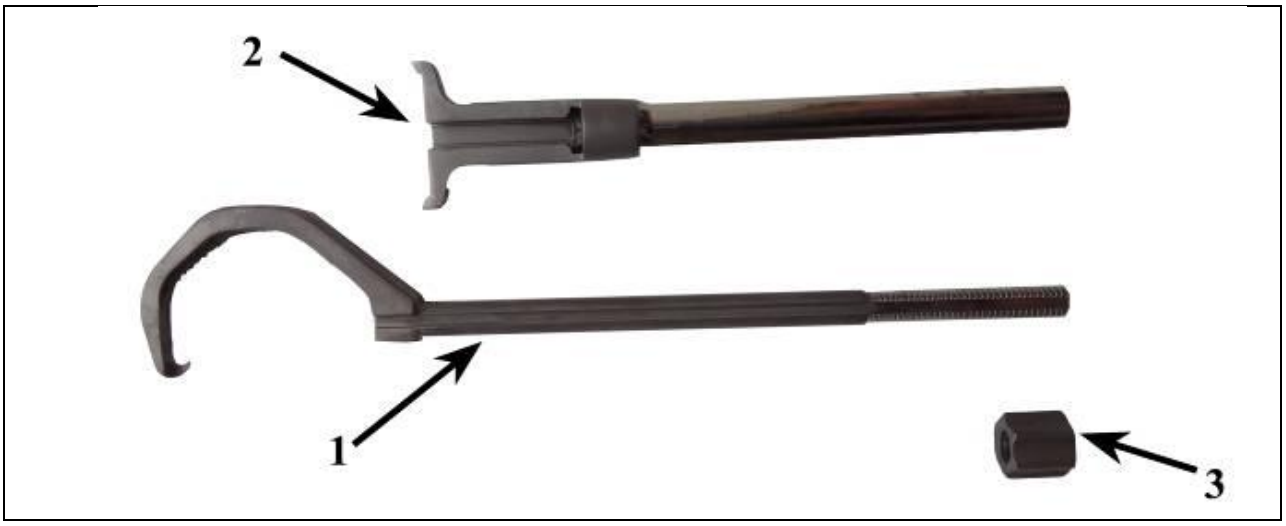



Fig. 2. SUV-clamp when disassembled, where: 1 – hook-shaped part; 2- T-shaped part; 3 - nut

The hook-shaped part of the SUV-clamp (Fig. 3) contains a hook-shaped curved pud consisting of four ribs. The pud is eccentrically connected to the shank, which has thread and grooves.

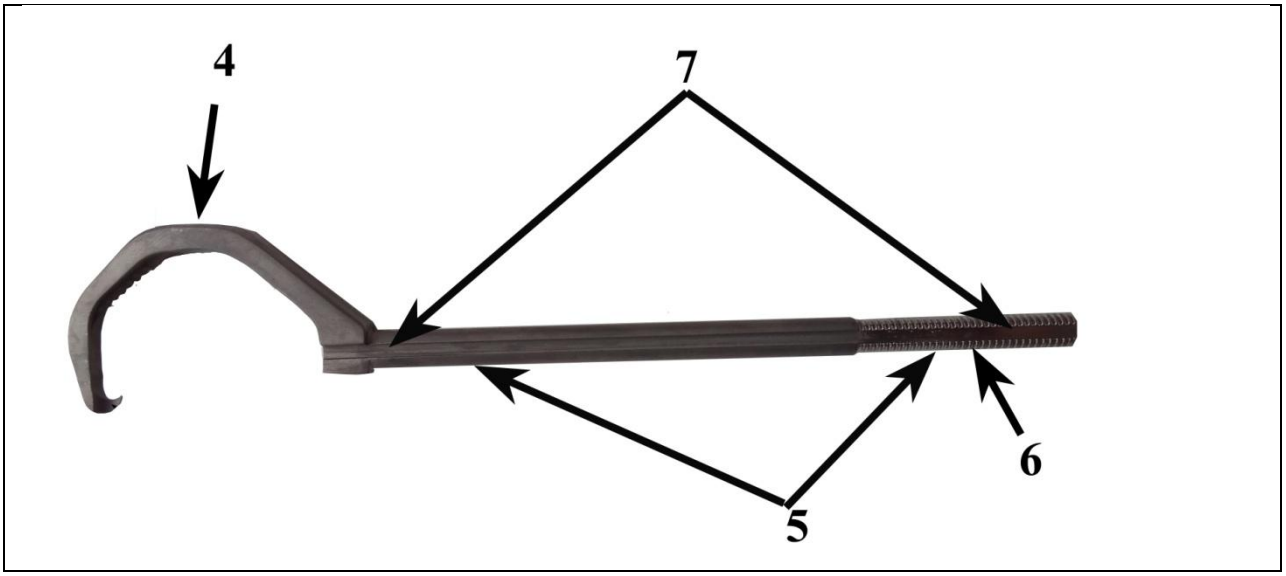



Fig. 3. Hook-shaped part of SUV-CLAMP, where: 4 – hook-shaped curved pad; 5 – shank; 6 – threaded part of the shank; 7 - groove

T-shaped part of SUV-clamp has T-shaped stop with two teeth and a hollow shank (Fig. 4)

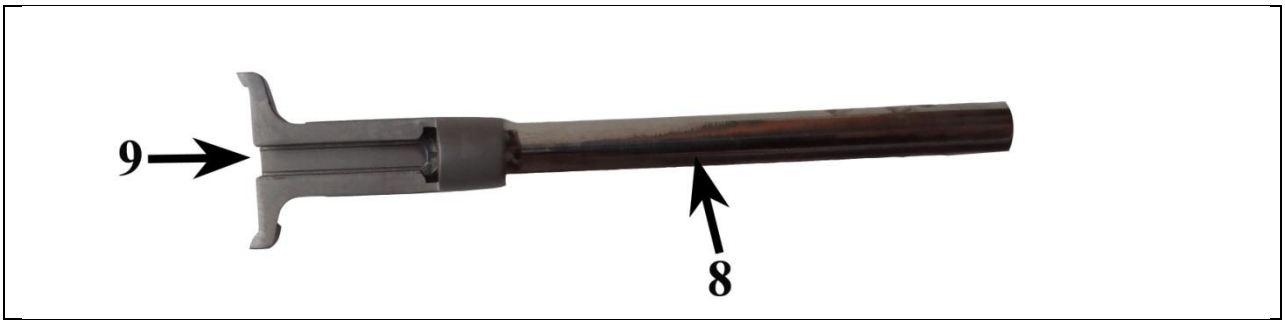



Fig. 4. T-shaped part of SUV-clamp, where: 8 – shank; 9 - T-shaped stop

The T-shaped part of SUV-clamp is telescopically mounted on the hook-shaped part and fixed with a nut. The tightening of the nut ensures coaptation between the pud and the T-shaped stop (Fig. 5).

