CCG® - the biological Compression Cerclage- and Stabilization-System
TABLE OF CONTENTS

CCG® Band - Design 1
CCG® Stabiliser - Design 3
Indications - Contraindications 5
Histology 7
CCG® Band Surgical Technique 8
CCG® Stabiliser Surgical Technique 15
Case Studies 17
Implants and Instrumentation 19
Reference 20
FOREWORD

The CCG® system was developed by Dr. Ferdinand Gundolf in the year 1993 in Kufstein (Tyrol). It consists of biocompatible titanium bands with a broad contact face so that the bone is not constricted and the blood flow is not disrupted either, as well as titanium stabilisers that are capable not only of primarily stabilising the bone, but also of strengthening it sustainably through osseo-integration of the rough titanium surfaces.

Since its introduction, the CCG® system has internationally established itself impressively in a broad range of indications. In addition to traumatology indications, the CCG® system has proved itself especially in the area of hip revision surgery as a protection from fissures when reaming the new implant bed, and as a corticalis reinforcement.

The clinical successes in the last 20 years confirm the biological concept and have made the Gundolf Compression Cerclage system one of the leading cerclage systems.
The CCG® system consists of the CCG® band and the CCG®-GF band. The CCG®-GF band was primarily developed for conical bones, notably the proximal and distal ends of the femur.

**Large bone contact surface**
Thanks to the large surface area, the disadvantages of a cerclage wire can be eliminated. The CCG® cerclage does not cut into the bone and allows for controlled compression.

**One size**
With a length of 27 cm, the CCG® cerclage is long enough to go around the greater trochanter as well as thinner bones. The continuous adjustability allows application for all diameters of long bones which contributes to a substantial simplification of inventory.
**Material and surface roughness**

The CCG® cerclage is manufactured from pure wrought titanium according to ISO Standard 5832-2. The rough blasted surface has a mean roughness of 3 – 5 μm which supports osteointegration of the band.

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**CCG® band with linkage and fixation spikes**

As the band fastener is rotatable the band can be shaped to fit conical bones shape with minimal surface compression.

The fixation spikes prevent the band from slipping down the bone and secure loose pieces of bone such as fracture segments or bone chips in position. In particular, the fixation spikes reduce the risk of axial slippage of the greater trochanter after osteotomy utilising Dr. Gundolf’s technique.

In principle, the CCG® system can be used in all circumstances where a cerclage wire would previously have been employed. Wire cerclage has well known shortcomings: wire breakage is relatively frequent; furthermore, the wire can cut into the bone and then ceases to exert adequate compression.
The excellent primary stability of the CCG® System on the bone is due to the frictional resistance between the CCG® Bands and the stabilisers, the stabiliser spikes anchored in the bone, and the CCG® GF bands, fixation pins.

The secondary stability of the CCG® System is a result of the osseointegration of the CCG® Bands and CCG® Stabilisers, achieved through the bone-inducing effect of the rough titanium surface. The bone can penetrate through the apertures between the spikes, where it finds ideal conditions for ongrowth on the roughened inside of the curved surface. Osseointegration takes place within a short time, leading to the ingrowth of the CCG® Band and CCG® Stabiliser.

This process prevents any micromovements between the CCG® Stabiliser and the CCG® Bands, thereby excluding titanium abrasion on the contact surfaces.
New alternatives for hip revision surgery
In addition to the intramedullary support by the hip stem, the combined CCG® System provides an effective external reinforcement of the cortical bone and thus effectively becomes a functional part of the weakened cortical bone. Contrary to an endoprosthesis with a screwed plate there is no conflict between screws and the stem of the prosthesis.

New alternatives for traumatology
In isolated fractures of the femur it is possible to achieve stable load-bearing osteosynthesis with CCG® Stabilisers. Due to the adaptive mode of fixation the system is well suited for geriatric bone surgery and may also serve as a last resort for very elderly patients.

