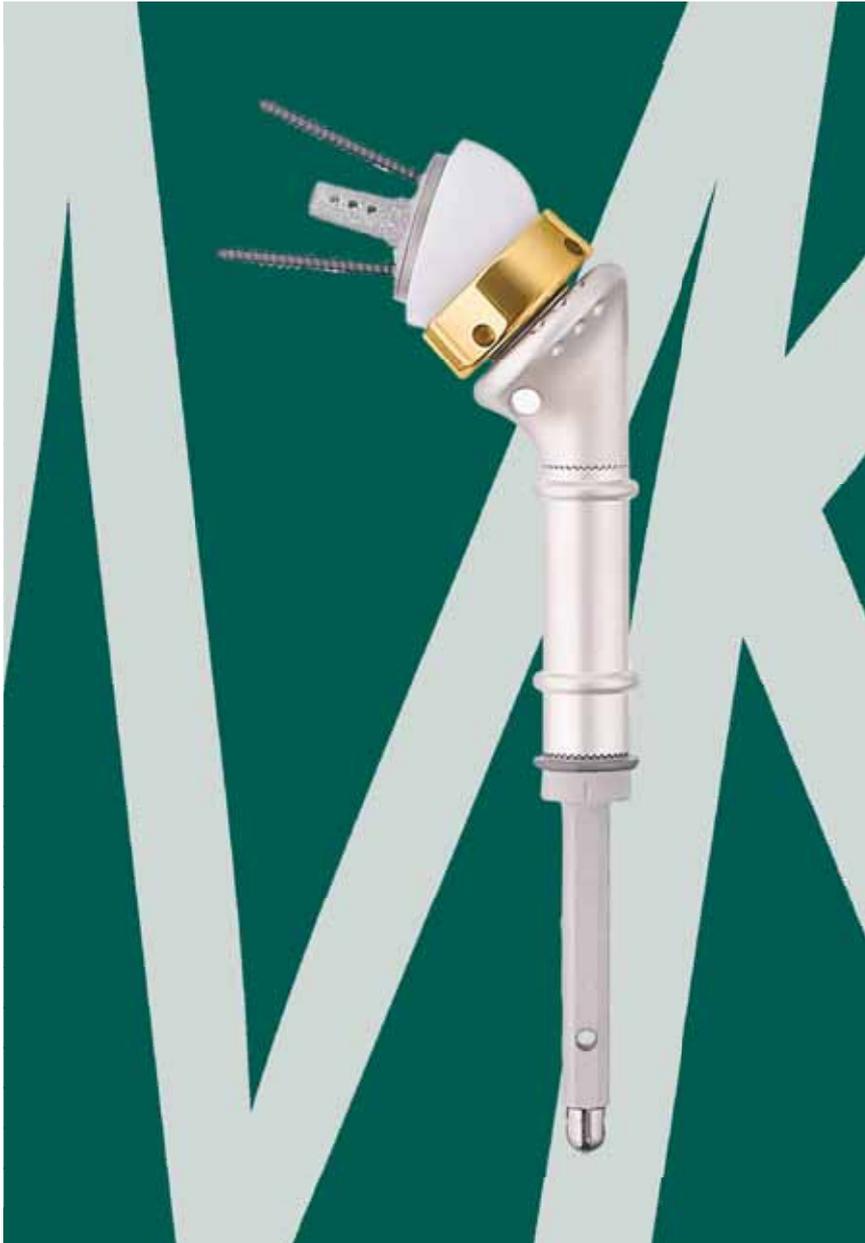


MUTARS®



implantcast



Humerus Inverse
Surgical Technique



Humerus Inverse Surgical Technique

MUTARS® was developed in co-operation with Univ.-Prof. Dr. W. Winkelmann (ex-director) and Univ.-Prof. Dr. G. Gosheger (director) Department of General Orthopaedics and Orthopaedic Oncology at the University Hospital of Münster, Germany. MUTARS® is in successful clinical use since 1992.

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Nota Bene: The herein described surgical technique shows the treatment suggested by the author in uncomplicated surgical procedures. However, it is ultimately the operating surgeon's decision, which approach is the most reasonable and effective for the respective patient.

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The Silver Coating

Infections represent the most severe complications of tumour arthroplastic treatments. Although local and systemic antibiotic treatments are considered, the scientific literature reports of infection rates from 5 to 35 percent [1]. Reasons for these high rates are, for example, the long surgery time, the large incisions and the immunosuppression due to chemo therapy and radio therapy as well as the increasing resistance of the bacteria against antibiotic drugs.