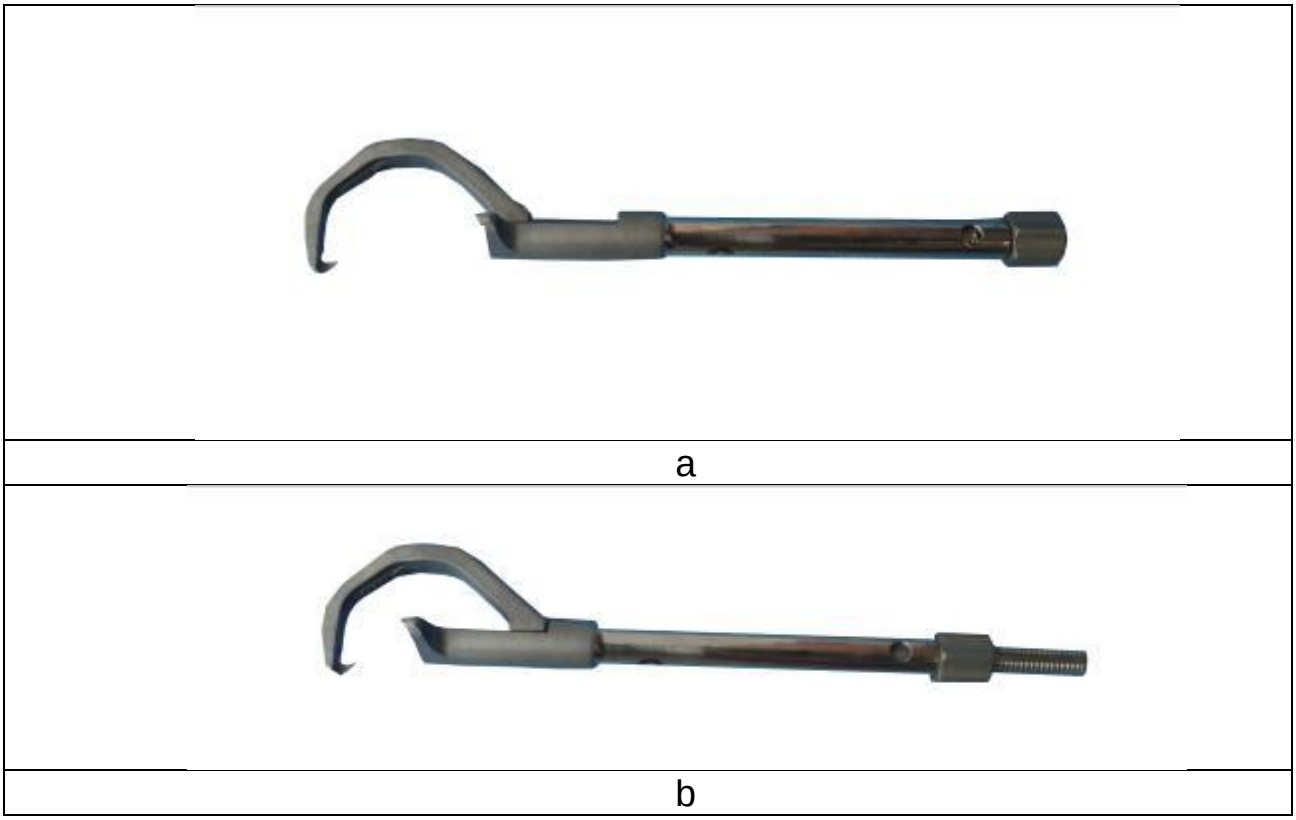



Fig. 5. T-shaped part of SUV-clamp: a – initial position; b – after tightening of the nut

Two special instruments are used to insert and remove the SUV-clamp. Instrument #1 (Fig. 6) is used to insert the hook-shaped part.

a


b

Fig. 6. Instrument #1: a – appearance; b – Instrument #1 with the hook-shaped part fixed in it by the nut (3)

Instrument #2 (Fig. 7) is used for insertion of T-shaped part of SUV-clamp. For fixation of T-shaped part of SUV-clamp to the Instrument #2 compression bolt is used.

