Surgical Technique

smith&nephew

NANOS®

Neck Preserving Hip System

Legal Manufacturer

OHST Medizintechnik AG

NANOS◇

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Disclaimer

These Surgical Instructions are intended exclusively for professionals in the medical technology field. They are expressly not intended for informational purposes of medical lay persons. The product explanations contained in this pamphlet are of a general nature and do not constitute medical advice. The instructions were created and compiled by medical experts and technically qualified employees of OHST AG, based on their best knowledge. We do not assume liability or guarantee the topicality, accuracy and completeness of the information provided herein. Any liability for damages, material or immaterial, incurred through the use of this information shall be excluded.

Introduction and Product Description

The NANOS® femoral neck prosthesis provides metaphyseal anchoring and load transfer. The implant requires a gentle and minimal bone resection. The cancellous bone around the metaphysis and the greater trochanter are retained to ensure load distribution and transfer.[1,2] This upholds the principle of the 'second line of defense' for this prosthesis concept.[1,2,3,4,5,6]

Matching sizes as well as a clearly structured assortment of instruments make it easier to determine and select the suitable implant intraoperatively.

A total of eleven fully compatible sizes are available, designed to complement each other. The part of the femoral neck below the conus has been tapered to increase the range of motion.

The development is based on past clinical experience of various short stem prostheses, biomechanical explorations and physiological optimization. NANOS® is the third generation of this type of prosthesis.

Figure 1: NANOS Neck Preserving Hip Prostesis

Femoral Neck Preservation

The resection is done with maximum bone retention with a straight cross-cut osteotomy of the femoral neck. The arched stem follows the cancellous channel of the femoral neck into the femur and thus accommodates anatomical anteversion and retroversion as well as varus and valgus position of the femoral neck.

Retention of femoral neck = retention of offset
The implant follows the natural CCD angle as shown in the example below.

Coxa valga

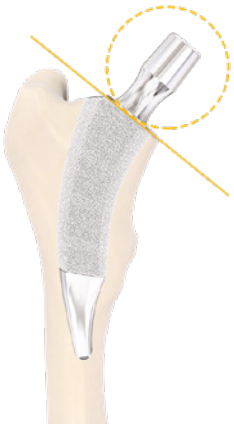

Figure 2: Illustration coxa valga

Figure 3: Post-op x-ray coxa valga

Coxa normala

Figure 4: Illustration coxa normala

Figure 5: Post-op x-ray coxa normala

Coxa vara

Figure 6: Illustration coxa vara

Figure 7: Post-op x-ray coxa vara

Indications

- Primary and secondary coxarthrosis
- Dysplasia coxarthrosis
- Avascular and post-traumatic femoral head necrosis
- Patients with good bone density and intact femoral neck

Contraindications

- Marked osteoporosis
- Dysmorphia and loss of bone substance, as well as prior surgical procedures that do not guarantee the intended support
- Marked coxa valga
- Marked coxa vara with an implant position CCD < 125°
- Intolerance to the materials

If femoral heads with a neck XL are used, the range of motion is reduced by about 30°.

Risks and conditions that can impair the success of the operation

Potential risks associated with the operation are:

- Obesity (body mass index BMI > 30)
- Anticipated extreme stresses (e. g. through sports or work), especially in patients with a body weight over 100 kg
- Disorders of bone metabolism (osteoporosis, osteomalacia)
- Occurrence of fissures, in rare cases fracture of the femoral bone
- Circulatory disorders of the affected limb
- Neurological disorders of the affected limb
- Muscle malfunction in the affected limb
- Overweight
- Alcohol or substance abuse
- Patient groups with mental disorders or addictions
- Pregnancy
- Growth in children and adolescents
- Anticipated extreme loading e.g. due to work and sport
- Epilepsy or other reasons for repeated trauma with an increased risk of fracture
- Joint deformities that make fixation of the implant difficult
- Weakening of the bearing structures by tumour
- High-dose ingestion of cortisone or cytostatics
- Previous or threatening infectious diseases with possible joint involvement
- Deep vein thrombosis and/or history of pulmonary embolism
- All general surgical risks

Surgical Technique

The information provided under surgical technique is intended as recommendations and references. However, the detailed application or feasibility of application depends on the skill and experience levels of the individual practitioner.