Silver, in particular free silver ions, is well known for its broad-spectrum antimicrobial activity. The silver coating has been shown to reduce bacterial colonization on the device surface.

Until now only non-articulating surfaces and surfaces without direct bony contact are coated with silver.

In the catalogue information of this surgical technique you can find the supplement *S indicating which MUTARS® components are available in a silver coated version. The eight digit REF number receives an addition after the last digit (e.g. 5220-0020S).

Important Intra-Operative Instructions for the Use of Silver-Coated Implants

It is not permitted to flush the wound with antiseptics that contain H₂O₂, Iodine or heavy metals (such as Betaisodona®) and acetic acid during surgery since this can lead to a subsequent loss of effectiveness of the silver coating due to their oxidative properties. Alternatively, solutions such as NaCl or Lavasept® and Prontosan® can be used. The additional use of antibiotic-containing bone cement can be an advantage particular in case of a septic revision.

The TiN Coating for Allergy Prophylaxis

All metallic implant components release ions to their environment over time. In some patients such ions can elicit allergic reactions. Nickel, cobalt and chromium, which are elements of the base material CoCrMo of the articulating implant components, are considered the most frequently allergy eliciting metals [2] The TiN-coating is biocompatible and acts like a barrier; the potential release of allergy eliciting ions of the base material is reduced to a minimum [3]. Also in clinical practice there have never been any evidence of allergic reactions with implants that have been TiN-coated showing an intact surface [5]. Therefore the TiN-coating on implant components is especially suitable for patients with sensitivity to nickel, chromium or cobalt [4][5].

Since almost all components of the MUTARS® tumour system consist of titanium alloy, this only concerns those components, which are made of a CoCrMo alloy. The REF-numbers of the TiN-coated implants have the suffix N after the last digit (e.g. 5720-0005N). Items which are available with Silver and TiN coating have the suffix SN after the last digit (e.g. 5720-0005SN).

***S:** Implants are available with Silver coating!

***N:** Implants are available with TiN coating!

***SN:** Implants are available with Silver and TiN coating!

[1] Gosheger et al. 2004. Silver-coated megaendoprostheses in a rabbit model – an analysis of the infection rate and toxicological side effects. *Biomaterials* 25, 5547-5556.

[2] Eben R et al. (2009) Implantatallergieregister - ein erster Erfahrungsbericht. *Orthopäde* 38: 557-562

[3] Wisbey et al. (1987) Application of PVD TiN coating to Co-Cr-Mo based surgical implants. *Biomaterials*, 11

[4] Prof. Thomas LMU München Final Report Effect of a TiNbN or TiN surface coating on cobaltchromium- molybdenum and stainless steel test specimens regarding the release of nickel, chromium and cobalt: evaluation via eluate analysis and in-vitro cytokine release from peripheral human blood cells, Data on file

[5] Baumann A. (2001) Keramische Beschichtungen in der KTEP Standardlösung für Allergiker. *JATROS Orthopädie & Rheumatologie* 6: 16-17

MUTARS® Humerus Inverse

Pre-Operative Planning

Pre-operative planning and precise surgical techniques are mandatory for optimal results. The instructions and the procedure given in the surgical technique to the system must be adhered to. Familiarity with the recommended surgical technique and its careful application is essential to achieve the best possible outcome.

Before surgery a surgical planning with regard to the dimensions of the prosthetic model and the positioning of the implant components in the bone has to be carried out by the surgeon.

For this purpose, x-ray templates are available:

Digital templates: Digital templates are included in the data base of the common planning systems. For missing templates, please contact the provider of the planning software and request for these templates.

Radiographic templates: Alternatively radiographic templates are available in various scale factors, which can be obtained from your local representative.