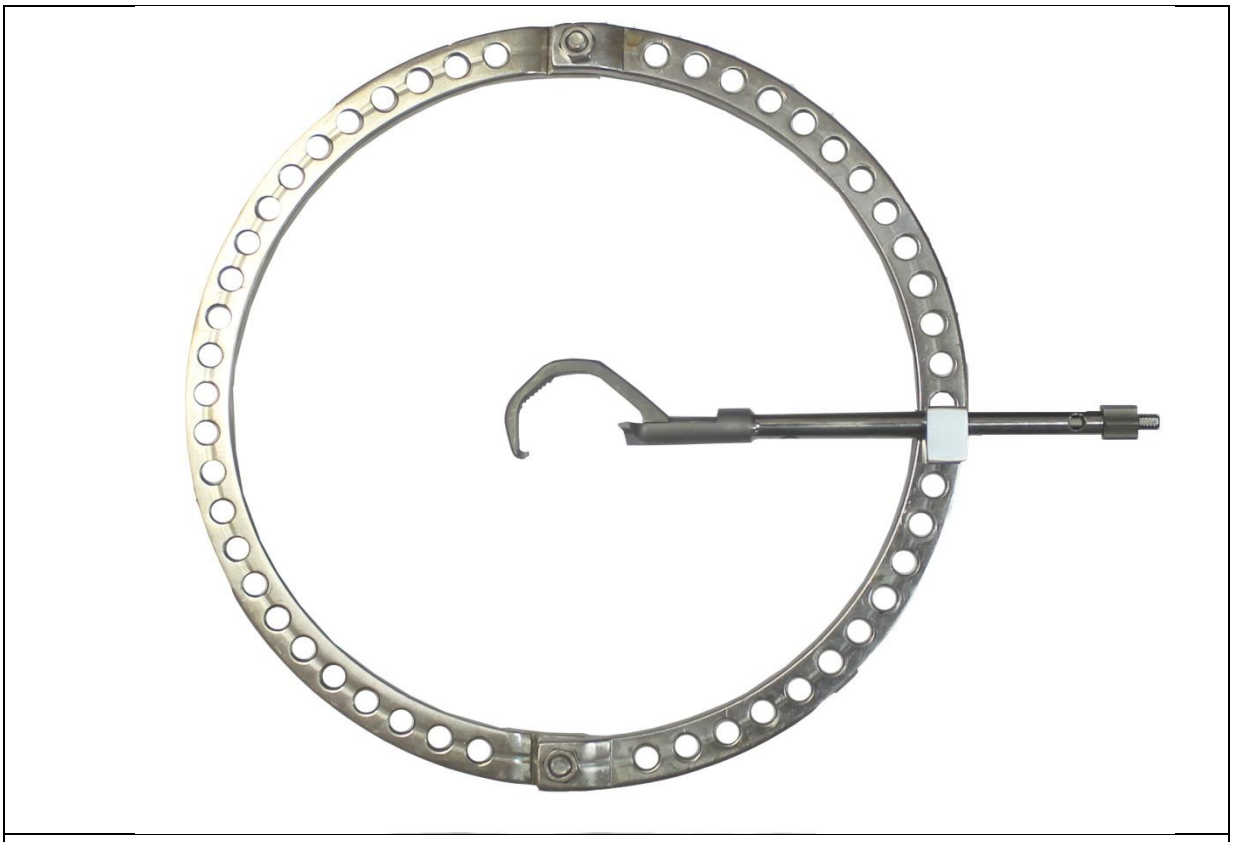
a


b

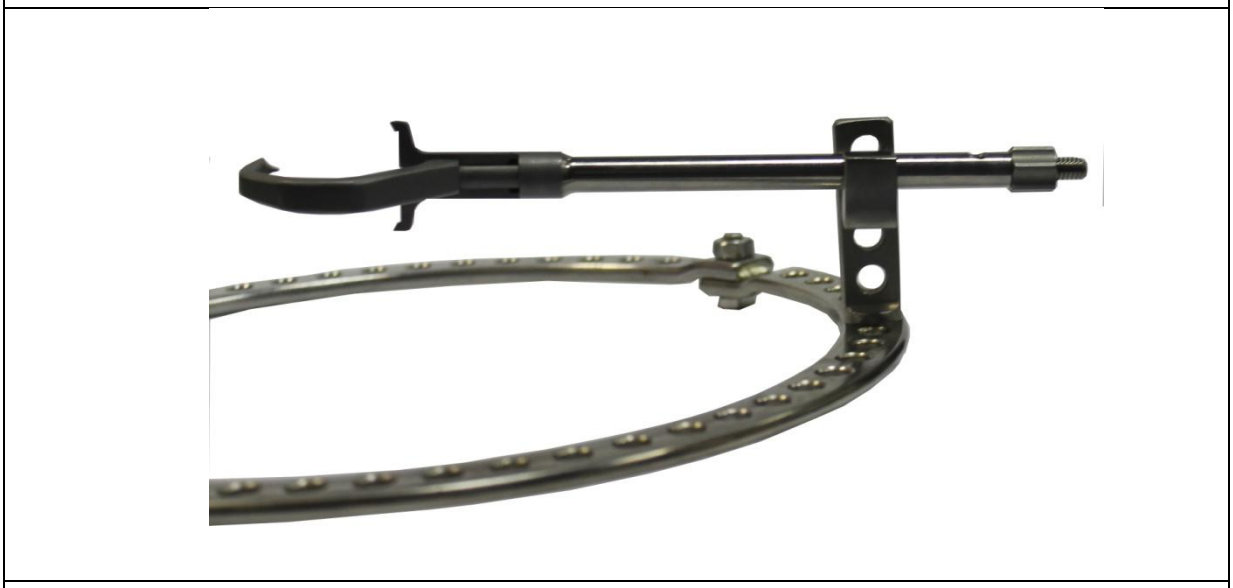
Fig. 7. Instrument #2: a – appearance; b – Instrument #2 fixes T-shaped part of SUV-clamp by means of compression bolt (10)

After fixation of SUV-clamp to the bone it's external part is fixed to a ring of ExFix frame or to a post by means of L-shaped fixator (Fig. 8).

a



b



c

Fig.8. L-shaped fixator: a – appearance; b – fixation of SUV-clamp to the ring of Ilizarov apparatus; c - fixation of SUV-clamp to the post

## SUV-clamp Set

The kit for extracortical fixation consists of SUV-clamps of 6 standard sizes. The sizes differ in the length of the semicircle of the hook-shaped curved pad (3 variants) and in the length of the shank (2 variants) (Fig. 9). Table 1 is used to select the required size of the EF.

Fig. 9. Standard sizes of SUV-clamp

Table 1

Identification of the SUV-clamp required size

| Typesyzes | Size of the curved pad | Size of the shank | Range of bone width, mm | Range of soft tissues, mm |
|---|---|---|---|---|
| 1 | Large | Large | 31,5…39 | 80...110 |
| 2 | Large | Small | 31,5…39 | <80 |
| 3 | Medium | Large | 25,5…31,5 | 80...110 |
| 4 | Medium | Small | 25,5…31,5 | <80 |
| 5 | Small | Large | 18…25,5 | 80...110 |
| 6 | Small | Small | 18…25,5 | <80 |

In addition, the kit includes Instruments for insertion of SUV-clamp L-shaped fixators for attaching SUV-clamp to the ring of ExFix frame. Instrument # 1 has 2 sizes, corresponding to two standard sizes of shank: short and long (Figure 10).

Fig. 10. The standard sizes of the Instrument #1

## SUV-clamp insertion

First step is to determine the level at which insertion of SUV-clamp is planned. Then, at this level, the width of the bone is determined using 2 K-wires (Fig. 11).

Fig 11. Insertion of SUV-clamp: the borders of the bone are determined using 2 K-wires at the planned level of SUV-clamp insertion

Then, to determine the length of incision, T-shaped stop is leaned against the skin. After that incision through skin and fascia is performed (Fig. 12).

a

b

c

Fig. 12. Insertion of SUV-clamp: a – T-shaped part of SUV-clamp in connection with Instrument#2; b - T-shaped stop is leaned against the skin to determine the length of incision; c – the skin incision is performed

Then a channel through the soft tissues till the bone surface is performed. In projection of SUV-clamp insertion the bone is dissected periosteally.

a

b

Fig. 13. Insertion of SUV-clamp: forming a channel in the soft tissues to the bone and periosteal dissection

After it finger-control of the channel for SUV-clamp insertion is performed.

