Wagner SL Revision™ Hip Stem

A further enhanced classic

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The original Wagner SL Revision Stem offers a time-proven solution in the treatment of revision hips. While its underlying anchorage philosophy and bone-regenerating ability is uncontested, almost 20 years of clinical experience with this implant have led to the introduction of a number of modifications, which enhance the use of the implant and its indication range. Thus, the third generation is a natural evolution of the original Wagner SL Revision Stem and offers state-of-the-art features to accommodate today's demands in revision total hip arthroplasty.

A revolutionary concept

When first presented in 1987, the anchorage philosophy of the *Wagner SL Revision* Stem, devised by Professor Heinz Wagner, was truly revolutionary, and has since set a milestone in the field of revision surgery of the hip joint.

By means of his long, longitudinally ribbed SL Revision Stem, Professor Wagner sought to bridge an extensive defect in the proximal femur resulting from the removal of a primary implant or from a complex fragmented fracture in an elderly patient by anchoring the stem distally in solid bone.

Spectacular cases of bone remodeling in the postoperative follow-up were found, and have verified the concept of bridging the deficient proximal bone bed in order to stimulate the regeneration of bone growth in the region of the old prosthesis bed. Today, the *Wagner SL Revision* Stem is the most successful uncemented monobloc system for secondary interventions in Europe, and has been trusted by surgeons throughout the world for almost 20 years.

Design features

Tapered design and longitudinal ribs: reliable and future-proof

Features of the stem concept are its tapered design, longitudinal ribs and circular cross-section. The narrowing in a 2° angle continues linearly for the entire length of the stem.

Eight sharpened longitudinal ribs run down to the lower edge of the neck of the prosthesis and cut approximately 0.1 to 0.5 mm into the cortical bone, conferring increased primary and rotational stability.

Circular cross-section for greater flexibility

The circular profile along the entire length of the *Wagner SL Revision* Stem means that the antetorsion angle can be freely adjusted. It also makes it possible to prepare the canal with reamers instead of rasps in order to protect and preserve the bone. As there are no edges, there is an even distribution of stress, thereby preventing peak loads. This also reduces the risk of fissures when the stem is inserted.

Osteophilic material and surface: proven long-term anchorage

The *Wagner SL Revision* Stem is made of titanium-aluminum-niobium alloy (*Protasul*®-100), whose biocompatibility has been proven by numerous histological studies of implant retrievals. The rough-blasted surface supports bone formation and, thus, generates reliable secondary stability. The characteristic narrow ribs on the *Wagner SL Revision* Stem promote bone formation as well: the longitudinal furrows between the ribs provide room for the vessels in the narrow cavities to regenerate. This is an effective prerequisite for reactive ossification and revascularization in the cortex.

A fundamental advantage of *Protasul*-100 is its modulus of elasticity, which can have particularly positive effects in revision surgery. This element clearly fulfills a biomechanical role, in that it supports visible bone regeneration in the proximal femoral segment.