Picture shown: MUTARS® Humerus inverse implant in A/P view

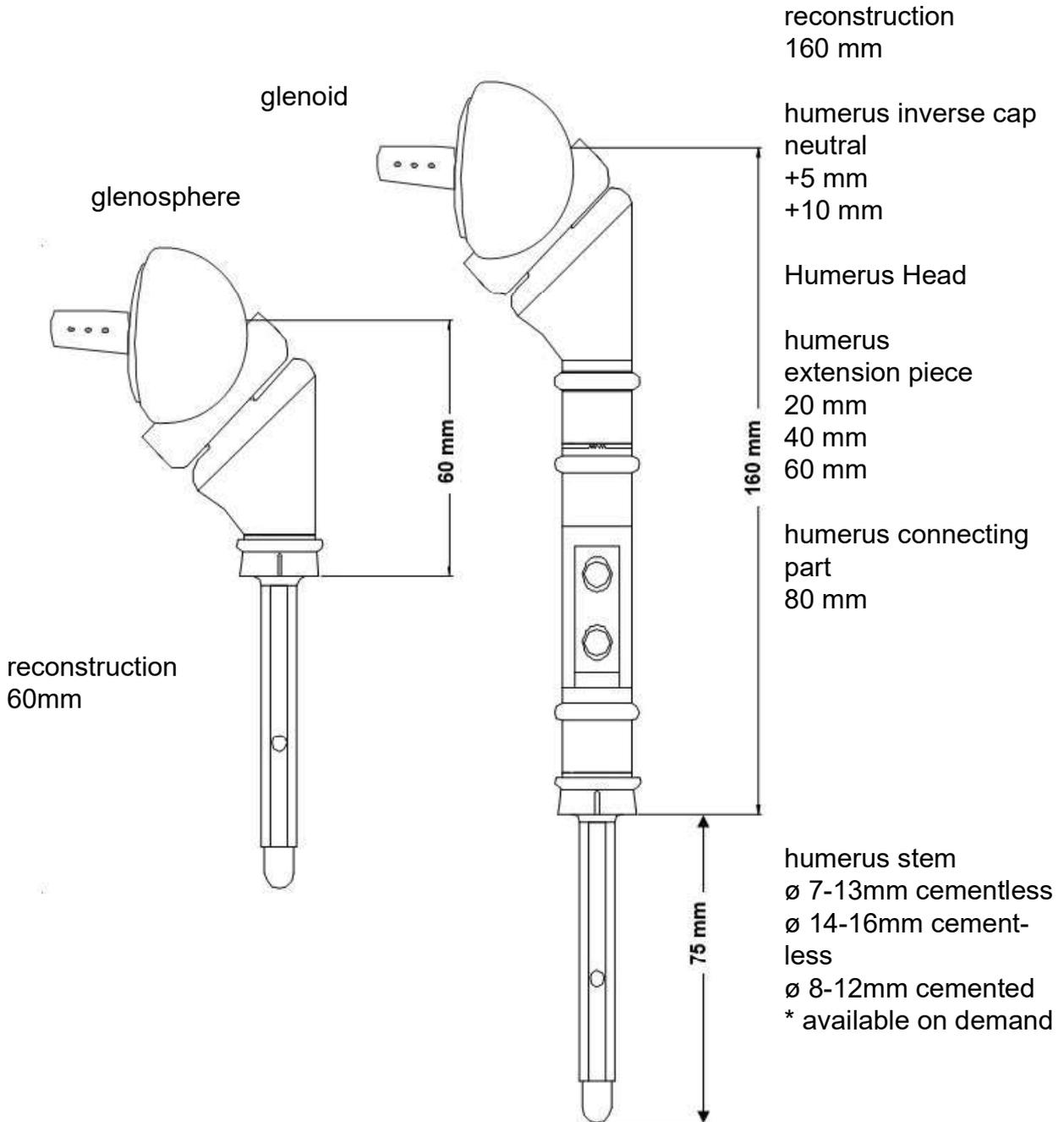


Picture shown: MUTARS® Humerus inverse implant in M/L view



MUTARS® Humerus Inverse

System Overview





MUTARS® Humerus Inverse

Assembling Options

by using a MUTARS® humerus inverse cap (length in mm)

| Components | | | |
|---------------------|-----------|--|------------|
| Reconstruction (mm) | Head (mm) | Extension piece / connecting part 80 mm (mm) | Screw (mm) |
| 60 | 50 | - | 15 |
| 80 | 50 | 20 | 35 |
| 100 | 50 | 40 | 55 |
| 120 | 50 | 60 | 75 |
| 140 | 50 | 80 | 15 + 15 |
| 160 | 50 | 20 + 80 | 35 + 15 |
| 180 | 50 | 40 + 80 | 55 + 15 |
| 200 | 50 | 60 + 80 | 75 + 15 |
| 220 | 50 | 60 + 80 + 20 | 75 + 35 |
| 240 | 50 | 60 + 80 + 40 | 75 + 55 |
| 260 | 50 | 60 + 80 + 40 + 20 | 75 + 75 |

Note: Please notice that the amount of implants and instruments send with an individual shipment may differ from the information in the catalogue information of this brochure. Please make sure, during the preoperatively planning, that all necessary implants and instruments are available for the surgery.