Fig. 14. Insertion of SUV-clamp: finger control of the implemented channel

The hook-shaped part of the SUV-clamp is attached to Instrument #1 and fixed by the nut. Hook-shaped curved pad initially is placed parallel to the incision (Fig. 15). The handle of Instrument #1 is also placed parallel to the longitudinal axis of the bone.

a

b

Fig. 15. Insertion of SUV-clamp: a,b – insertion of the hook-shaped part of SUV-clamp using Instrument #1

After insertion of the hook-shaped pad into the formed channel, turn the handle 90 degrees so that it took to posterior, i.e. perpendicular to the longitudinal axis of the femur (Fig. 16). The concave portion of the hook should be over the center of the diameter of the bone.

Fig. 16. Insertion of SUV-clamp: the handle of Instrument #2 is turned for 90 degrees from the initial position

Then the nut is unfastened and removed, and Instrument #1 is removed from the hook-shaped part of SUV-clamp (Fig.17).

a

b

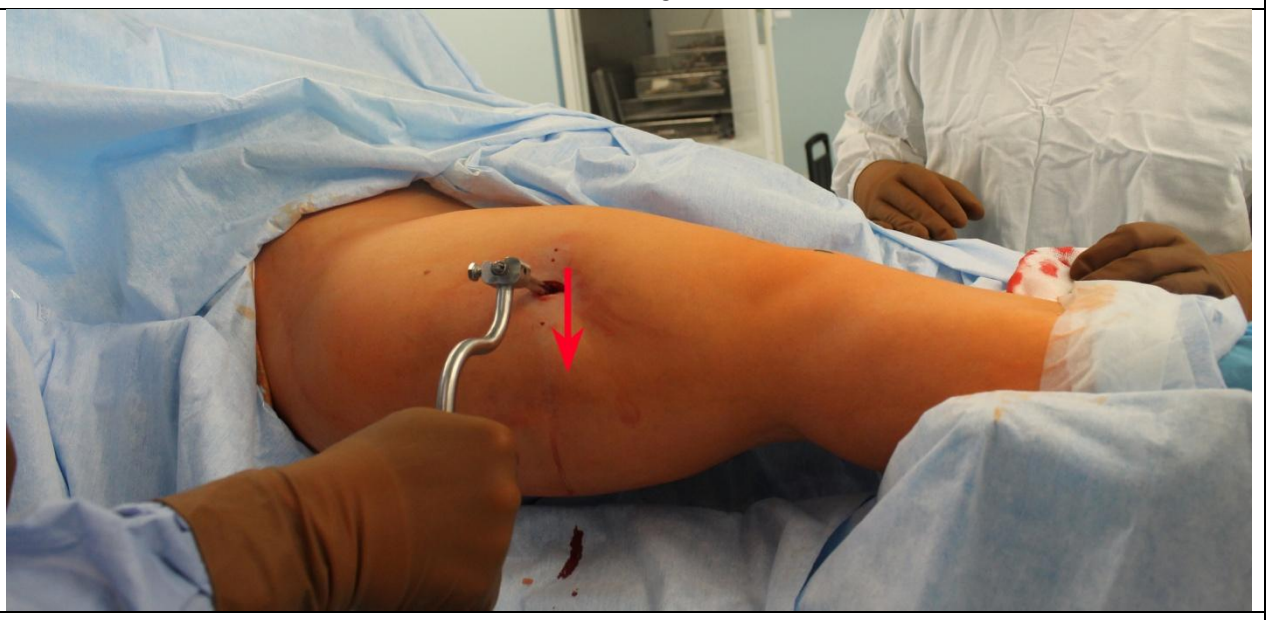
c

Fig. 17. Insertion of SUV-clamp: a – removal of the nut; b – removal of Instrument #1; c – the shank of the hook-shaped part of SUV-clamp should be hold by fingers

Then the T-shaped part of SUV-clamp is fixed to Instrument#2 by the means of compression bolt. Then T-shaped part is put on the shank of the hook-shaped part of SUV-clamp. The handle of Instrument #2 should be placed perpendicular to the longitudinal axis of the femur. Gripping the handle of the Instrument #2 the pad of SUV-clamp is tightly pressed to the bone (Fig. 18).

a

b



c

Fig.18. Insertion of SUV-clamp: a – T-shaped part of SUV-clamp in connection with Instrument #2; b – T-shaped part is immersed fully into the soft tissues till the stop at bone; c - manually performed pressure on the shank of the T-shaped part of SUV-Clamptowards the bone (pointed by arrow)

A nut is attached on the threaded end of the shank, moved along it and fastened by wrench M10 fixing SUV-clamp to the bone.

Fig. 19. Insertion of SUV-clamp: a nut is put on the threaded end of the shank and fastened by wrench

Then compression bolt is unfastened and Instrument #2 is removed (Fig. 20).

Fig. 20. SUV-clamp is inserted

The wound around SUV-clamp is stitched. External part of SUV-clamp is fixed directly to the ring of ExFix device or to male or female post using L-shaped fixator (figs. 8, 21).

a

Fig. 21. Fixation of SUV-clamp to the ring of ExFix Frame: a – appearance; b – external part of SUV-clamp is fixed to the ring by L-shaped fixator; c – SUV-clamp is fixed to the ring with the help of male post and L-shaped fixator

## SUV-clamp Removal

For removal of SUV-clamp Instrument #2 is connected with the shank of the T-shaped part and fixed by compression bolt (Fig. 22).

a

b

Fig. 22. Removal of SUV-clamp: a – Instrument #2 is connected with T-shaped part of SUV-clamp; b – the nut is unfastened by wrench

The incision of soft tissues is made through an old scar. T-shaped part is removed (Fig. 23).

a

b

c

Fig. 23. Removal of SUV-clamp: a,b – using Instrument #2 T-shaped part of SUV-Clampis removed; c – T-shaped part of SUV-clamp is removed. The shank of hook-shaped part of SUV-clamp is seen

The outer end of hook-shaped part of SUV-clamp is connected with Instrument #1 by such a way that the handle of Instrument #1 was perpendicular to the longitudinal axis of the born, i.e. faced dorsally.

a

b

c

Fig. 24. Removal of SUV-clamp: a, b – assembling of Instrument #1 on the shank of the hook-shaped part of SUV-clamp; c – fixation by a nut

Then the handle of Instrument #2 is turned 90 degrees counterclockwise and the hook-shaped part of SUV-clamp is removed (Fig. 25).

a

b

c

d

Fig. 25. Removal of SUV-clamp: a – initial position of the handle of Instrument #1; b – turn of the handle of Instrument #1 for 90 degrees; c – removal of the hook-shaped part of SUV-clamp out of the soft tissues; d – the wound is stitched

## Peculiarities of SUV-clamp usage

Sufficient rigidity of fixation of the proximal or distal femur fragments can be provided by use of 2 SUV-clamp. These two SUV-clamps should be placed at the maximal possible distance, and with crossing 30-60 degrees. In bone transport use of one SUV-clamp for fixation the transported fragment is sufficient.