For detailed information about the implant system and the instruments please refer to their respective instructions for use (Lit. No. 50000697 and 50000354).

Preoperative Planning

X-ray templates with 15% enlargement in analogous form are available for preoperative planning. As a standard, digital x-ray templates with a scale of 1:1 for use with the planning software MediCAD* are also available for download. The following illustration shows the preoperative planning for the NANOS° femoral neck prosthesis.

The size and position of the prosthesis are planned using the anterior/posterior and the axial x-ray image. Depending on the system requirements, attachment is advised in the anterior/posterior region on the calcar femorale and the lateral corticalis. In the axial x-ray a proximal pressfit in the ventro/dorsal region and support of the distal tip of the prosthesis is achieved. Leg length and offset can be adjusted during the planning by setting the resection height and the appropriate choice of prosthesis.

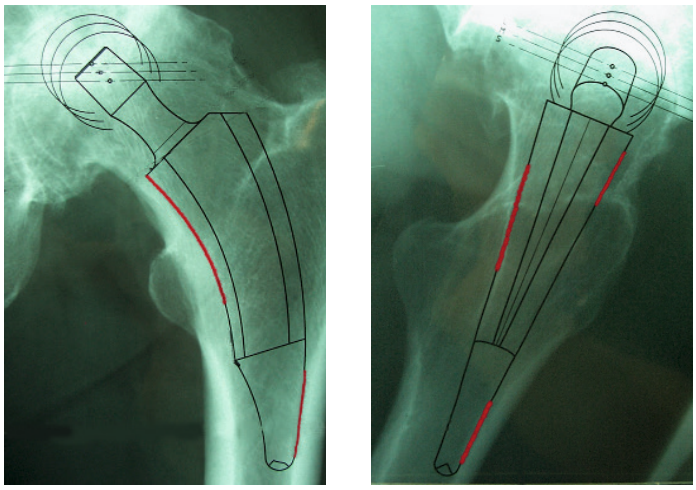

Figure 8: Example of preoperative planning for the NANOS° Neck Preserving Hip Prostesis

**Upon request, the manufacturer OHST Medizintechnik AG, Rathenow will provide digital x-ray templates in databases of other providers for the digital planning software.*

Case Studies

Case 1

Left hip, 49 years of age, male

Figure 9: Preoperative x-ray

Figure 10: Postoperative x-ray

Case 2

Left hip, 48 years of age, male

Figure 11: Preoperative x-ray

Figure 12: Postoperative x-ray

Surgery Step 1

Resection of the femoral neck

A maximum amount of bone is preserved during the resection of the femoral neck, in accordance with the planning. Usually 0.5 – 1.0 cm subcapital with a straight transverse osteotomy of the femoral neck.

Figure 13: Resection of the femoral neck

In case of a narrow bone situation or a fracture of the femoral neck, the resection can be performed as shown in Figure 14.

Figure 14: Resection of the femoral neck in case of a narrow bone situation or a fracture of the femoral neck

Surgery Step 2

Preparing the prosthesis site

The opening rasp is used to prepare the path for the forming rasps. The opening rasp is inserted with a slight curved motion inside the interior cortex until the lateral cortical bone is reached at the height of the bottom edge of the lesser trochanter.

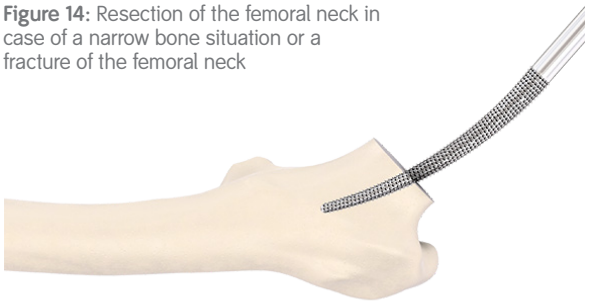

Figure 15: Preparation with the opening rasp

For minimally invasive preparation, the size 0 rasp is connected to the curved rasp handle and moved forward along the calcar ridge. This rasp can later be used for the finishing preparation at the lateral cortical ring.