Surgical Technique

Tumour Resection

Resect the tumour and measure the length of the explant and determine the length of the explant. The minimum bone resection is 60mm.

Preparation of the Glenoid

Place the glenoid drill guide and choose the correct position for the glenoid implant. Drill the central hole with the 3.2mm pin and leave in the pin (Fig. 1). Alternatively, the drill guide (Fig. 2) can be used. Drill approximately 2.5cm deep. Prevent from drilling too deeply as the drill has no stop.

In order to expose the subchondral bone, ream the glenoid bone with the glenoid reamer guided by the 3.2mm central pin. The reamer is guided by the central peg (Fig. 3 and Fig. 4).

Leave the pin inside the bone. The best fixation is achieved when the bleeding subchondral bone is reached (Fig. 5).

Note: The central peg hole is slightly smaller than the central peg of the implant. The central peg will lock by PressFit eventually.



Fig. 1



Fig. 2



Fig. 3



Fig. 4



Fig. 5

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Fig. 6



Fig. 7

Screw the humerus impactor to the glenoid implant. Make sure that the cranial marking is orientated correctly. Impact the implant with cautious beats into the bone until the glenoid lies completely flush on the reamed bone surface. Make sure that the "cranial" marking is properly placed (Fig. 6 and Fig. 7) and remove the impactor afterwards.

The drilling angle can be chosen freely between 0° and 15°.

Optional Surgical Technique

In order to position the screws in 15° precisely, use the special glenoid drill guide correctly orientated, so the cranial and caudal position is found. Use the 2.0mm drill and the drill guide to pre-drill for the additional cancellous screws (Fig. 8).

The glenoid drill guide allows only to drill through the cranial and caudal hole in an angle of 15°. The pre-drilled threads in the glenoid implant allow only to position the cranial and caudal screws 15° angled.

Use the 2.0mm drill to predrill the screw holes for the additional fixation screws (Fig. 8).



Fig. 8



Fig. 9

Measure the screw length with the depth guide (Fig. 9).



Insert the 4:2MM angle stable screws with the 2.5mm hexagon screwdriver until the screw head is fully flat with the surface of the metal glenoid implant (Fig. 10).



Fig. 10

Impaction of the Glenosphere

Seat the glenosphere to the glenoid implant. The lip of the glenosphere will lock onto the outer locking rim of the glenoid implant (Fig. 11).



Fig. 11

Enhance the locking by the use of the head impactor (Fig. 12).



Fig. 12

Make sure that the glenosphere is fully seated onto the glenoid metal implant (Fig. 13).



Fig. 13

MUTARS[®] Humerus Inverse

Humeral Bone Preparation

Ream the medullary cavity with the medullary cavity reamer (Fig. 14).



Fig. 14

Cementless Use

Drill the medullary cavity with a humerus drill 1 mm smaller than the size of the preoperatively chosen humerus stem (Fig. 15).

Make sure that at least 4cm of cortical bone contact is available.

Cemented Use

Drill the medullary cavity with a humerus drill 2 mm larger than the size of the preoperatively chosen humerus stem (Fig. 15).



Fig. 15



Rasping of the Humeral Cavity

Assemble the humeral rasp of the appropriated size (see tables below), the extractor device, the humerus impactor and the sleeve. Lock the rasp on the humerus impactor by using the counter wrench.

Remark: The use of a humeral rasp for a cemented stem is optional. Generally you can proceed with the trial assembly.

Use of Cementless Stems

Use the humeral rasp (Fig. 16), of the same size as the preoperatively chosen humerus stem (table 1).

| Stem size | Rasp size |
|-----------|-----------|
| 9 mm | 9 mm |
| 10 mm | 10 mm |
| 11 mm | 11 mm |
| 12 mm | 12 mm |
| 13 mm | 13 mm |

Table 1

Optional Technique for the Use of Cemented Stems

If you want to prepare for a cemented stem with the humeral rasp, please use the rasp which is 2 mm larger than the preoperatively chosen cemented humerus stem (Fig. 16).