While the CCG® Stabiliser achieves the load-bearing stability of a conventional bone plate after 4 - 6 weeks, it differs substantially from the latter through the preservation of elasticity and consequently the vitality of the supported bone.
The CCG® cerclage functions as a support, and it is suitable for certain types of osteosynthesis, for example for cerclage of the greater trochanter and the femur during hip revision. Contrary to the cerclage wire, a functional compression can be achieved with the CCG® band.

**INDICATIONS**

- Fissures and stem fractures
- Reinforcement of weakened cortical bone
- Bridging of bone defects
- Achieving an improved bone implant construct e.g. after removal of the greater trochanter, for extramedullary support in the proximal and distal femur
- Prophylactic application of one or more stabilisers in stress areas, e.g. in the area of tip of the prosthetic stem, over an intramedullary support, e.g. MODULAR-PLUS® stem, intramedullary nails.

**Windowing of the cortex**
The CCG® cerclage is very suitable for closure of a windowed cortex.

**Reattachment of greater trochanter**
Using the CCG® cerclage method of Gundolf, the reattachment of a previously removed greater trochanter is significantly simplified.

**Fractures**
Fractures, in particular those in the area of a femoral prosthesis, can be attended to by the CCG® band.
It is recommended that the CCG® band be used as preventive protection against splitting in the case of:

- clear osteoporosis
- dysplastic cases
- elderly patients

While strictly complying with the rules of internal fixation, the CCG® band can be used to stabilise fissures and splits in the bone.

CONTRAINDICATIONS

• The use of the CCG® System in revision hip surgery requires an appropriate prosthesis in both design and length. Complications resulting from difficulties such as instable implantation, subsidence of the prosthesis, stem and prosthesis fractures, cannot be entirely prevented through the use of CCG® Stabilisers.

• The CCG® System is not indicated in cases where there are large cortical bone defects so that contact occurs with the prosthesis, which can cause metal abrasion.

• Lack of bony tissue or poor bone quality, compromising the stable fit of the CCG® System.
Microradiography three weeks postoperatively:

The titanium band is firmly and uniformly positioned on the bone of the femur. No evidence of necrosis.

Detail from histological section three weeks postoperatively:

On the inner surface of the titanium band, separate from the bone of the femur, there is an elongated ridge of bone occupied by osteoblasts. Ground section, not decalcified, toluidine blue staining

Detail from the histological section enlarged (picture above):

The osteoblastic line on the inner side of the titanium band and the bone of the femur provides evidence of the tendency towards union or bone healing.
The number of the required bands depends on the indications: as a fracture protection, one band in the area of the implant tip is sufficient. In cases with weakened bone or during removal of the greater trochanter, several bands may be necessary – one in the trochanter area, one in the lower third of the prosthesis, and, should the distance be too long, one in between.

Please consult the special surgical technique for surgeries including the removal of the greater trochanter.

Documentation Dr. Gundolf Nr. 87

The bone fragments which are to be fixed need to be brought together with repositioning forceps.

Repositioning cannot be accomplished by the CCG® band.

The bone needs to be subperiostally uncovered at the cerclage site with a small rasp or a curette. The bone must not be exposed by the loop awl.

Introduce the CCG® loop awl, maintaining contact with the bone by palpation. When using the CCG®-GF band, slide the moveable spike into a suitable position.

Hook the ends of the band together, taking care that the band fastener faces outwards. Then carefully tighten the band.
Insert the CCG® band through the clasp and tighten it by hand. A slight pressure on the clasp will prevent the band from sticking.

Bring the carriage of the cerclage tightener all the way to the front by turning the knob on the handle counterclockwise.

Insert the band into the cerclage tightener, pull it tight and secure it with the lever.

The compression is carefully carried out by turning knob on the handle clockwise with thumb and index finger only. The intended compression has been achieved when the band cannot be tightened further.
When the CCG®-GF band is being fitted to a bone of conical profile, the surgeon positions one or more spikes then tightens the band exactly as described above.

