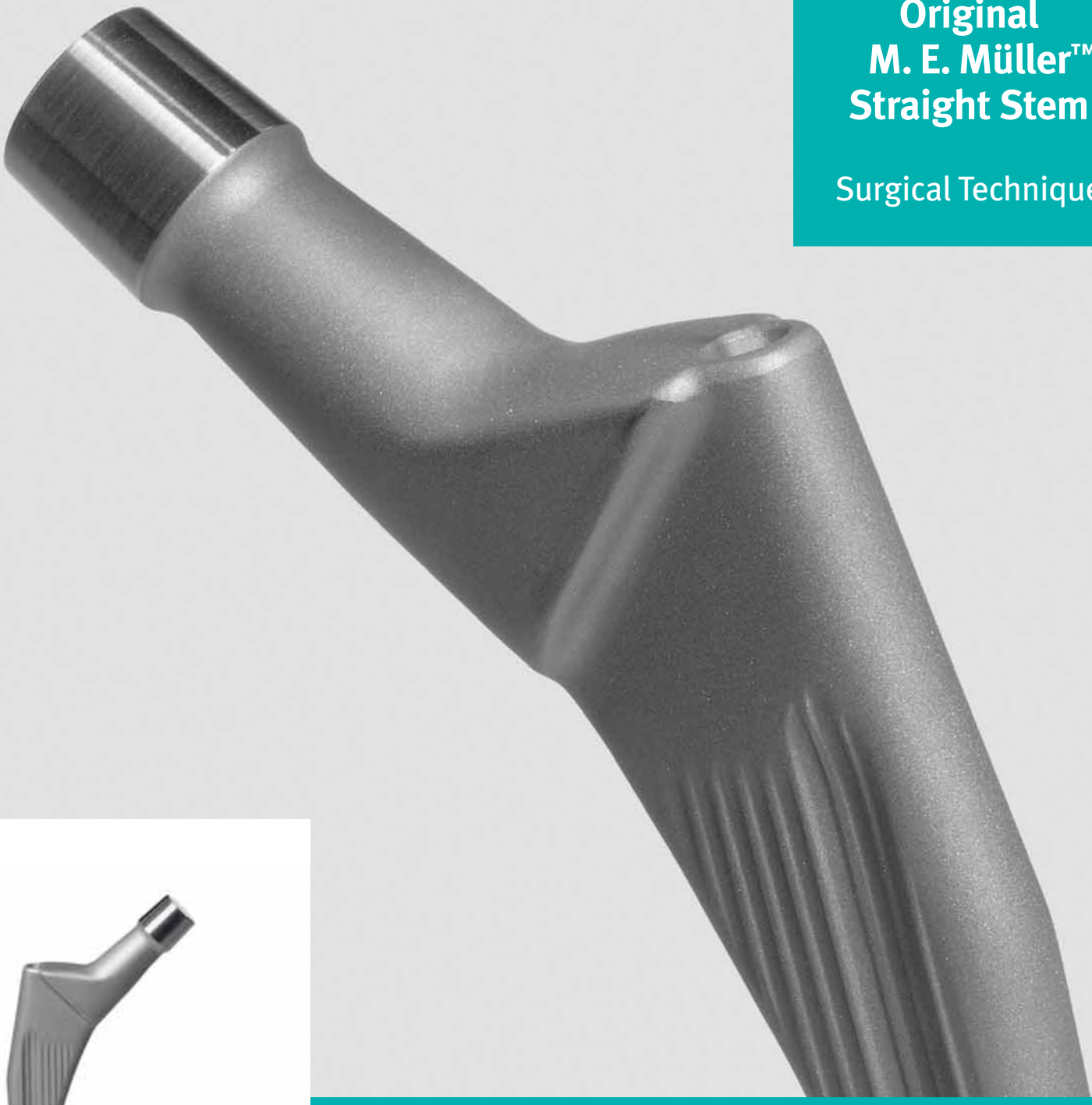
Original M. E. Müller™ Straight Stem

Surgical Technique



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Surgical Technique Original M. E. Müller Straight Stem

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Introduction – Original M. E. Müller Straight Stem

The history of the *Original M. E. Müller* Straight Stem is an example of consistent implementation of a fundamental biomechanical principle in practice.

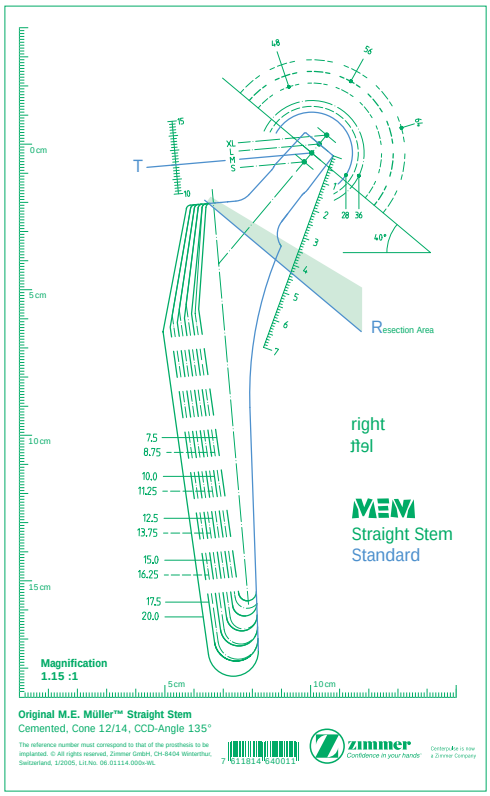
The Müller Straight Stem locks itself according to the three-point principle. The straight, conically tapering shape of the stem allows the implant to be placed in the femur in a neutral axis. Due to its wedge shape, the stem finds the central axis automatically, thus excluding a varus or valgus position.