That will provide a cement mantle of 1mm thickness (table 2).

| Stem size | Rasp size |
|-----------|-----------|
| 8 mm | 10 mm |
| 9 mm | 11 mm |
| 10 mm | 12 mm |
| 11 mm | 13 mm |
| 12 mm | 14 mm |

Table 2

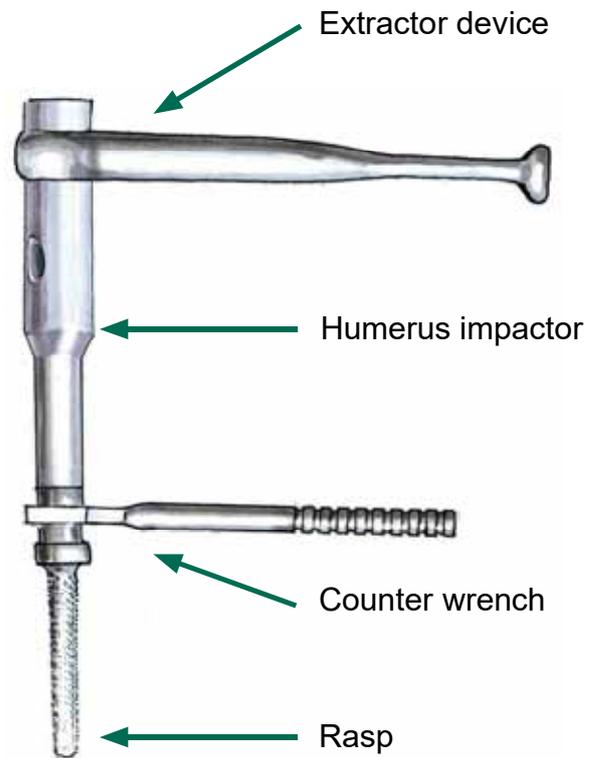


Fig. 16

MUTARS® Humerus Inverse



Fig. 17

Rasp the medullary cavity with the chosen humeral rasp (Fig. 17 and Fig. 18). A carefully use of the mallet is recommended.



Fig. 18

Remark: It is recommended to clean the rasp from bone chips during the rasping.
To prevent fractures of the cortical bone, it is helpful to fix a bone forceps around the humeral bone during rasping.

Leave the humeral rasp in the bone for the trialing.

Trial Reduction With the Trial Components

Mount the trial humerus head and the possibly used trial extension pieces (possible enlargement from 20 to 200 mm; see „Assembling Options“ auf Seite 5) onto the top of the rasp (Fig. 19).

Please insert the trial screw of the appropriate length and tighten the screw with the socket wrench (Fig. 20).

Remark: Please, keep in mind that no humerus trial stems are available. If you have not opted for the rasping option when implanting cemented stems, the only way to trial will be with the original cemented stem without cementing it.



Fig. 19



Fig. 20

Put the inverse humerus trial cap on the head (fig. 16). There are caps in sizes of neutral, +5 mm, +10 mm available.

Perform a trial reduction and control the muscle tension and the range of motion. In case of instability change the trial cap accordingly.

If a sufficient function is achieved please remove all trial components.



Fig. 21

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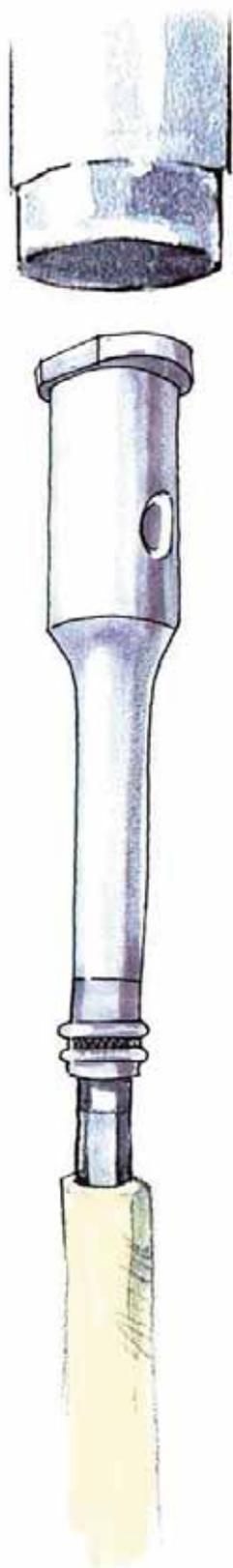


Fig. 22

Implantation of the Humeral Stem

Mount the humerus stem of the proper size, the impact sleeve on the impactor.