Figure 16: Preparation with rasp size 0

This is followed by finishing with the cancellous compactors. The aim of the preparation with compactors is to compact cancellous bone.

The preparation is carried out in stages until the planned size is reached or until the compactor is in cortical contact in the load-bearing zones. Cortical contact can be determined by mechanical stability and when the sound changes.

The rasps or compactors should be used in a slightly curved motion to ensure that there are no gaps that won't be filled by the prosthesis. The compactor should be beyond or flush with the resection line. If needed, the next size will be fitted.

Figure 17: Compactor in situ

Note

Rasps of all sizes can be used for individual applications as desired.

Surgery Step 3

Trial positioning

Once the correctly fitting compactor is properly positioned, remove the rasp handle and add the trial head. Next the trial positioning takes place. The range of motion should be checked for possible restrictions, along with clinical review of telescoping and leg length.

Trial heads are available in diameters of 22*, 28, 32 and 36 mm with a neck length of XS*, S, M, L and XL.

**optional*

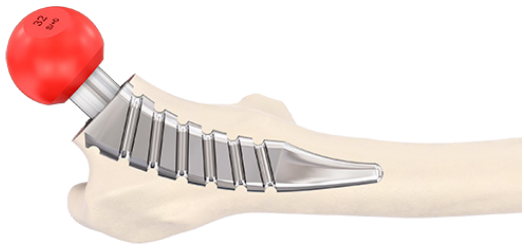

Figure 18: Trial reduction using a compactor and trial head

After reduction, it is recommended to use a c-arm x-ray unit to assess the fit, center of rotation and offset of the implants.

Remove the trial head and compactor.

If needed, rework the prosthesis site with the rasps and a larger compactor. Lateral, between the compactor and the cortical femoral neck ring where a bone conflict can occur should the opening rasp be used, until the compactor can be put in place with the desired fit.

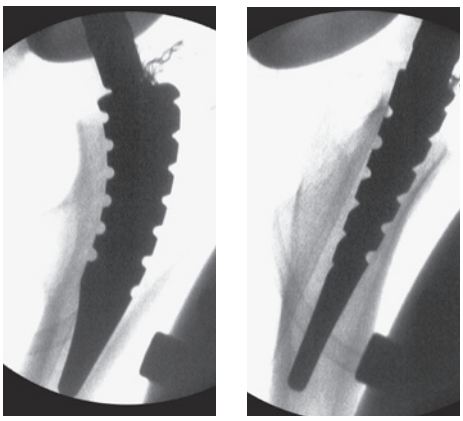

Figure 19: Intraoperative sizing and X-ray control with compactor in situ

Surgery Step 4

Implanting the stem

Manually insert the NANOS® original prosthesis that corresponds to the size of the last used compactor. Subsequently impact it to the same depth as the compactor had previously, using the inserter.

Carefully clean the conus, position and impact the original ball head. Reposition, check stability and movement.

The wound is sutured in the standard way according to the surgeon's preference.

Figure 20: Implantation of the stem

Prosthesis Removal

If it is necessary to intraoperatively remove a NANOS® original prosthesis, the provided extraction instrument can be used.

This can be fitted to the cone and connected to the rasp handle to remove the implant.

Figure 21: Stem extractor

Postoperative Treatment

The follow-up treatment depends on the surgery outcome. Mobilization can be started very quickly after a minimally traumatic implantation. The postoperative procedure with partial or full load bearing, walking aids, three point gait, four point gait will be determined by the surgeon or the person in charge of postoperative treatment on an individual basis. The bone quality and condition of the patient should be taken into consideration. Directed behavior, muscle building through physiotherapy and gait training have a positive impact on the postoperative course.

Notes Regarding Implant Unpacking

The implants are packaged in 3 layers of clear pouches made of plastic film (radiation sterilization 25 kGy minimum) with cardboard. The outer pouch of the 3-layer clear pouch packaging should be removed together with the cardboard by non-sterile staff. The second pouch should be opened in a manner that will not endanger the sterility of the inner pouch. The innermost pouch will be pulled out and opened by sterile staff. The implant needs to be handed to the surgeon in this way to enable direct removal of the sterile implant.