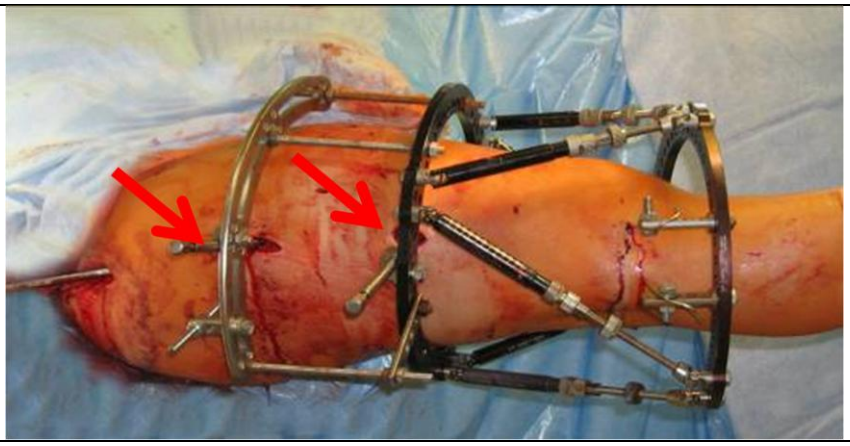
When combining SUV-clamp with conventional transosseus elements, one SUV-clamp should be supplemented with at least two half-pins or 3-4 K-wires. The distance between transosseus elements should also be as large as possible.

Postoperative care for the SUV-clamps doesn't differ with the same for half-pins and K-wires: regular dressing-changes, checking of stability.

In "weakening" of SUV-clamp the nut of the SUV-clamp shank should be turned for 1-3 full turns. Once a week rigidity of fixation by L-shaped fixator should be also checked.

**Case 1:** Use of SUV-clamp for ExFix assisted nailing (Fig. 26).

a

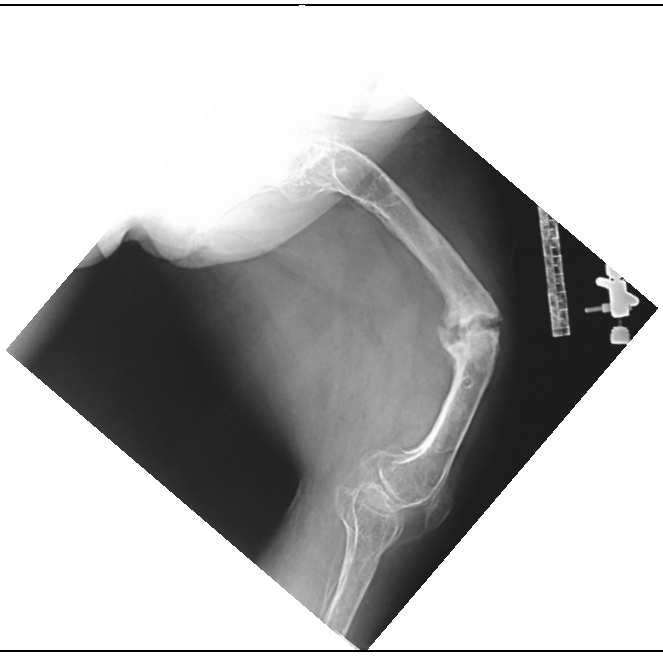


b

c

Fig. 26. Photos and x-ray films of patient S., 22 y.o., with complex deformities of the femurs and lower legs: a – preoperative planning; b – intraoperative photo: two-level osteotomy of the femur with simultaneous correction of the deformities and intraoperative fixation by ExFix frame on the base of 2 SUV-clamp s (pointed by arrows) and further BIOS; c – after the surgery

**Case 2:** use of SUV-clamp for consequentive use of ExFix and nailing (Fig. 27).



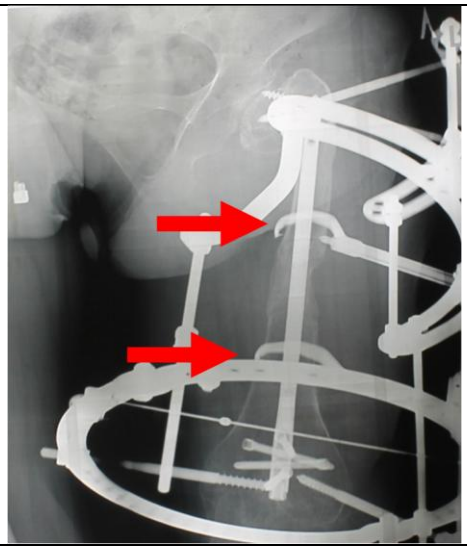
a

b

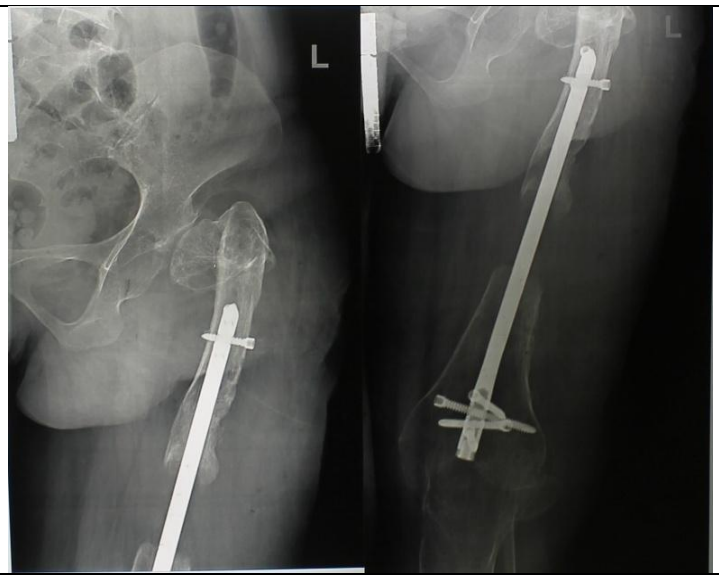
c

Fig. 27. Patient K., 20 y.o. with congenital femur shortening, non-union that complicated previous operative treatment: a – before the surgery; b – gradual correction by Ortho-SUV frame (SUV-clamp s are pointed by arrows); c – after nailing