Fasten the connection using the counter instrument. Impact the humerus stem (Fig. 22).

When using the cementless stem, insert the stem of the same size as the previously used rasp.

Remark: To prevent fractures of the cortical bone, it is helpful to fix a bone forceps around the humeral bone during impactation.

It is possible to protect the humerus stem against rotation using a 3.5mm cortical screw.

If a cemented implantation is planned, insert the cement and use the cemented stem which is 2 mm smaller than the previously used drill or rasp.

Remove all instruments, especially during the cement hardening to prevent bending moments.

Final Assembly

Combine the proximal implant components on the humeral stem and lock the components in the correct rotational alignment. Fasten the screw of the bar screw of correct length (see „Assembling Options“ auf Seite 5). Use the socket wrench small and secure the composition with the counter instrument (Fig. 23). Lock the humerus safety screw in the same way (Fig. 24)

Screw the humerus inverse cap of the correct size on the humeral head. Tighten the humerus inverse cap with the wrench for cap/counter instrument and secure it with the wrench for humerus (Fig. 26).

Reduce the shoulder joint and check the joint stability and the range of motion (fig. 20).



Fig. 23



Fig. 24



Fig. 27



Fig. 25



Fig. 26

MUTARS® Humerus Inverse



Fig. 28

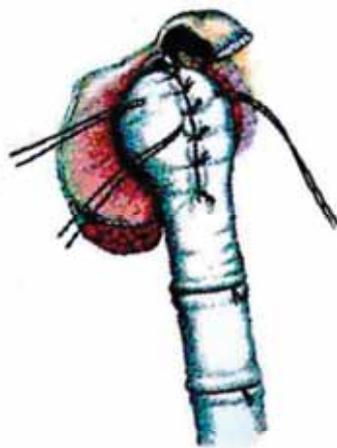


Fig. 29

The Use of the Attachment Tube

Fasten the attachment tube with 4 ethibond (thread size 2) or similar non-resorbable suture material to the remaining joint capsule / rotator cuff.

Fix the tube proximal first than distal.
Pull the tube over the joint capsule and fix the tube to the capsule wall.

Afterwards tighten the tube and fix it over and under the pads of the MUTARS® components (Fig. 28 and Fig. 29).

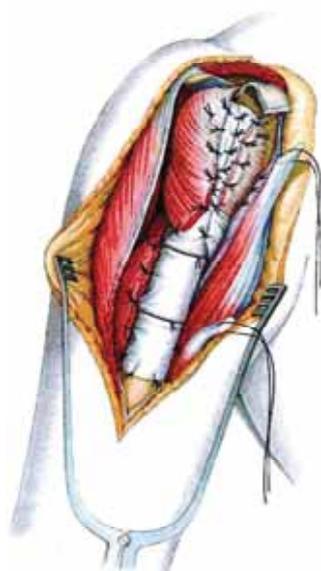


Fig. 30

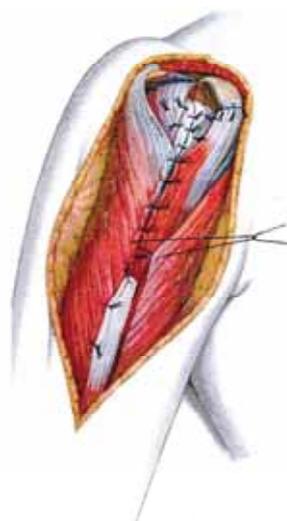


Fig. 31

Fix muscles and tendon tissues with sutures to the meshes of the tube (Fig. 30 and Fig. 31).



Implants

*S: Implants are available with Silver coating!

*N: Implants are available with TiN-coating!

*SN: Implants are available with Silver and TiN-coating!

MUTARS® humerus cap inverse

mat.: *implatan*®; $TiAl_6V_4$ acc. to ISO 5832-3 with TiN-coating

| REF | size |
|-----------|-------|
| 5210-1000 | 0mm |
| 5210-1005 | +5mm |
| 5210-1010 | +10mm |



MUTARS® humerus head *S

mat.: *implatan*®; $TiAl_6V_4$ acc. to ISO 5832-3
5200-0000



MUTARS® humerus screw

mat.: *implatan*®; $TiAl_6V_4$ acc. to ISO 5832-3

| REF | size |
|-----------|----------|
| 5230-0015 | M8x15 mm |
| 5230-0035 | M8x35 mm |
| 5230-0055 | M8x55 mm |
| 5230-0075 | M8x75 mm |



MUTARS® humerus stem HA cementless

mat.: *implatan*®; $TiAl_6V_4$ acc. to ISO 5832-3 with *implaFix*® HA; HA-coating acc. to ISO 13779-2

| REF | size |
|-----------|--------|
| 5240-0808 | 8 mm |
| 5240-0809 | 9 mm |
| 5240-0810 | 10 mm |
| 5240-0811 | 11 mm |
| 5240-0812 | 12 mm |
| 5240-0813 | 13 mm |
| 5240-0814 | 14 mm* |
| 5240-0815 | 15 mm* |
| 5240-0816 | 16 mm* |

*available on request.