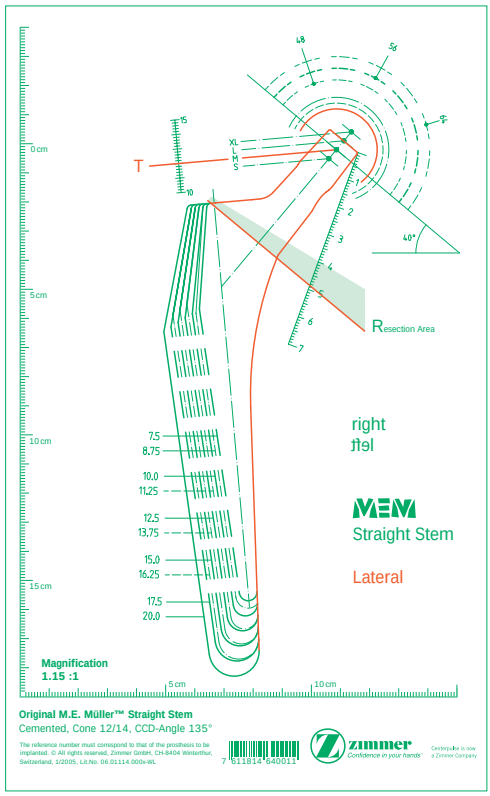
With the *Original M. E. Müller* Straight Stem, Professor Müller has developed a coherent prosthetic system, which is a constituent part of his orthopedic philosophy. The fundamental principles are the well thought-out prosthesis components, the simple pre-operative planning, and the reproducible surgical technique, together with the documentation/evaluation of the hip operations. Additional elements are precise and long-lasting instruments and the unproblematic removability of the implants.
The excellent clinical results of the *Original M.E. Müller* Straight Stem have proved the biomechanical concept behind this implant since 1977.
In 2003, the millionth *Original M. E. Müller* Straight Stem was implanted in Munich, Germany.

Pre-Operative Planning – Purpose and Aids

The graphic planning of the hip replacement implantation forces the orthopedic surgeon to carry out detailed analysis of the X ray image, and to anticipate the operation in detail.
“This (correct planning – author) provides important information about the choice of the correct model and the correct size of the prosthesis, the depth of the acetabulum preparation, the height of the neck resection, and the positioning and alignment of the pelvic and femoral components. It allows fast and systematic execution of the operation and thus minimizes the risk of complications for the patient.” (Müller, M. E., Jaberg, H., 1989)

Besides the obvious advantages of anticipating intraoperative difficulties, the pre-operative planning serves to correct and avoid differences in leg length.
As a part of quality assurance, pre-operative planning supports the work of the surgical team, and serves as a method of self-monitoring for the surgeon.





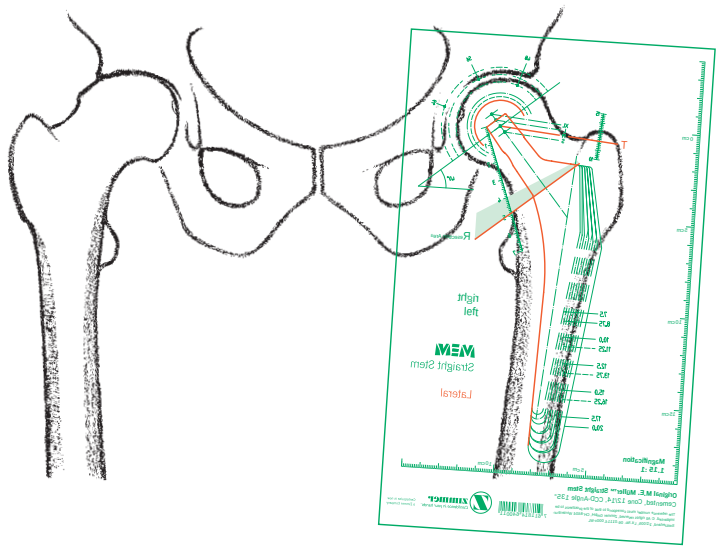
Planning template Original M. E. Müller Straight Stem, standard and lateral, enlargement factor 1.15 : 1, Lit. No. 06.01114.000

Planning Steps

The planning sketch provides the necessary information with regard to model and size of the prosthesis components, as well as with regard to the position of the center of rotation. Graphic planning with the *Original M. E. Müller* Straight Stem starts with the determination of the offset, i. e. with the question of whether the standard or the lateral version is indicated. In the simple case of unilateral coxarthrosis, this can be answered on the healthy opposite side (reference side). One also orientates oneself on this side with regard to the position of the center of rotation that is to be reconstructed with the hip prosthesis.
When fitting the *Original M. E. Müller* Straight Stem, attention must be paid to a centered position and an indicated cortex contact in the medullary cavity.

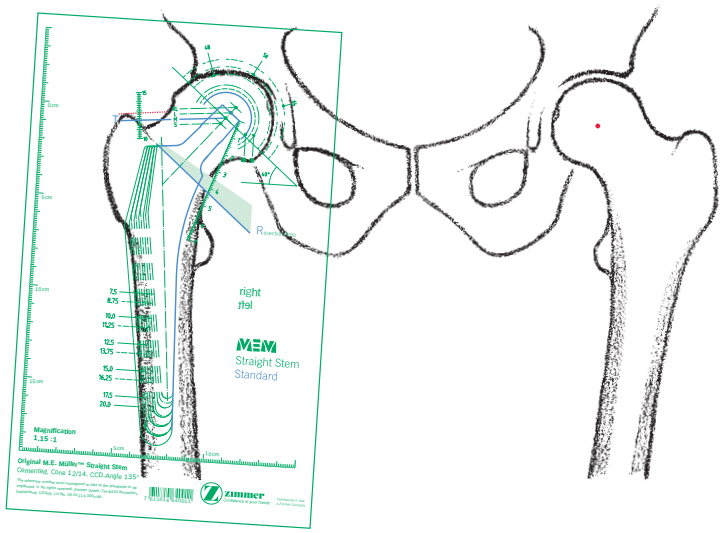
1. Standard or Lateral Version?

In our example, the template of the lateral version of the *Original M. E. Müller* Straight Stem is placed over the healthy hip in such a way that on the one hand it is concentric in relation to the center of rotation, and on the other hand it has its axis parallel to the longitudinal axis of the femur. If the medial contour of the prosthesis stem is more than 6 mm lateral of the medial cortex (as in our example), the standard version (blue) should be selected.
In this planning step, one also notes the height of the head center in relation to the tip of the trochanter, and transfers it to the side to be operated on, in order to be able to realize the same leg lengths on both sides.