Femoral Heads

Only femoral heads that are compatible with the system may be used for the assembly with the implant. The approved combinations with Smith & Nephew femoral heads are listed in a compatibility matrix. The matrix is available at: www.smith-nephew.com/compatibilitymatrix (Lit. No. 04758).

Implants

NANOS® femoral neck prosthesis

(ISO 5832-3 Ti6Al4V, TPS/Bonit®)

Implants		Art. No.	SAP No.
NANOS® femoral neck prosthesis size 0	ISO 5832-3 Ti6Al4V, TPS/Bonit	425000	75008154
NANOS® femoral neck prosthesis size 1	ISO 5832-3 Ti6Al4V, TPS/Bonit	425001	75008155
NANOS® femoral neck prosthesis size 2	ISO 5832-3 Ti6Al4V, TPS/Bonit	425002	75008156
NANOS® femoral neck prosthesis size 3	ISO 5832-3 Ti6Al4V, TPS/Bonit	425003	75008157
NANOS® femoral neck prosthesis size 4	ISO 5832-3 Ti6Al4V, TPS/Bonit	425004	75008158
NANOS® femoral neck prosthesis size 5	ISO 5832-3 Ti6Al4V, TPS/Bonit	425005	75008159
NANOS® femoral neck prosthesis size 6	ISO 5832-3 Ti6Al4V, TPS/Bonit	425006	75008160
NANOS® femoral neck prosthesis size 7	ISO 5832-3 Ti6Al4V, TPS/Bonit	425007	75008161
NANOS® femoral neck prosthesis size 8	ISO 5832-3 Ti6Al4V, TPS/Bonit	425008	75008162
NANOS® femoral neck prosthesis size 9	ISO 5832-3 Ti6Al4V, TPS/Bonit	425009	75008163
NANOS® femoral neck prosthesis size 10*	ISO 5832-3 Ti6Al4V, TPS/Bonit	75103109	75103109

BONIT® is a Registered Mark from DOT (Medical Implant Solutions).
*Special size

Instrumentation

NANOS® Instrument Tray
(Set SAP No. 75200170)

No.	Description	Art. No.	SAP No.
1	Opening rasp 90° rotated	506-1155	7500-8173
2	NANOS® rasp size 0	506-1170	7500-8185
3	NANOS® compactor size 0	506-1160	7500-8175
4	NANOS® compactor size 1	506-1161	7500-8176
5	NANOS® compactor size 2	506-1162	7500-8177
6	NANOS® compactor size 3	506-1163	7500-8178
7	NANOS® compactor size 4	506-1164	7500-8179
8	NANOS® compactor size 5	506-1165	7500-8180
9	NANOS® compactor size 6	506-1166	7500-8181
10	NANOS® compactor size 7	506-1167	7500-8182
11	NANOS® compactor size 8	506-1168	7500-8183
12	NANOS® compactor size 9	506-1253	7501-8378
13	NANOS® compactor size 10*	7510-3110	7510-3110
14	Rasp handle, curved	506-1169	7500-8184
15	NANOS® impactor with silicone	7510-2877	7510-2877
16	Stem extractor	506-073	7500-8168
17	Handle adapter, hook coupling	506-075	7500-8169
18	Trial head 28 S/+0	7510-3045	7510-3045
19	Trial head 28 M/+4	7510-3046	7510-3046
20	Trial head 28 L/+8	7510-3047	7510-3047
21	Trial head 28 XL/+12	7510-3048	7510-3048
22	Trial head 32 S/+0	7510-3051	7510-3051
23	Trial head 32 M/+4	7510-3052	7510-3052
24	Trial head 32 L/+8	7510-3053	7510-3053
25	Trial head 32 XL/+12	7510-3054	7510-3054
26	Trial head 36 S/+0	7510-3057	7510-3057
27	Trial head 36 M/+4	7510-3058	7510-3058
28	Trial head 36 L/+8	7510-3059	7510-3059
29	Trial head 36 XL/+12	7510-3060	7510-3060
30	Alignment rod ø8 mm	506-015	7500-8164
	NANOS® tray	7510-3166	7510-3166
	Lid for tray	7510-2521	7510-2521