MUTARS® humerus stem cemented *N

mat.: *implavit*®; CoCrMo acc. to ISO 5832-4

| REF | size |
|-----------|-------|
| 5240-0408 | 8 mm |
| 5240-0409 | 9 mm |
| 5240-0410 | 10 mm |
| 5240-0411 | 11 mm |
| 5240-0412 | 12 mm |

special stem sizes are available on request.



glenoid cementless size 3 round

mat.: pure titanium (*cpTi*) acc. to ISO 5832-2 with *implaFix*® HA; HA-coating acc. to ISO 13779-2
3800-4001





MUTARS® Humerus Inverse



MUTARS® glenosphere

mat.: UHMW-PE acc. to ISO 5834-2

| | size |
|---------------|------|
| REF 5210-1002 | 40mm |



cancellous screw size Ø 4.0mm

mat.: implatan®; TiAl₆V₄ acc. to ISO 5832-3

| | size |
|---------------|------|
| REF 5793-4026 | 26mm |
| REF 5793-4028 | 28mm |
| REF 5793-4030 | 30mm |
| REF 5793-4032 | 32mm |
| REF 5793-4034 | 34mm |



MUTARS® humerus extension piece *S

mat.: implatan®; TiAl₆V₄ acc. to ISO 5832-3

| | size |
|---------------|-------|
| REF 5220-0020 | 20 mm |
| REF 5220-0040 | 40 mm |
| REF 5220-0060 | 60 mm |



MUTARS® humerus connecting part *S

mat.: implatan®; TiAl₆V₄ acc. to ISO 5832-3

| | size |
|---------------|-------|
| REF 5221-0080 | 80 mm |



MUTARS® attachment tube

mat.: Polyethylene terephthalate (PET)

| | size |
|---------------|-------|
| REF 5900-0300 | 35 mm |
| REF 5900-0310 | 55 mm |



cancellous screw angle stable 4.2mm

mat.: implatan®; TiAl₆V₄ acc. to ISO 5832-3

| | size |
|---------------|------|
| REF 5794-4220 | 20mm |
| REF 5794-4222 | 22mm |
| REF 5794-4224 | 24mm |
| REF 5794-4226 | 26mm |
| REF 5794-4228 | 28mm |
| REF 5794-4230 | 30mm |
| REF 5794-4232 | 32mm |
| REF 5794-4234 | 34mm |
| REF 5794-4236 | 36mm |
| REF 5794-4238 | 38mm |
| REF 5794-4240 | 40mm |