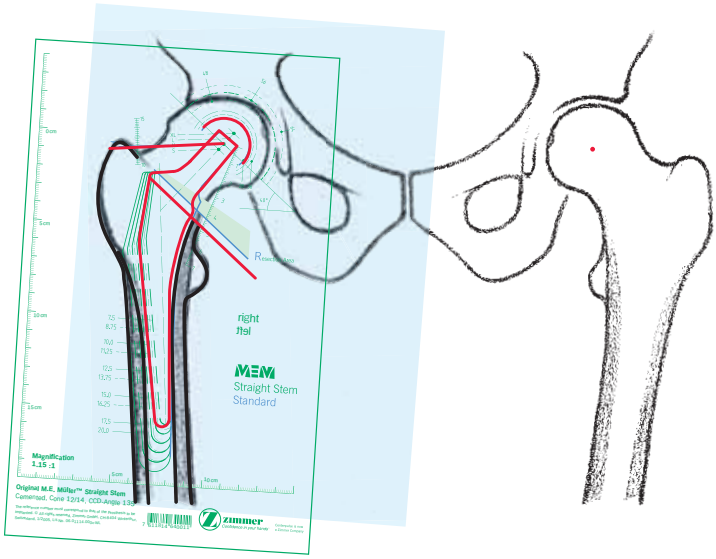
2. Which Stem Size?

The selected template is now positioned over the femur that is to be operated on, such that the prosthesis stem comes to rest centered in the medullary cavity and at the same time the T-line comes to rest at the same height as on the reference side.
The stem size that will probably fit will be the one, which roughly comes into contact with the cortex of the shaft (or the next smaller one).



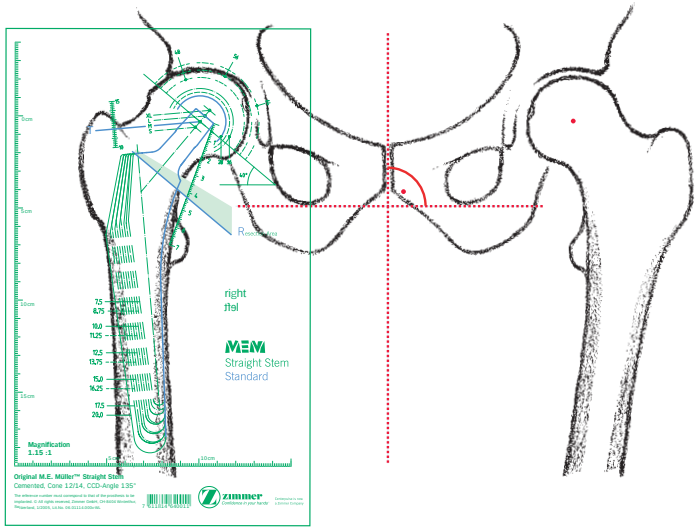
3. Drawing the Prosthetic Stem and the Femur Contours

The correct size of prosthetic stem and the contours of the femur are now transferred onto a sheet of tracing paper, which is placed over the template and X ray image. Care must be taken here that the sheet with the drawing is placed parallel to the template, in order to maintain a physiological hip joint position on the planning sketch.



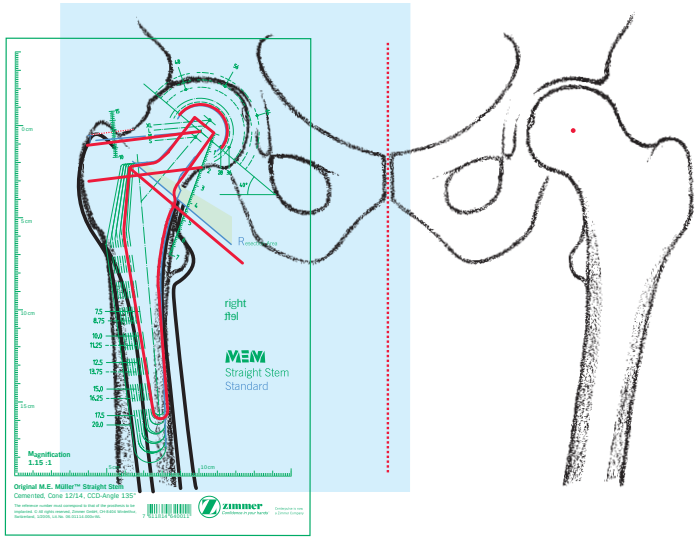
4. Which Cup and which Cup Size?

The template for the selected cup is placed over the acetabulum in such a way that the center of the cup corresponds with the anatomical center of the acetabulum, the cup contour comes into direct contact with the subchondral bone cranially, and the desired inclination is achieved. With the template for the Straight Stem prosthesis, an acetabular inclination of 40° is shown when the template is placed parallel to the longitudinal axis of the pelvis.