To adapt it to the conical profile, the band which has been inserted into the CCG® cerclage device is turned within the rotatable band fastener in the direction of the bone end, until it visibly conforms to the conical profile.

**CAUTION**

Excessive tightening force may cause undesirable overcompression and breakage of the band. If the cleft in the band begins to open, the permitted degree of compression has already been slightly exceeded. The compression must not be increased any further.

The CCG® band is constructed in such a way that the cleft will rupture before it damages or destroys the bone by overtightening.
Bend the CCG® cerclage tightener and the band slowly and to not more than a maximum of 90°!

WARNING
The bending operation must be carried only just far enough to prevent the band from slipping back. Any excessive or rapid bending movement beyond 90° could cause overloading due to increased tension while bending moments may break the CCG® band. After removing the CCG® cerclage tightener, further bending should be performed with the CCG® fixator. At this stage there is no risk of breakage. Special emphasis is placed upon the need to avoid this serious technical error.

Loosen the lever and remove the cerclage tightener.
Fit the CCG® fixator on to the CCG® band and bend the CCG® band backwards.

Use of the CCG® fixator is the best way of avoiding breakage of the CCG® band while bending it backwards, and prevents any incorrect shortening of the band.

Bend the CCG® band over and press it firmly into the cutting edge of the fixator with a thumb.

Move the band back and forth a few times until it breaks off while the other hand holds the CCG® fixator.
Bend the end of the band over by slowly straightening the fixator by 90°. Then pull the fixator off.

NOTE
A band which has been applied and has to be removed again must never be reused. The cerclage must be repeated with a new band.

Apply the CCG® fixator with a stirrup to the middle of the band end and drive the end into place.
IMPLEMENTATION OF A WIRE CUTTER AND IMPACOTR

Instead of using the CCG® fixator, cut off the CCG® cerclage with wire cutters about 1 cm above the clasp.

Then bend the end of the band over the clasp and use an impactor to fix it in place.
The CCG® Stabiliser is to be used only in conjunction with the CCG® Bands.

The correct choice of length and number of stabilisers depends on the cortical bone to be supported. A single CCG® Stabiliser is sufficient only in the case of intramedullary implants, such as prosthetic stems. 3 to 4 stabilisers are required for osteosynthesis, with two on opposite sides in each case.

It is advisable to use two stabilisers on opposite sides to secure stress areas, e.g. at the prosthetics tip. The length of the stabilisers is chosen depending on the structure of the bone. In case of doubt the next length up should be selected.

The stabilisers are positioned in the longitudinal direction axially to the bone and secured with reduction forceps pressing the anchorage spikes into the bone. The first CCG® Band should be applied with the reduction forceps still in place. Once one end has been encircled the reduction forceps should be applied to the other end of the stabilisers, where the procedure is repeated.

Reduction forceps should also be used for pre-fixing when placing the inner cerclage bands where, again the stabiliser spikes should be pressed into the bone. In this way the stabiliser adapts to the curvature of the bone.

When using CCG® GF bands it is important to ensure that the pin of the fixed loop at the end of the band is placed on one side of the stabiliser and the pin of the sliding loop on the other. In this way the stabiliser adapts to the bone curvatures.
When using several stabilisers it is important to ensure that they are positioned in parallel, and opposite to one another whenever possible. Contact between stabilisers must be avoided in all cases.

The CCG® Stabiliser should be positioned so that direct contact with other metal implants is avoided.

The spikes along the edges of the CCG® Stabiliser are pressed into the bone with the reduction forceps and, if necessary, tapped in with light hammer blows. It is also recommended to tap the pins of the CCG® GF band carefully with a hammer in order to fix them to the bone.