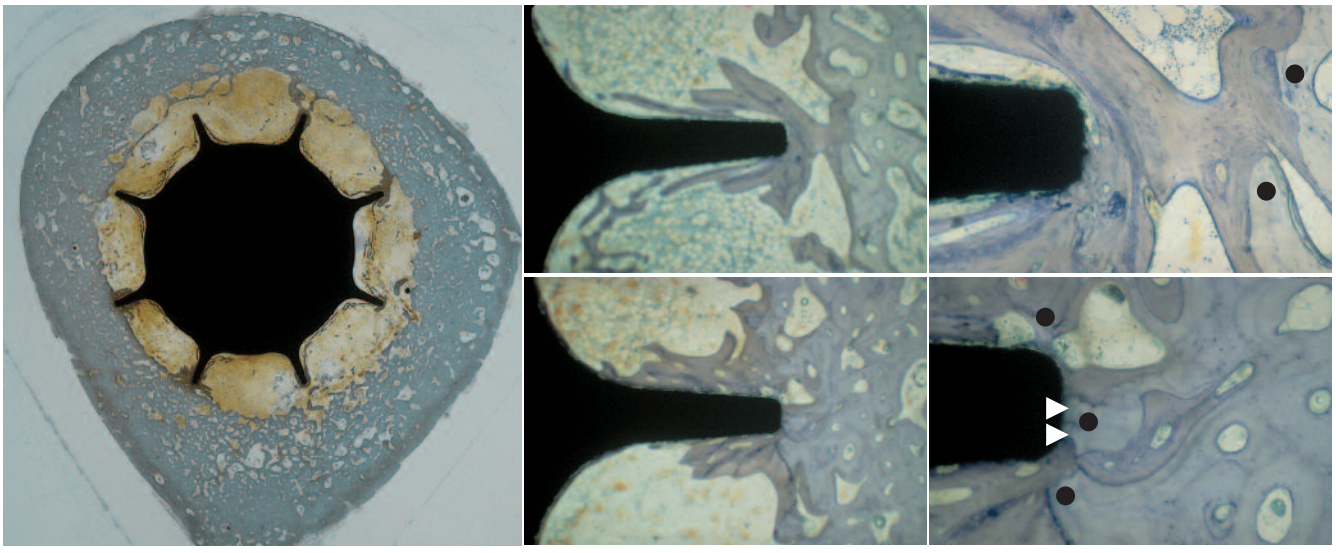
The synergetic interaction between material, surface structure and design of the *Wagner SL Revision* Stem creates ideal conditions for accelerated bone formation.

Histology

In their paper entitled "On the reaction of the bone to an uncemented SL femur revision prosthesis", the authors, Schenk and Wehrli, confirm Heinz Wagner's theoretical assumption on bone growth behavior.
In the case of a 65-year-old patient, who had undergone revision hip arthroplasty, but deceased 5.5 months later due to a pulmonary embolism, the following histological findings were made:

- newly formed bone in direct contact with the stem surface
- solid anchorage of the stem in the distal diaphysis
- direct bone apposition and bony anchorage also further proximally

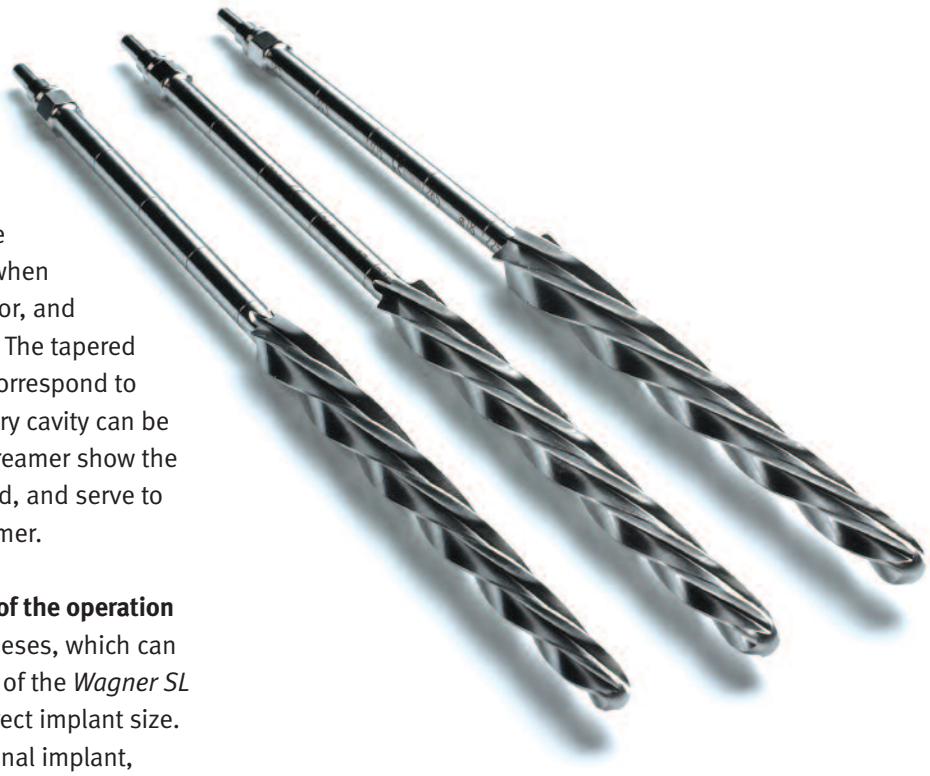
Overview of the cross section in the distal anchorage zone