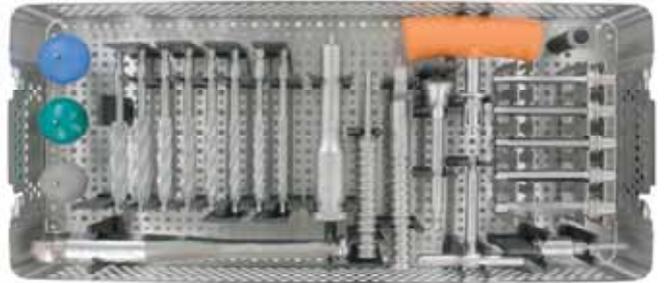


MUTARS® Humerus Inverse

Instruments

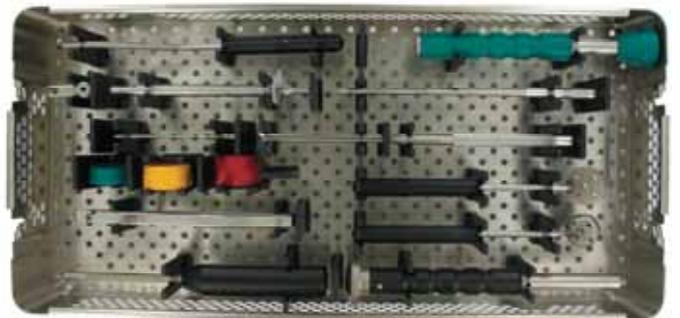
MUTARS® humerus container

7999-5200



MUTARS® humerus inverse container

7999-5201



MUTARS® humerus trial container

7999-5202





MUTARS® Humerus Inverse

MUTARS® humerus container
7999-5200

MUTARS® extractor device
REF 7220-0000



MUTARS® socket wrench small
REF 7608-1010



MUTARS® humerus drill ic-connection

| | | |
|---------------|-------|--|
| | size | |
| REF 7630-0207 | 7 mm | |
| REF 7630-0208 | 8 mm | |
| REF 7630-0209 | 9 mm | |
| REF 7630-0210 | 10 mm | |
| REF 7630-0211 | 11 mm | |
| REF 7630-0212 | 12 mm | |

MUTARS® medullary cavity reamer
REF 4220-0000



MUTARS® rasp for humerus stem

| | | |
|---------------|-------|--|
| | size | |
| REF 7770-0809 | 9 mm | |
| REF 7770-0810 | 10 mm | |
| REF 7770-0811 | 11 mm | |
| REF 7770-0812 | 12 mm | |
| REF 7770-0813 | 13 mm | |

MUTARS® humerus impactor
REF 7710-0000



MUTARS® humerus impact + extract sleeve
REF 7721-0000



MUTARS® wrench for cap/ counter instrument
REF 7710-0001



MUTARS® counter instrument Ø6mm
REF 7420-0001



MUTARS® humerus trial cap

| | | |
|---------------|--------|--|
| | size | |
| REF 7710-1000 | small | |
| REF 7710-1005 | medium | |
| REF 7710-1010 | large | |

ic- T-handle Zimmer-Jakobs
REF 4223-0023



ic-adapter
REF 4223-0022





MUTARS® Humerus Inverse

MUTARS® humerus inverse container 7999-5201

MUTARS® humerus trial cap inverse with thread

| | size | |
|---------------|-------|---|
| REF 7710-1201 | 0mm |  |
| REF 7710-1105 | +5mm | |
| REF 7710-1110 | +10mm | |

glenoid reamer 30mm REF 7800-4030



glenoid impactor REF 7800-4001



MUTARS® glenoid drill guide REF 7710-1101



hexagon screw driver 2.5mm REF 7608-1001



depth gauge small REF 0270-1015



glenoid drill guide REF 7800-4016



glenosphere impactor REF 7801-0001



drill A/O chuck 2.0mm REF 7700-0020



fixation pin 3.2 mm x 97 mm (2 pcs) REF 4223-0008



pin extractor REF 4223-0007 or alternatively ic-pin extractor REF 7512-0800



pin impactor 3.2 mm REF 4223-0006



drill guide for glenoid cementless 12 mm REF 7710-1104



MUTARS® humerus trial container 7999-5202

MUTARS® humerus trial cap with thread

| | size | |
|---------------|--------|---|
| REF 7710-1200 | small |  |
| REF 7710-1205 | medium | |
| REF 7710-1210 | large | |

MUTARS® humerus trial head REF 7710-1252



MUTARS® humerus trial extension piece

| | size | |
|---------------|-------|---|
| REF 7710-0020 | 20 mm |  |
| REF 7710-0040 | 40 mm | |
| REF 7710-0060 | 60 mm | |

MUTARS® humerus trial reducer

| | size | |
|---------------|--------|--|
| REF 7710-2100 | 10 mm |  |
| REF 7710-2101 | 100 mm | |

MUTARS® humerus trial connecting part

| | | |
|---------------|-------|---|
| REF 7710-2180 | 80 mm |  |
|---------------|-------|---|

MUTARS® humerus trial screw

| | size | |
|---------------|----------|---|
| REF 7710-2315 | M8x15 mm |  |
| REF 7710-2335 | M8x35 mm | |
| REF 7710-2355 | M8x55 mm | |
| REF 7710-2375 | M8x75 mm | |

MUTARS® distal humerus 50mm trial REF 7710-1275





MUTARS[®] Humerus Inverse



implantcast

implantcast GmbH
Lüneburger Schanze 26
D-21614 Buxtehude
Germany
phone.: +49 4161 744-0
fax: +49 4161 744-200
e-mail: info@implantcast.de
internet: www.implantcast.de



Your local distributor:

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