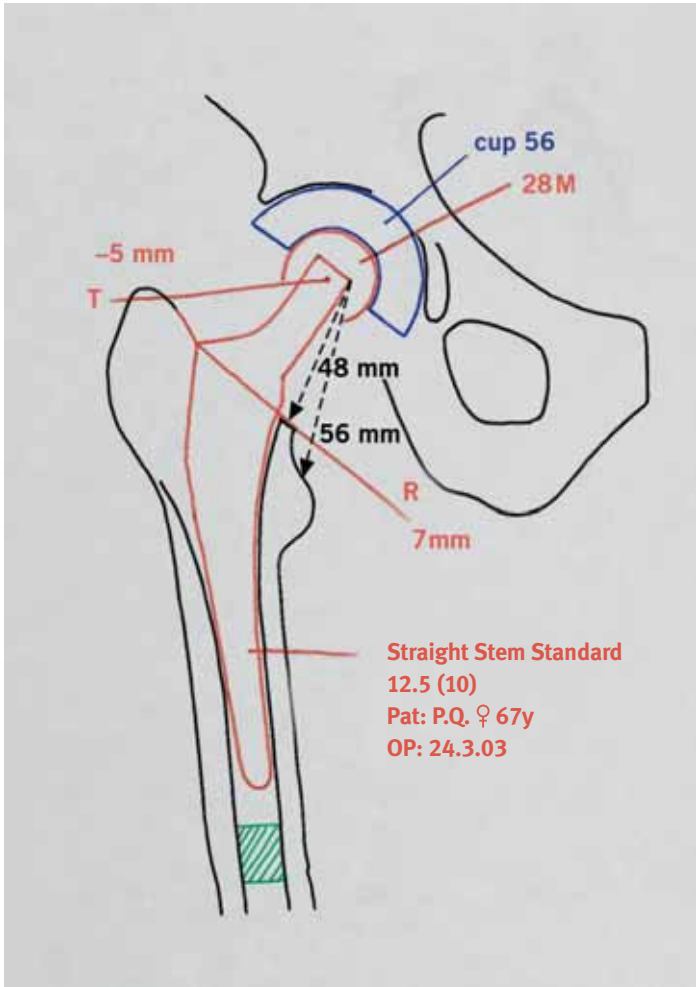
5. Drawing the Acetabulum and the Pelvis Contours

The planning sketch which has been started is now placed over the template and the X ray image in such a way that the center of the head (sketch) and the center of the acetabulum (template) correspond, and the tracing paper sheet lies parallel to the template. The contours of the correct cup and of the hemi-pelvis are then transferred to the planning sketch.



6. Final Drawing

Finally, all the necessary information about the prosthetic components (type, size, insert) is entered, and the distances to the greater and lesser trochanter (T-line – trochanter tip, R-line – trochanter base, taper end – trochanter base and taper end – resection level) are measured and noted.
The planning sketch is completed with patient identification and the date of the operation, as well as any details of additional measures.



Further literature

Gill TJ, Sledge JB, Müller ME:
Total hip arthroplasty with use of an acetabular reinforcement ring in patients who have congenital dysplasia of the hip.
J Bone Joint Surg Am 80: 969, 1998

Lützner J, Ochsner PE:
Langzeitergebnisse mit der Original M.E. Müller Geradschaftsprothese aus CoNiCrMo-Schmiedelegierung (Protasul-10).
Orthopädische Praxis 7: 36, 2000

Müller ME, Jaberg H:
Total hip reconstruction. In Evarts CM (ed):
Surgery of the musculoskeletal system.
2nd ed. Churchill Livingstone, New York, 1989

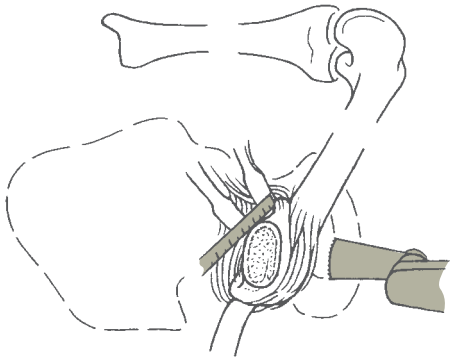
Ochsner PE (Hrsg):
Die Hüfttotalprothese. Implantationstechnik und lokale Komplikationen.
Springer, Berlin, 2003

Surgical Technique

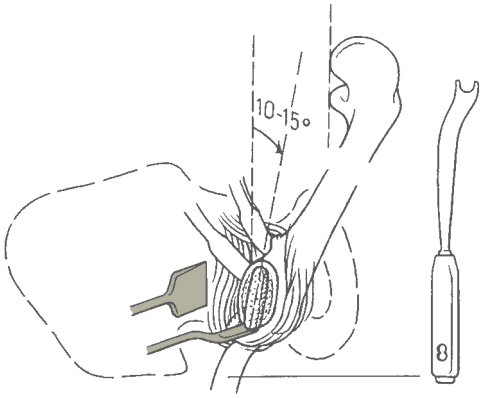
Preparation of the Medullary Canal

The *Original Müller* Straight Stem can be implanted via all surgical approaches with the patient lying on the side or on the back. Illustrated below are the individual surgical steps for the lateral approach with the patient lying on his or her back. All technical details can, however, be transferred accordingly to other approach routes.

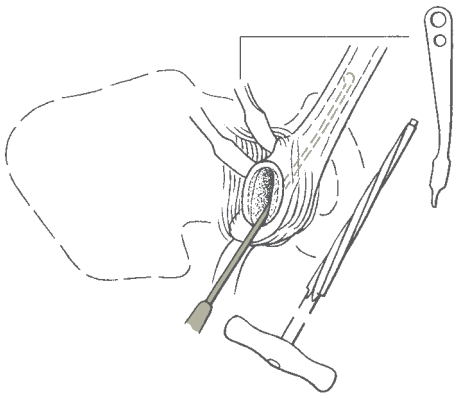
1. The distance between the lesser trochanter and the resection level is measured. If necessary, perform further resection to conform with the pre-operative planning.



2. The medullary cavity is opened with the Lexer chisel and the right-angled gouge, maintaining an antetorsion of 10°–15°, sufficiently dorsolaterally on account of the recurvation of the proximal femur end.

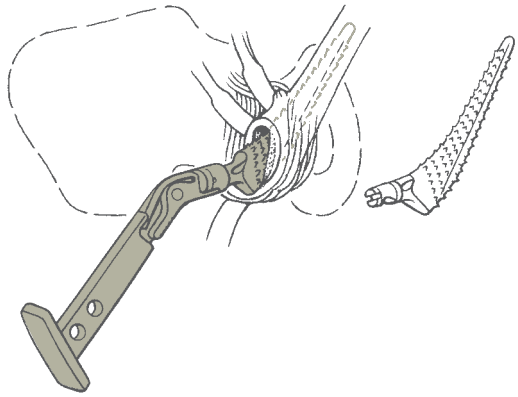


3. The medullary cavity is probed in the direction of the knee, using a long curette, in order to establish the rasp direction.
In the event of difficulty, the awl can be used to assist here.