**Case 3:** Use of SUV-clamp for the Lengthening Over the Nail (Fig. 28).



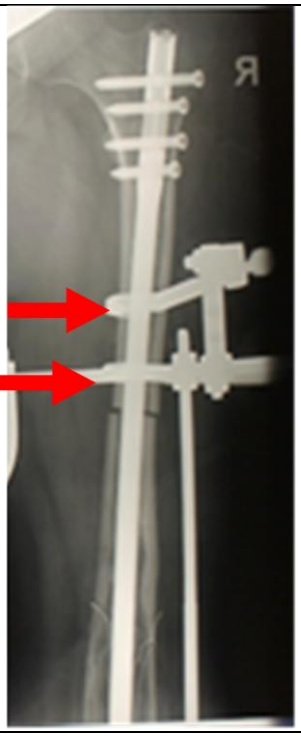
a



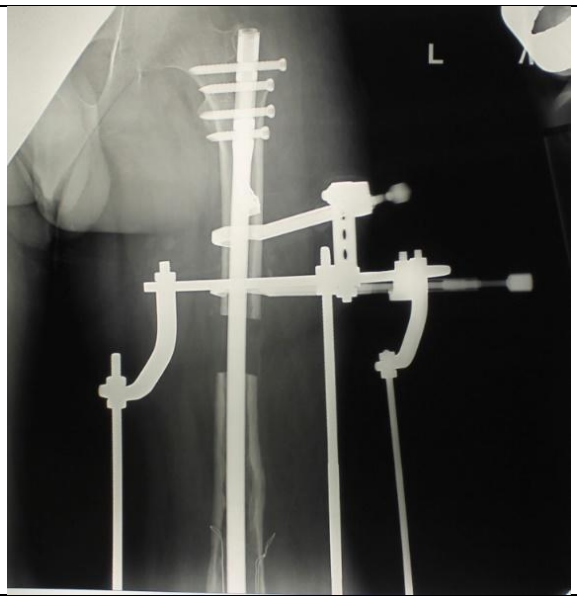
b

Fig. 28. X-ray films of patient A., 20 y.o., with coxa vara congenita: a – during lengthening over retrograde nail (SUV-clamps are pointed by arrows); b – after distraction, proximal locking and ExFix frame removal

**Case 4:** Use of SUV-clamp in bone transport over the nail (Fig.29).



a



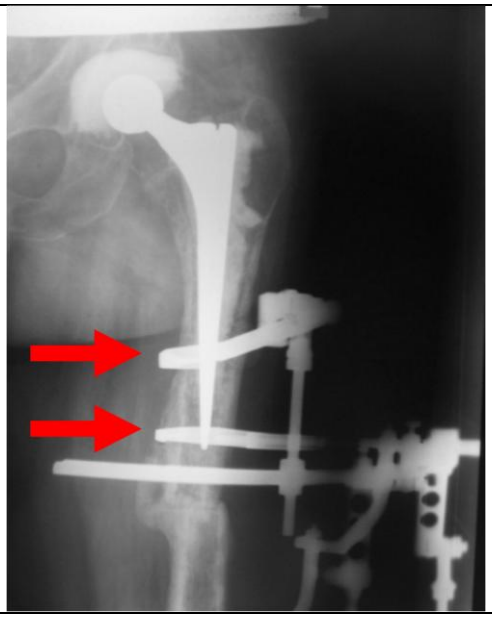
b

c

Fig. 29. X-ray of patient D., 29 y.o., with defect of bones forming the knee joint: a – x-ray films before bone transport over the nail (SUV-clamps are pointed by arrows); b – after the transport; c – after ExFix frame removal

**Case 5:** Use of SUV-clamp in treatment of periprosthetic non-union (Fig. 30).


a



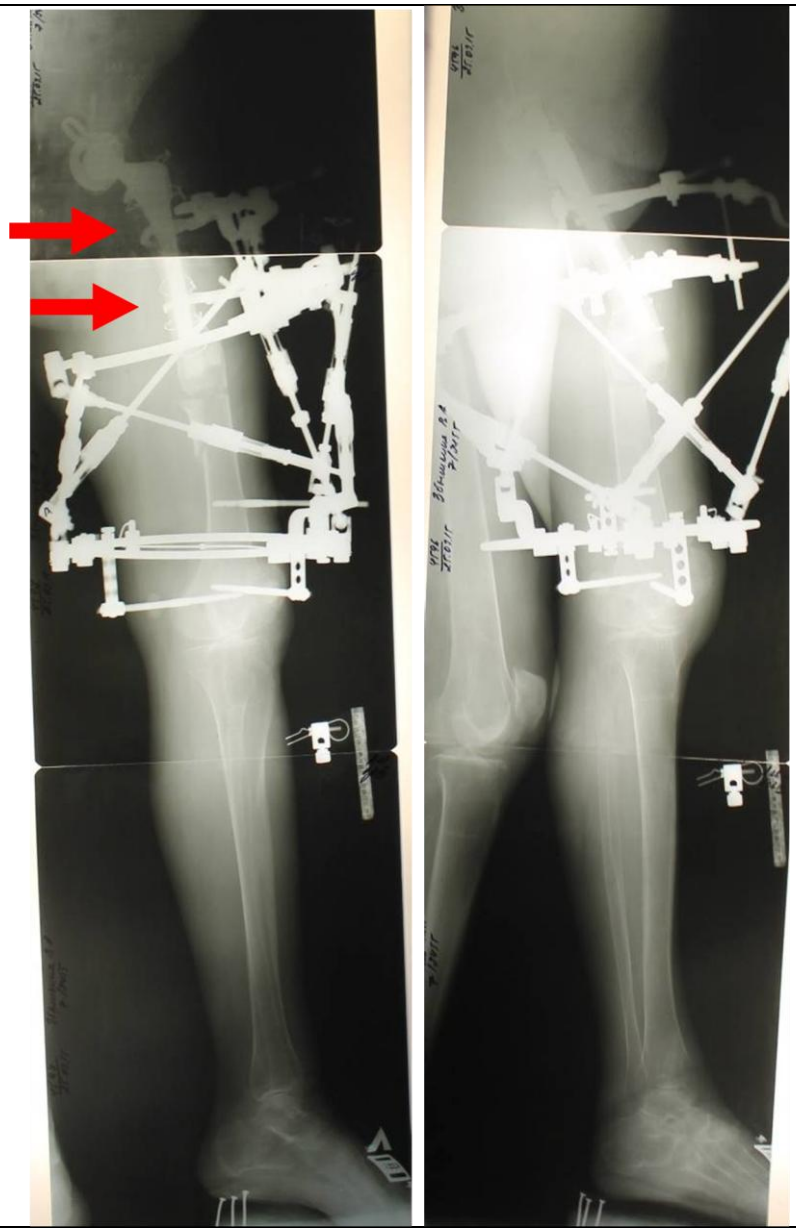
b


c

Fig. 30. X-rays of patient L., 66 y.o., with periprosthetic non-union of the femur: a – before the surgery; b – after plate removal and external fixation (SUV-clamps are pointed by arrows); c – after consolidation