A bridge of mainly lamellar bone constructed between the longitudinal ribs (left) and the inner cortex wall (right).
The white arrows show the extent of contact surfaces created by press-fit, which were presumably reduced by modification processes. Closer to the periphery, a distinct Haver modification of the mostly dead original cortex (•) can be recognized.

Comprehensive set of instruments

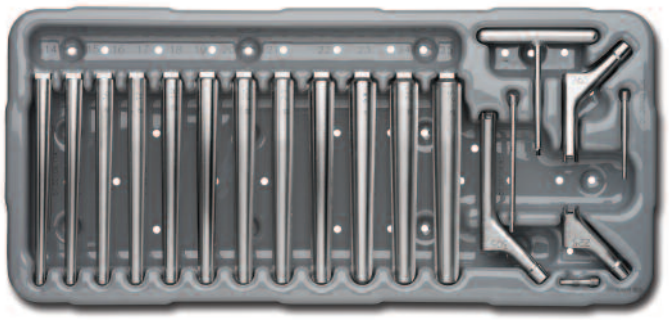
The instruments for the *Wagner SL Revision* Stem have been tried and proven in practice, and are simple to use.



Modular reamers for precise preparation of the implantation site
The use of reamers enables the surgeon to prepare the medullary cavity with care and precision. This particularly applies when bone quality in the proximal femur is poor, and when using rasps is out of the question. The tapered reamers are graded in millimeters and correspond to the implant diameter. Thus, the medullary cavity can be enlarged step by step. Markings on the reamer show the relative position of the center of the head, and serve to control the penetration depth of the reamer.

Trial prostheses for increased accuracy of the operation
There is a modular system of trial prostheses, which can be used to test the appropriate position of the *Wagner SL Revision* Stem and to determine the correct implant size. They penetrate in the same way as the final implant, meaning that the optimal implant diameter can be ascertained with high accuracy.

The trial prostheses can be driven in to the final anchoring depth. The advantage of this is that a trial head with the final head length can be used for trial reduction. In this way, soft tissue tension, as well as range of motion and the antetorsion angle can be tested accurately. Any findings from this trial procedure can then be taken into account when the final implant is inserted.



The implant range – a wide selection for a targeted choice

In revisions, circumstances vary from case to case, depending on the condition of the bone. It is therefore important to offer a range of implants of different length and diameter. Above all, to achieve optimal press-fit, it is extremely important to measure the implant as precisely as possible.

Summary of the range:

4 standard lengths:	190, 225, 265, 305 mm
2 extra lengths:	345, 385 mm (available upon request)
Diameters:	14 mm to 25 mm, graded in millimeters

Third generation of a design classic

18 years of clinical practice with the Original *Wagner SL Revision* Stem clearly demonstrated its efficacy. However, clinical experience also taught us how to render the system even more versatile and user-friendly.

Without putting Wagner's original, tried and tested concept into question, the third, most recent generation of the *Wagner SL Revision* Stem addresses demands from the clinic with some clever adjustments to the instruments and by providing a longer offset and an increased range of motion.

Thus, the updated version of the *Wagner SL Revision* Stem offers the market a comprehensive uncemented revision system that not only takes into account the latest findings in modern hip arthroplasty, but which has already proven its worth over nearly two decades of clinical use.