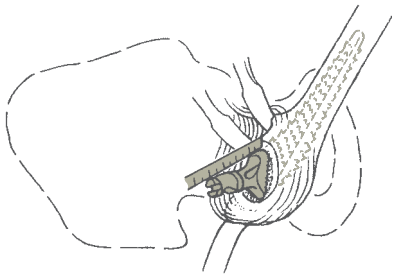


4. The medullary cavity is widened with shaped rasps of increasing size, starting with the smallest size. Depending on whether a Straight Stem standard or a Straight Stem lateral was envisaged in the pre-operative planning, the work is carried out with rasps in standard or lateral versions.

The modular rasp simultaneously serves as a trial prosthesis.

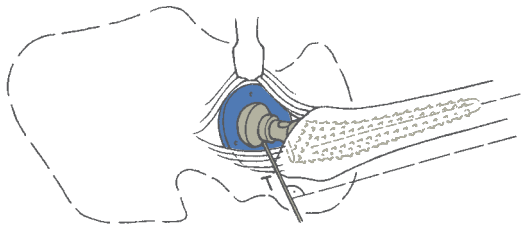


5. After removal of the modular handle, the distance from the taper end to the resection level is measured, in order to determine the correct leg length.

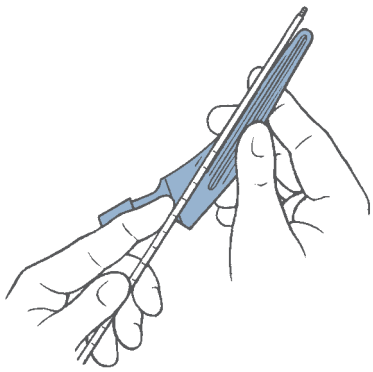


6. The test head is mounted for trial reduction. Possible check of the trochanter distance T (distance from the trochanter tip to the height of the head center) with Kirschner wire.

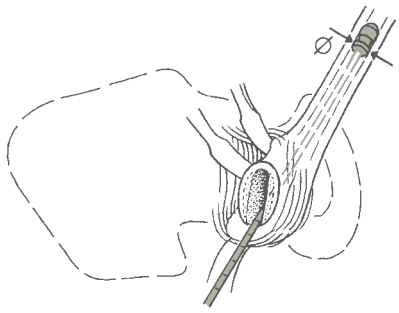
Check the range of movement, tendency to dislocation (internal rotation with flexion, external rotation with extension, adduction) and the leg length.



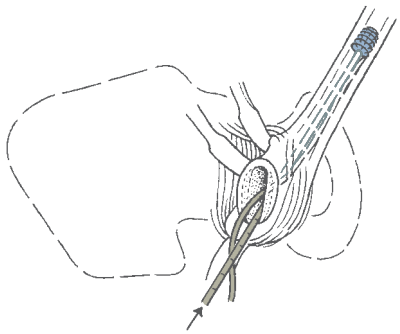
7. On the Straight Stem prosthesis that is to be implanted, with the introducing rod for medullary plug, a measure is now taken for the position of the medullary plug, measured from the prosthetic medial rim indicating the level of resection. The plug should be placed 0.5–1 cm distally of the prosthesis tip.



8. After the trial rasp has been extracted, the size of the medullary plug is determined with the aid of the measure cone.

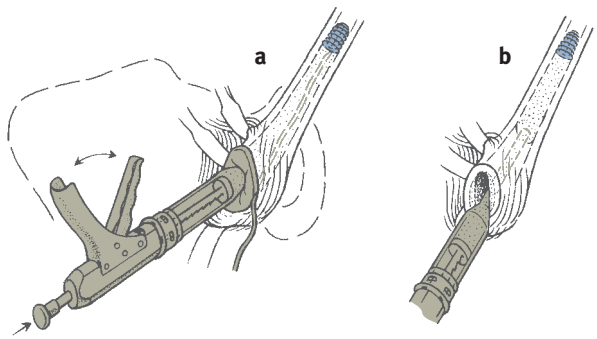


9. The Stühmer/Weber or other medullary plug is placed. Medullary plugs of autologous bone have the advantage that they can be absorbed.

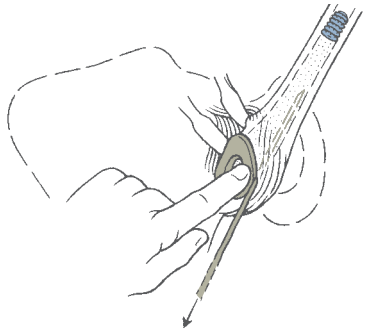


10. a The cement is introduced in antegrade fashion, using a drain and a silicon disk for compression.

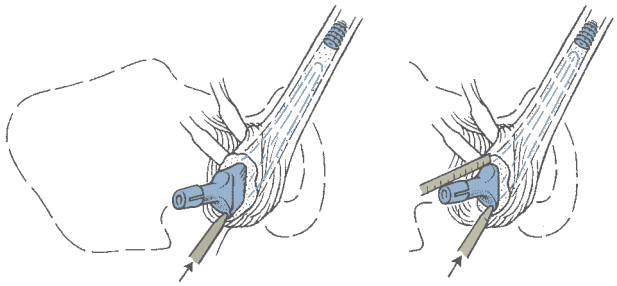
10. b Alternatively, the cement is pressed in in retrograde manner. This procedure requires neither a compression disk nor a drain.



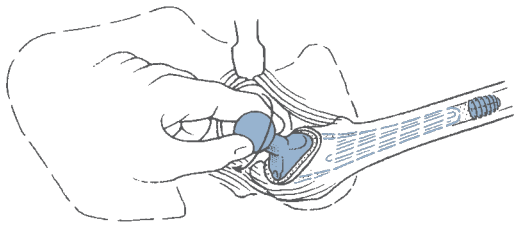
11. In the case of the antegrade technique, as soon as the medullary space has been filled with cement, the drain and compression disk are removed.



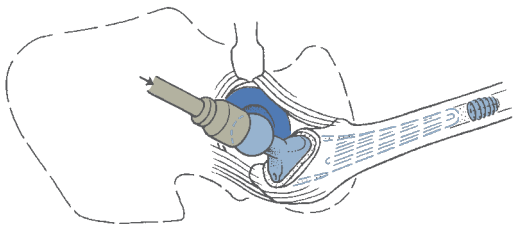
12. The stem is introduced using the impactor, with dosed pressing in of the stem until the specified distance between the cone edge and the resection level has been reached.