**Case 6:** Use of SUV-clamp in periprosthetic femur deformity correction (Fig. 31).

а



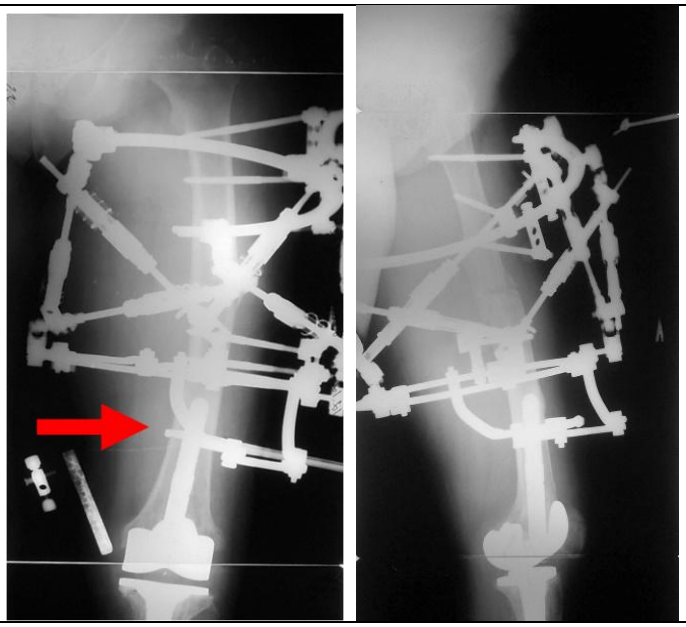
b

c

Fig. 31. X-rays of patient M., 62 y.o., with periprosthetic deformity of the femur: a – before the surgery; b – deformity correction by Ortho-SUV Frame (SUV-clamps are pointed by arrows)

**Case 7:** Use of SUV-clamp in periprosthetic deformity correction (Fig. 32).

a

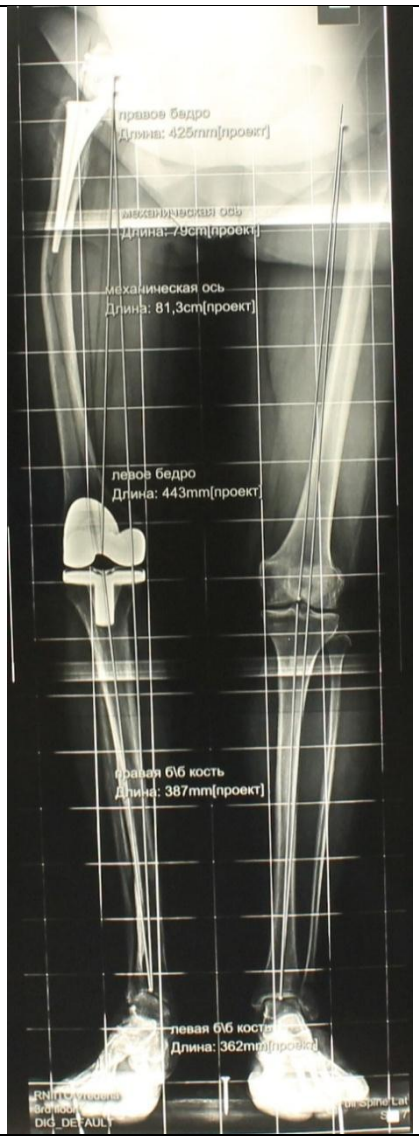


b

c

Fig. 32. X-rays of patient O., 66 y.o., with periprosthetic deformity: a – before the surgery; b – deformity correction by Ortho-SUV Frame (SUV-clamp is pointed by arrow); c – result of treatment

**Case 8:** Use of SUV-clamp in interprosthetic deformity correction (Fig. 33).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механическая ось
Длина: 79cm[проект]
механическая ось
Длина: 81,3cm[проект]
левое бедро
Длина: 443mm[проект]
правая б\б кость
Длина: 387mm[проект]
левая б\б кость
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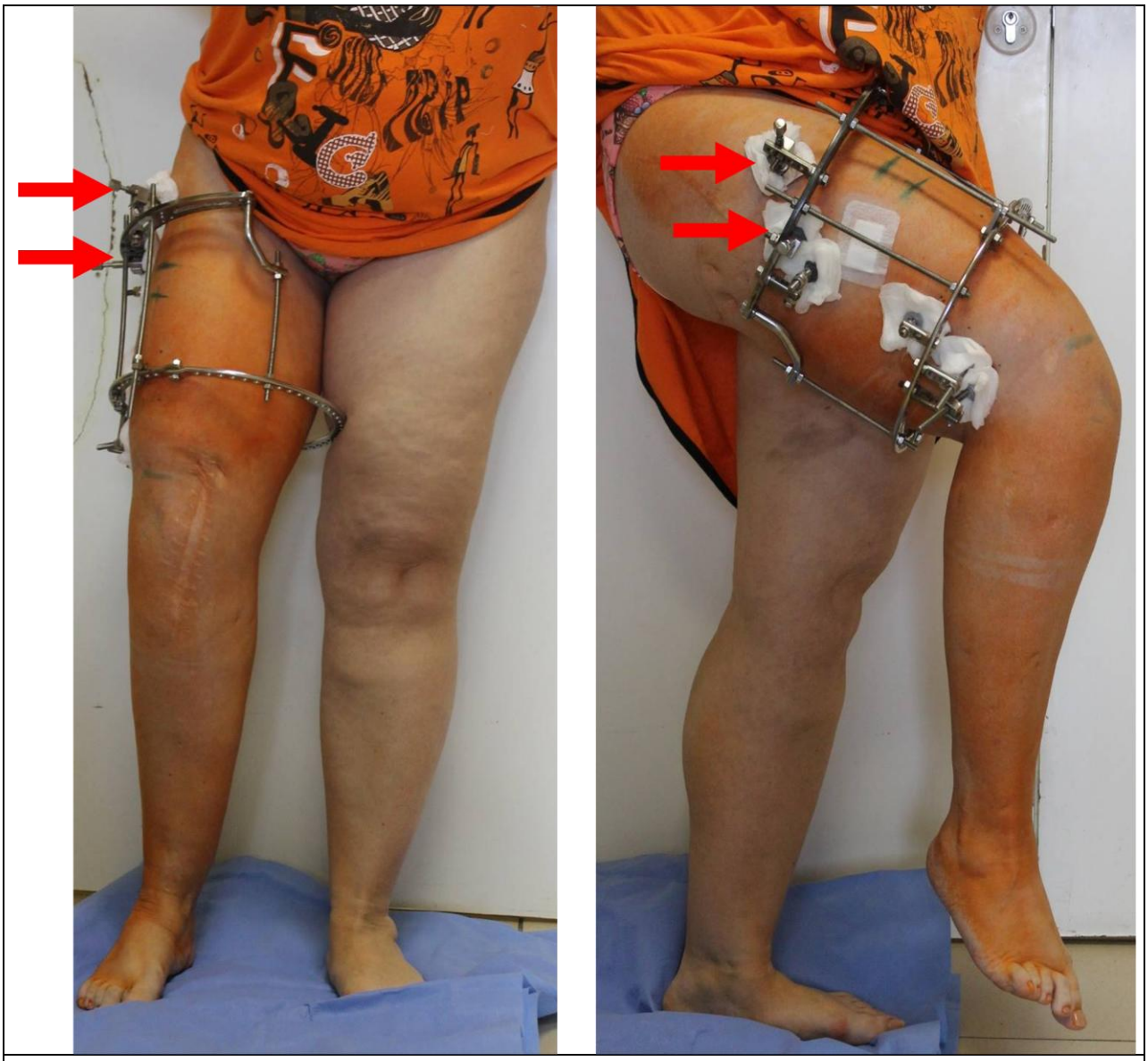
a