Distinguishing features

Lateralized design for optimum biomechanical reconstruction

The reduced CCD angle of 135° gives an offset of 42 to 46 mm, depending on the stem diameter. Benefits resulting from this larger offset are:

- a reduced risk of dislocation, as tension is forced against the center of the stem
- easier muscular stabilization of the hip, as there is greater leverage; the patient is less likely to limp
- increased range of motion

Short taper – slim neck for increased range of motion

A marked improvement of the range of motion is obtained thanks to the "short taper – slim neck" design. Particularly in cases of revision surgery, with questionable bone stock, the surgeon requires a certain amount of room to maneuver for optimal positioning of the stem. The short taper – slim neck design accommodates the surgeon in this respect.

Clinical results

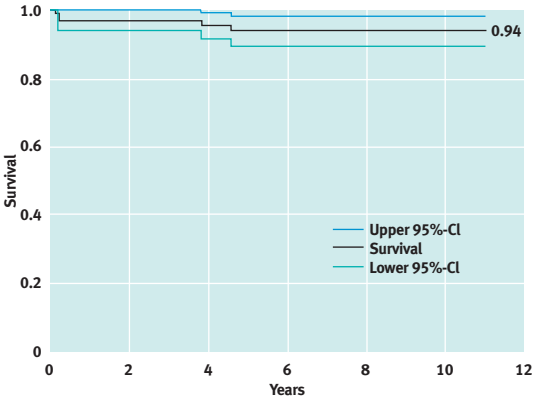
Extensive clinical follow-up verifies a unique biomechanical concept

The following table contains only a selection from the large number of papers documenting the results with the *Wagner SL Revision* Stem. The listed publications were selected based on duration of clinical follow up, number of patients included in the cohort and date of publication.

Year	Author	Journal	No. of cases	Follow up (years)
2004	P. Böhm, O. Bischel	Clinical Orthop 2004, 420, pp. 148–159	129	∅ 8.1 (5.1–14.1)
2002	M. Weber et al.	International Orthopedics (SICOT) (2002) 26, pp. 36–39	40	∅ 5.4 (2.4–9)
2000	H. Kienapfel et al.	Orthopädische Praxis 6/2000, 36, pp. 339–342	98	∅ 4.8
1999	M. Wagner/H. Wagner	Orthopaedics and Traumatology (1999) 7, pp. 260–276	69	∅ 6.5 (5–9)
1997	R. Gruenig, E. Morscher P. E. Ochsner	Arch Orthop Trauma Surg (1997) 116, pp. 187–197	40	∅ 3.9 (3–7)

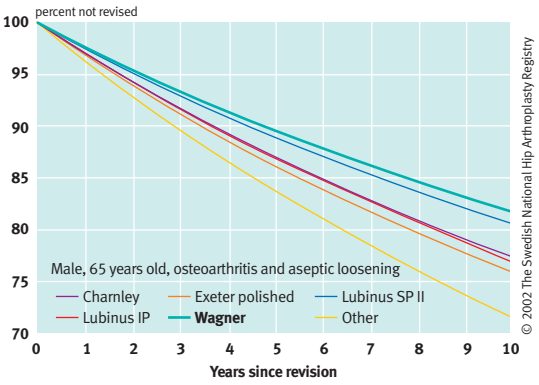
Note that the paper by P. Böhm and O. Bischel, published in 2004, yields for the *Wagner SL Revision* Stem a cumulative survival rate of 95.2% after 14.1 years in a "worst-case" scenario. Failures were defined as removal for any reason. Four of the six revisions were done within the first three months. There were no failures after the fifth year postoperatively.

Also the "Results and Analysis for Revision" from the Swedish National Hip Arthroplasty Register 1979–2000 determine the *Wagner SL Revision* Stem as a premium choice for hip revision.



Stem survival by type of implant

1st revision 8 years after primary THR



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