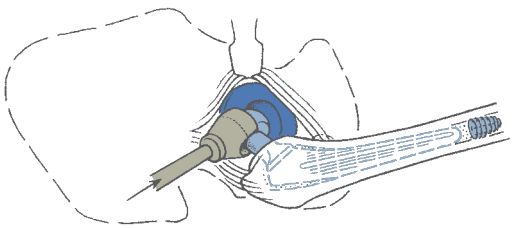
13. After the cement has hardened completely, and the taper has been carefully rinsed, the ball head is mounted. If necessary, a trial reduction is carried out beforehand with the trial head. The head is mounted with a rotatory movement.



14. Locking of the head by means of a light hammer blow on the reduction lever.

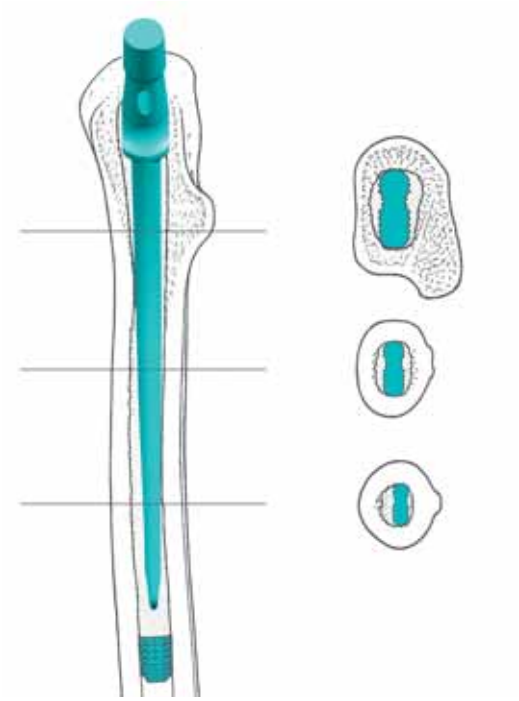


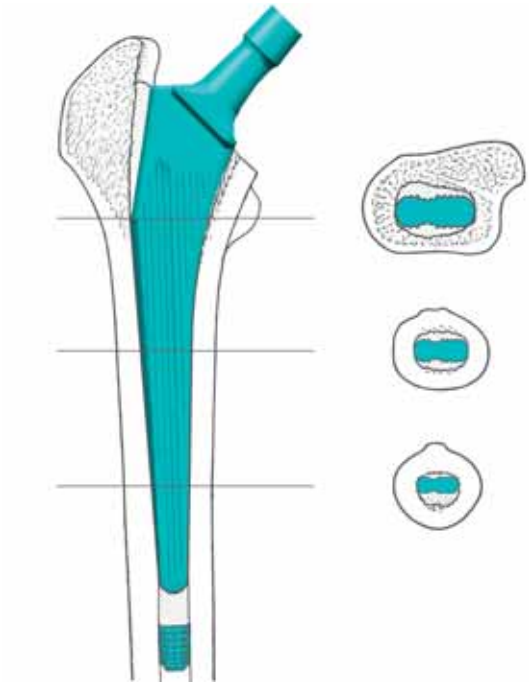
15. The joint components are reduced, and the function check repeated. Closure of the wound, Redon drainage.



Anchoring the Müller Straight Stem

The Straight Stem prosthesis is self-centering and locks itself thanks to its 6° taper (AP view) in the femur (in case of a valgus hip, it locks at three points in the frontal plane: medially on the calcar and at the prosthesis tip, and laterally in the metaphysis). Additional anchorage is achieved through the cement mantle, which, due to the flat cross-section of the stem, divides the cement mantle into a ventral and a dorsal cement half.





Case Studies

Male Patient, Date of Birth: 16 September 1960

Age at Time of Operation: 25 years

Indication: Femur head necrosis following fracture of the femur neck.

Implants: *Original Müller* Straight Stem, lateral, CoCr, size 12.5. *Müller* PE cup, cemented.

Walking ability: good – over 60 minutes without crutches, free of pain.

Flexion: > 90°,
abduction/adduction 30-0-40,
internal rotation/external rotation 20-0-30.
Free single-leg stance, no limping.

Preoperative

Postoperative

After 18 years

Female Patient, Date of Birth: 11 March 1922

Age at Time of Operation: 62 years

Indication: Dysplasia coxarthrosis

Implants: *Original Müller* Straight Stem, standard, CoCr, size 12.5. *Müller* PE cup, cemented.

Walking ability: good – up to 30 minutes without crutches, free of pain.

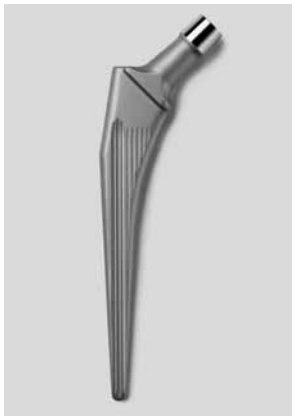
Flexion: > 90°,
abduction/adduction 30-0-20,
internal rotation/external rotation 10-0-30.
Slight limp.