The CCG® Bands have to be placed between two ribs at 90° to the CCG® Stabiliser. The bands should be applied to the bone with the periosteum completely stripped. In fractures one or two bands should be placed over the fracture line.
CASE STUDIE 1

A.H., weiblich, 69 Jahre, präoperatives Röntgen

Röntgenkontrolle 2 L Jahre
R.P. männlich 79 Jahre, präoperatives Röntgen

5 Jahre postoperativ
**IMPLANTS**

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<tr>
<th>Art. No.</th>
<th>Description</th>
<th>Length</th>
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<tr>
<td>91001</td>
<td>CCG® Band</td>
<td>27 cm</td>
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<tr>
<td>91002</td>
<td>CCG®-GF Band with Joint and Fication-Spike</td>
<td>27 cm</td>
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<tr>
<td>91007</td>
<td>CCG® Stabiliser</td>
<td>7 cm</td>
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<td>91011</td>
<td>CCG® Stabiliser</td>
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<td>91015</td>
<td>CCG® Stabiliser</td>
<td>15 cm</td>
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<tr>
<td>91017</td>
<td>CCG® Stabiliser</td>
<td>17 cm</td>
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**Material:** Pure titanium grade 4 3.1B according to EN 10204 ASTM B 348-97

**Recommendation**
- Stabiliser 7 cm: minimum 2 CCG bands
- Stabiliser 11 cm, 15 cm: minimum 3 CCG bands
- Stabiliser 17 cm: minimum 4 CCG bands

**INSTRUMENTS**

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<th>Description</th>
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<td>Complete Instrumentation</td>
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<td>910001</td>
<td>Cerclage Tightener</td>
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<td>910002</td>
<td>Loop Awl Large</td>
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<td>910003</td>
<td>Loop Awl Smal</td>
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<tr>
<td>910004</td>
<td>CCG® Fixator</td>
<td>4</td>
</tr>
</tbody>
</table>
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1996; Dr. med. Ferdinand Gundolf, A-6330 Kufstein, Kemterstraße 1, ISBN 3-9500499-0-8

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Kann eine Bandcerclage aus Titanium zu einer günstigeren knöchernen Stabilisierung nach TEP, TEPLockerung und Femurschaftfraktur führen?
Pathologisch-Bakteriologisches Institut SMZ-Otto Wagner Spital, Baumgartner Höhe, Wien; Orthopädische Abteilung des Landeskrankenhauses Salzburg; Orthopädie Kufstein

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Arch Orthop Trauma Surg 1998; 117(8): 448–52

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ACTA Chirurgiae Orthopaedicae et Traumatologiae Cechosi., 76, 2009. p 179 - 185

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STERILISATION

STERILISATION IMPLANTS
All the implants described in this Operating Technique are sterile when they are delivered by the manufacturer. Re-sterilisation is not allowed.

STERILISATION INSTRUMENTE
System components and instruments are not sterile when they are delivered. Before use they must be cleaned by the usual methods in accordance with internal hospital regulations and sterilised in an autoclave in accordance with the legal regulations and guidelines applicable in the relevant country.
(For detailed information please refer to leaflet Lit. No. 860502 E.)

The correct settings are given in the instructions for use issued by the autoclave manufacturer. Instrument manufacturers and dealers accept no responsibility for sterilisation of products by the customer.
CERCLATEUR (Art. Nr. 910001) CCG® - Compression Cerclage System

1. Casing
2. Shim
3. Shaft
4. Slot Nut
5. Lid

**Disassembly Instructions for Cleaning**

1. Push lid back towards twist grip
2. Remove slot nut
3. Firmly hold shim at the bottom Turn shaft counter-clockwise until it can be pulled out of the casing
4. Remove shim from casing groove
5. Remove lid (for general cleaning)

**Assembly Instructions after Cleaning**

1. Push lid arrow first into the casing as far as opening for the slot nut
2. Insert shim in casing and push back so that arrow points towards twist grip. Tilt tensioning lever on shim forwards and press shim onto casing in the direction of the arrow
3. Push shaft into the casing and turn clockwise all the way in Hold cerclateur in this position and turn round
4. Insert slot nut in recess and close lid