b



c

d

Fig. 33. Photos and x-rays of patient L., 70 y.o., with interprosthetic deformity: a – before the surgery; b, c – deformity correction using Ortho-SUV Frame on base of SUV-CLAMPs (SUV-clamps are pointed by arrows); e – result of treatment

**Case 9:** Use of SUV-clamp in osteomyelitis (Fig. 34).

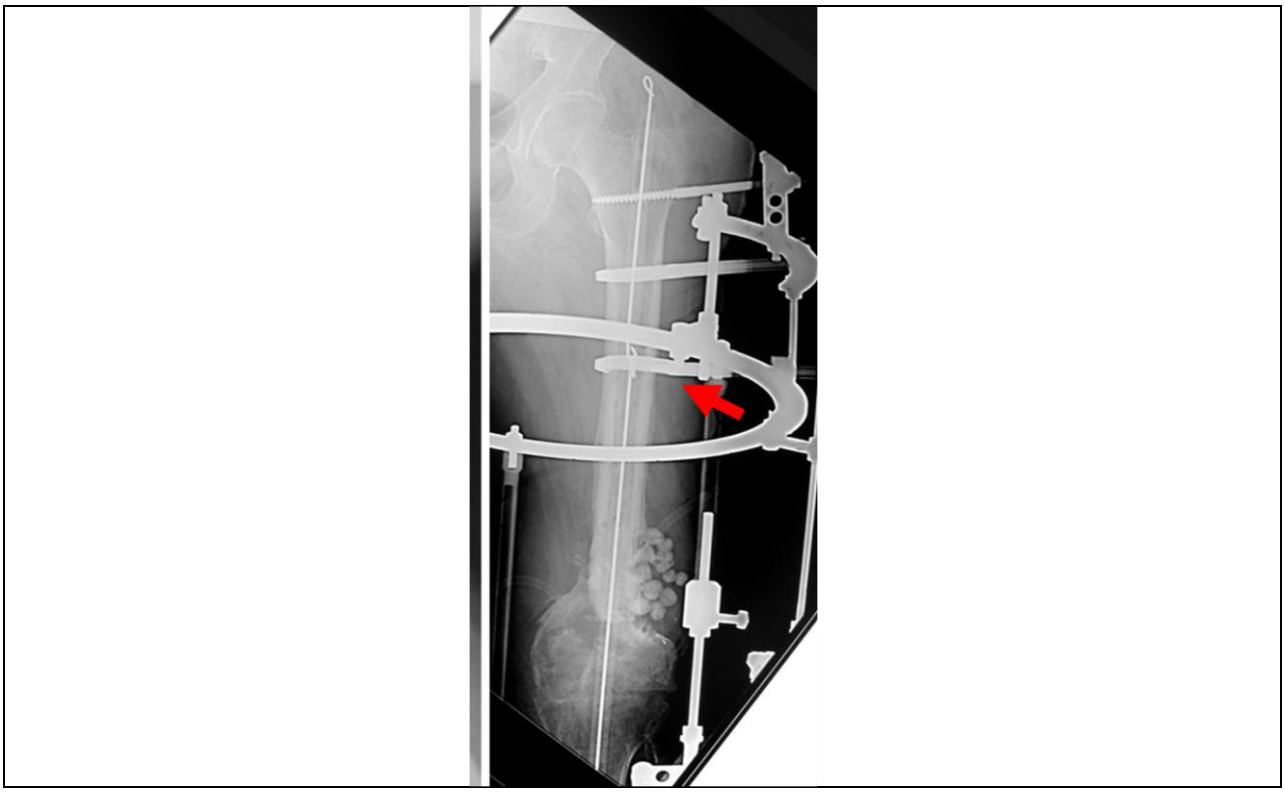


Fig. 34. X-rays of patient Z., 35 y.o., with posttraumatic osteomyelitis of the femur: sanation is perfomed, antibiotic spacer is introduced into the canal, external fixation by SUV-clamp-based frame (SUV-clamp is pointed by arrow)

**Possible complications**

Extracortical fixation has the similar complications as in the cases when traditional transosseous elements are used.

In pulling of the skin around SUV-clamp the release should be performed.

In cases of pin-tract infection around the SUV-clamp shank (according to our data – 10.7%), first of all, it is necessary to check the stability of the SUV-clamp. For this purpose, the SUV-clamp is temporarily disconnected from the ring of ExFix and try to slightly shake the shank of SUV-clamp by fingers. In case of instability the nut is additionally tighten for 2-4 turns. If the standard conservative treatment (dressings, antibiotics) is ineffective within 2-3 days, SUV-clamp is to be removed, and the ExFix Frame is to be additionally stabilized.

Broken SUV-clamp should be changed.