*Optional

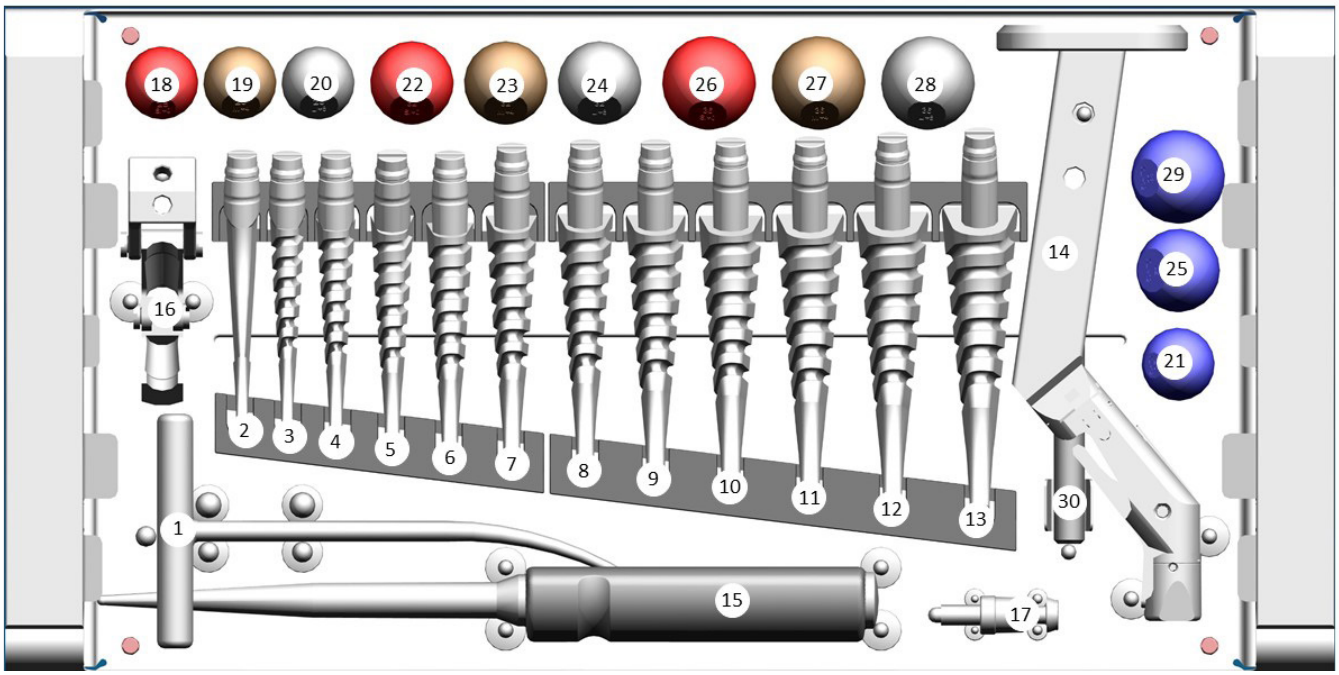

Figure 22: NANOS® Instrument Tray

Optional Instruments

NANOS® Tray Rasps
(Set SAP No. 75210420)

No.	Description	Art. No.	SAP No.
1	NANOS® rasp size 1	506-1418	7502-9226
2	NANOS® rasp size 2	506-1419	7502-9227
3	NANOS® rasp size 3	506-1420	7502-9228
4	NANOS® rasp size 4	506-1421	7502-9229
5	NANOS® rasp size 5	506-1422	7502-9230
6	NANOS® rasp size 6	506-1423	7502-9231
7	NANOS® rasp size 7	506-1424	7502-9232
8	NANOS® rasp size 8	506-1425	7502-9233
9	NANOS® rasp size 9	506-1426	7502-9234
10	NANOS® rasp size 10*	7510-3111	7510-3111
	NANOS® tray rasps	7510-3167	7510-3167
	Lid for tray	7510-2898	7510-2898