Preoperative

Postoperative

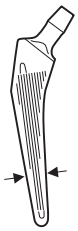
After 16 years

Implants – Original M. E. Müller™ Straight Stem



Müller™ Straight Stem, standard

Protasul® 10
Cemented
M. E. Müller™



STERILE R

Size in mm	REF
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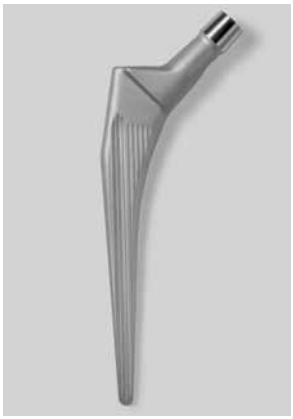
12.5	12.00.29-125
13.75	12.00.29-137
15.0	12.00.29-150
16.25	12.00.29-162
17.5	12.00.29-175



Müller™ Straight Stem, lateral

Protasul® 10
Cemented
M. E. Müller™

STERILE R

Size in mm	REF
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8.75	05.95001.065
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12.5	12.00.39-125
13.75	12.00.39-137
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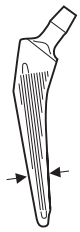
17.5	12.00.39-175

Müller™ Straight Stem, standard

Protasul® 30
Cemented
M. E. Müller™



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16.25	35.00.29-162
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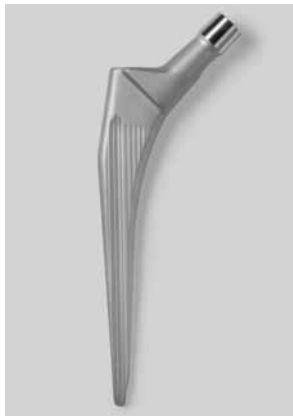
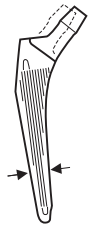


Müller™ Straight Stem, lateral

Protasul® 30
Cemented
M. E. Müller™



STERILE R

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12.5	35.00.39-125
13.75	35.00.39-137
15.0	35.00.39-150
16.25	35.00.39-162
17.5	35.00.39-175

Müller™ Straight Stem,
standard, ∅ 28 mm

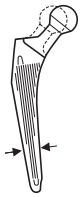
Protasul® 30
Cemented
M. E. Müller™

STERILE R

Size in mm	REF
7.5	35.28.29-075
10.0	35.28.29-100
11.25	35.28.29-112
12.5	35.28.29-125
13.75	35.28.29-137
15.0	35.28.29-150
17.5	35.28.29-175

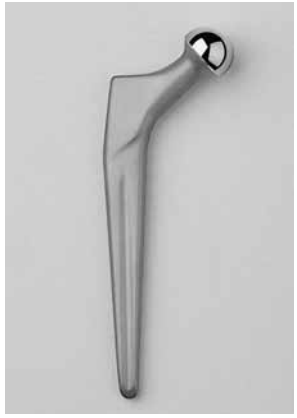
Müller™ Straight Stem,
lateral, ∅ 28 mm

Protasul® 30
Cemented
M. E. Müller™



STERILE R

Size in mm	REF
7.5	35.28.39-075
10.0	35.28.39-100
11.25	35.28.39-112
12.5	35.28.39-125
13.75	35.28.39-137
15.0	35.28.39-150
17.5	35.28.39-175



CDH stem,
∅ 22 mm

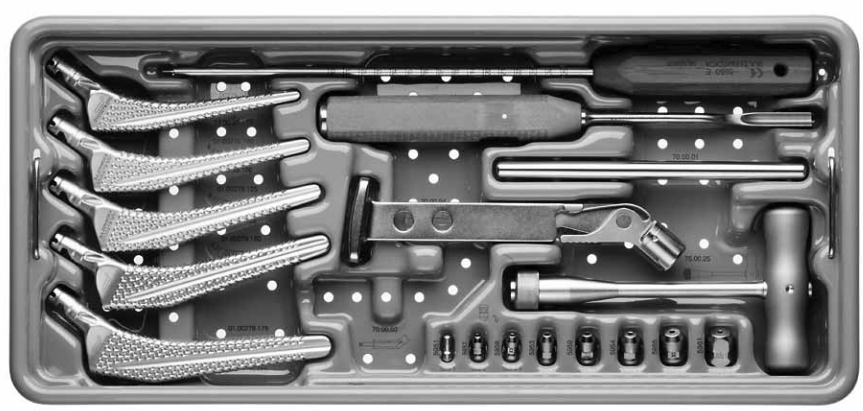
Protasul® 30
Cemented
M. E. Müller™

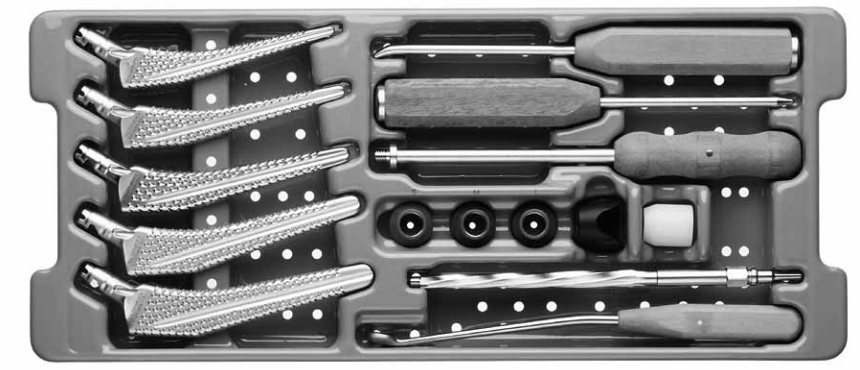
STERILE R

Size in mm	REF
5.0	30.22.69-050
7.5	30.22.69-075
10.0	30.22.69-100
12.5	30.22.69-125

The special instruments for implantation of the CDH stem (monobloc rasps and test prostheses) are available under REF 99.41.00-00.

Instruments – Original M. E. Müller™ Straight Stem





Tray, Müller™ Straight Stem (complete)

REF
01.00245.622

Tray, Müller™ Straight Stem (empty)

REF
01.00245.623

Insert for tray, Müller™ Straight Stem (empty)

REF
01.00245.624

Tray lid

REF
01.00029.031

Double-curved gouge

Size	REF
9 mm	75.09.15

Curette, medium

Size	REF
15 mm	75.13.33

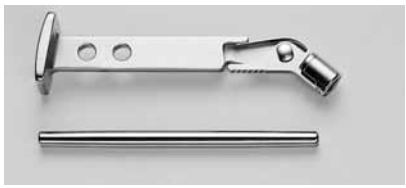
Awl

REF
75.05.31

Handle with quick coupling

REF
75.00.25

All Instruments not sterile



Handle for modular rasp

REF
70.00.94

Long bar

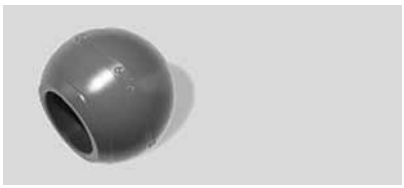
REF
70.00.01

Rasp, Müller™ Straight Stem, standard, modular

Size in mm	REF
7.5	01.00269.075
10.0	01.00269.100
12.5	01.00269.125
15.0	01.00269.150
17.5	01.00269.175

Rasp, Müller™ Straight Stem, lateral, modular

Size in mm	REF
7.5	01.00279.075
10.0	01.00279.100
12.5	01.00279.125
15.0	01.00279.150
17.5	01.00279.175



Test head

∅ mm	Size	REF
28	S	6896
28	M	6897
28	L	6898

Repositioning lever

REF
75.01.38

Synthetic top

REF
78.00.38

Repositioning top

∅ mm	REF
28	78.00.38-28

Setting instrument for measuring cones with scale

REF
5950

Measure cone

Size	∅ mm	REF
1	8	5951
2	11	5952
2.5	12	5958
3	14	5953
3.5	15	5959
4	16	5954
5	19	5955
6 W	21	5961

Impactor/extractor

REF
75.00.36

Extraction instrument

REF
75.85.75

All Instruments not sterile

On Request

Rasp, Müller™ Straight Stem, standard, modular

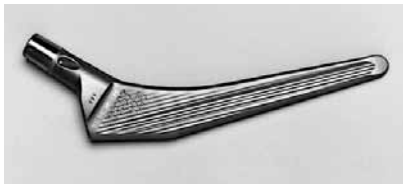
Size in mm	REF
8.75	05.00269.069
11.25	01.00269.112
13.75	01.00269.137
16.25	01.00269.162

Rasp, Müller™ Straight Stem, lateral, modular

Size in mm	REF
8.75	05.95001.069
11.25	01.00279.112
13.75	01.00279.137
16.25	01.00279.162

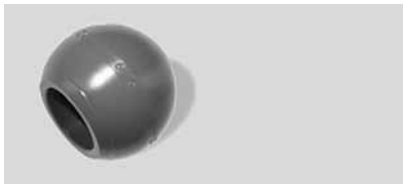
Test prostheses, Müller™ Straight Stem, standard

Size in mm	REF
7.5	53.00.25-075
8.75	53.00.25-087
10.0	53.00.25-100
11.25	53.00.25-112
12.5	53.00.25-125
13.75	53.00.25-137
15.0	53.00.25-150
16.25	53.00.25-162
17.5	53.00.25-175



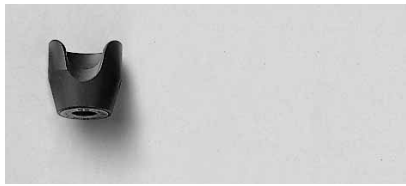
Test prostheses, Müller™ Straight Stem, lateral

Size in mm	REF
7.5	53.00.35-075
8.75	53.00.35-087
10.0	53.00.35-100
11.25	53.00.35-112
12.5	53.00.35-125
13.75	53.00.35-137
15.0	53.00.35-150
16.25	53.00.35-162
17.5	53.00.35-175



Test head

∅ mm	Size	REF
28	XL	01.01519.808
32	S	6836
32	M	6837
32	L	6838
32	XL	01.01519.208
36	S	01.01519.635
36	M	01.01519.636
36	L	01.01519.637
36	XL	01.01519.638



Repositioning top

∅ mm	REF
32	78.00.38-32
36	78.00.38-36

Measure cone

Size	∅ mm	REF
7 W	24	5962

Materials

ISO 5832-6 (ASTM F562) Protasul-10

CoNi35Cr20Mo10 alloy

Structure
– Fine-grained austenitic base matrix

Properties
– High mechanical strength values in medium-hard and hard state
– Can be welded to other Co alloys
– Not suitable as articulation partner with UHMWPE
– High nickel content (allergy possible in rare cases)

Processing
– Mechanical processing from hot-rolled rod
– Hot forging

Typical Application
– Anchoring components for cemented prostheses

Mechanical Data According to ISO 5832-6

	Apparent limit of elasticity $R_{p0.2}$ [MPa]	Tensile strength R_m [MPa]	Elongation at rupture A [%]
Soft	300 min.	800 min.	40 min.
Medium hard	650 min.	1000 min.	20 min.
Hard	1000 min.	1200 min.	10 min.

Chemical Composition According to ISO 5832-6

Weight %	Co	Cr	Mo	Ni	Fe	Mn	C	Si	Ti	P	S
min.	balance	19.0	9.0	33.0							
max.	balance	21.0	10.5	37.0	1.0	0.15	0.025	0.15	1.0	0.015	0.010

ISO 5832-9 (ASTM F1586) Protasul-S30

FeCr22Ni10Mn4Mo2NNb alloy

Structure
– Fine-grained austenitic base matrix

Properties
– High mechanical strength values in the medium-hard and hard state
– High resistance to attrition
– Articulation partner with UHMWPE (*Sulene*® PE and *Durasul*®)
– Can be welded to itself
– High nickel content (allergy possible in rare cases)

Processing
– Mechanical processing from hot-rolled or cold-formed rod
– Hot forging

Typical Application
– Cemented hip prostheses
– Ball heads
– Osteosynthesis implants

Mechanical Data According to ISO 5832-6 and ASTM F 1586

	Apparent limit of elasticity	Tensile strength	Elongation at rupture
	$R_{p0.2}$ [MPa]	R_m [MPa]	A [%]
Annealed	430 min.	740 min.	35 min.
Medium hard	700 min.	1000 min.	20 min.
Hard	1000 min.	1100 min.	10 min.

Chemical Composition According to ISO 5832-9

Weight %	Fe	Cr	Ni	Mn	Mo	Nb	N	C	Si	Cu	S	P
min.	balance	19.5	9.0	2.00	2.0	0.25	0.25					
max.	balance	22.0	11.0	4.25	3.0	0.80	0.50	0.08	0.75	0.25	0.01	0.025

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