*Optional

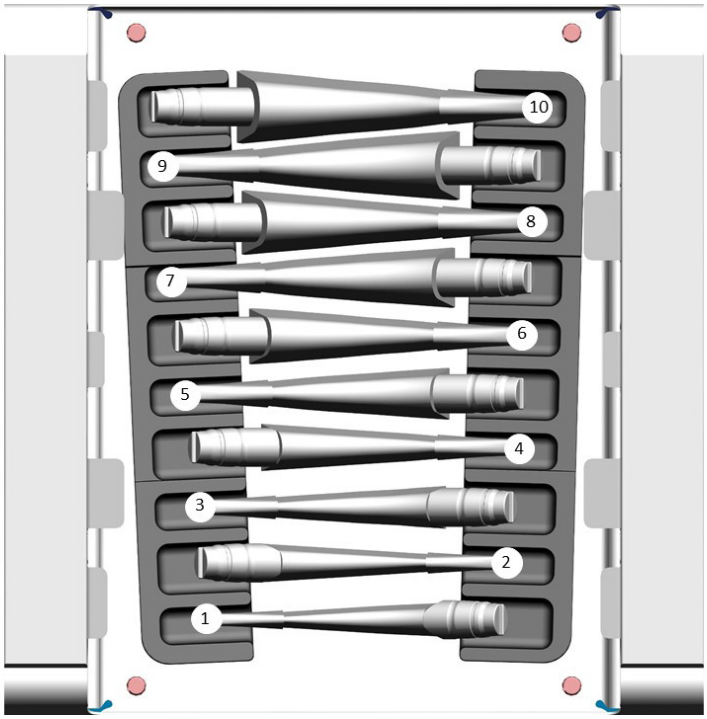

Figure 23: NANOS Rasp Tray

Description	Art. No.	SAP No.
Rasp handle, double offset, right, hook coupling	367-155	7510-3113
Rasp handle, double offset, left, hook coupling	367-156	7510-3114
IMT rasp adapter, double offset, right, hook coupling	367-158	7510-3115
IMT rasp adapter, double offset, left, hook coupling	367-159	7510-3116
NANOS® IMT rasp adapter, spring hook	506-1210	7509-4887
Rasp handle, spring hook, medial release mechanism	506-1245	7503-0476
NANOS® rasp handle, spring hook, straight	506-1204	7509-4886
Trial head 22 S/+0	7510-3040	7510-3040
Trial head 22 M/+4	7510-3041	7510-3041
Trial head 22 L/+8	7510-3042	7510-3042
Trial head 22 XL/+12	7510-3043	7510-3043
Trial head 28 XS/-3	7510-3044	7510-3044
Trial head 32 XS/-3	7510-3050	7510-3050
Trial head 36 XS/-3	7510-3056	7510-3056

X-ray Templates

Description	Lit. No.
X-ray template NANOS® femoral neck prosthesis ø22mm	12330
X-ray template NANOS® femoral neck prosthesis ø28mm	09777
X-ray template NANOS® femoral neck prosthesis ø32mm	09778
X-ray template NANOS® femoral neck prosthesis ø36mm	09779

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We have been assisting and supporting physicians and health care professionals for over 150 years.

References:
1. Stadler N, Lehner J, Trieb, K. Prospective mid-term results of a consecutive series of a short stem. Acta Orthopædica Belgica. 2016; 82:372-375. **2.** Falez F, Casella F, Papalia M. Current Concepts, Classification, and Results in Short Stem Hip Arthroplasty. Healio.com/Orthopedics. 2015; 38(3):6-13. **3.** Reinhardt A. Keep it short and simple – Ergebnisse einer Multicenter-Studie. Orthopädie im Profil. 2007;1:6-8. **4.** Jerosch J. Kurzschaftendoprothesen an der Hüfte. Springer-Verlag GmbH, Berlin, Deutschland. 2017; 33:161-171. **5.** Mai S, Pfeil J, Siebert W, Kutzner KP. Kalkar-geführte Kurzschäfte in der Hüfendoprothetik – eine Übersicht. Deutscher Ärzteverlag OUP. 2016; 5(6):342-347. **6.** Falez F, Casella F, Panegrossi G, Favetti F, Barresi C. Perspectives on metaphyseal conservative stems. J Orthop Traumatol. 2008;9:49–54.