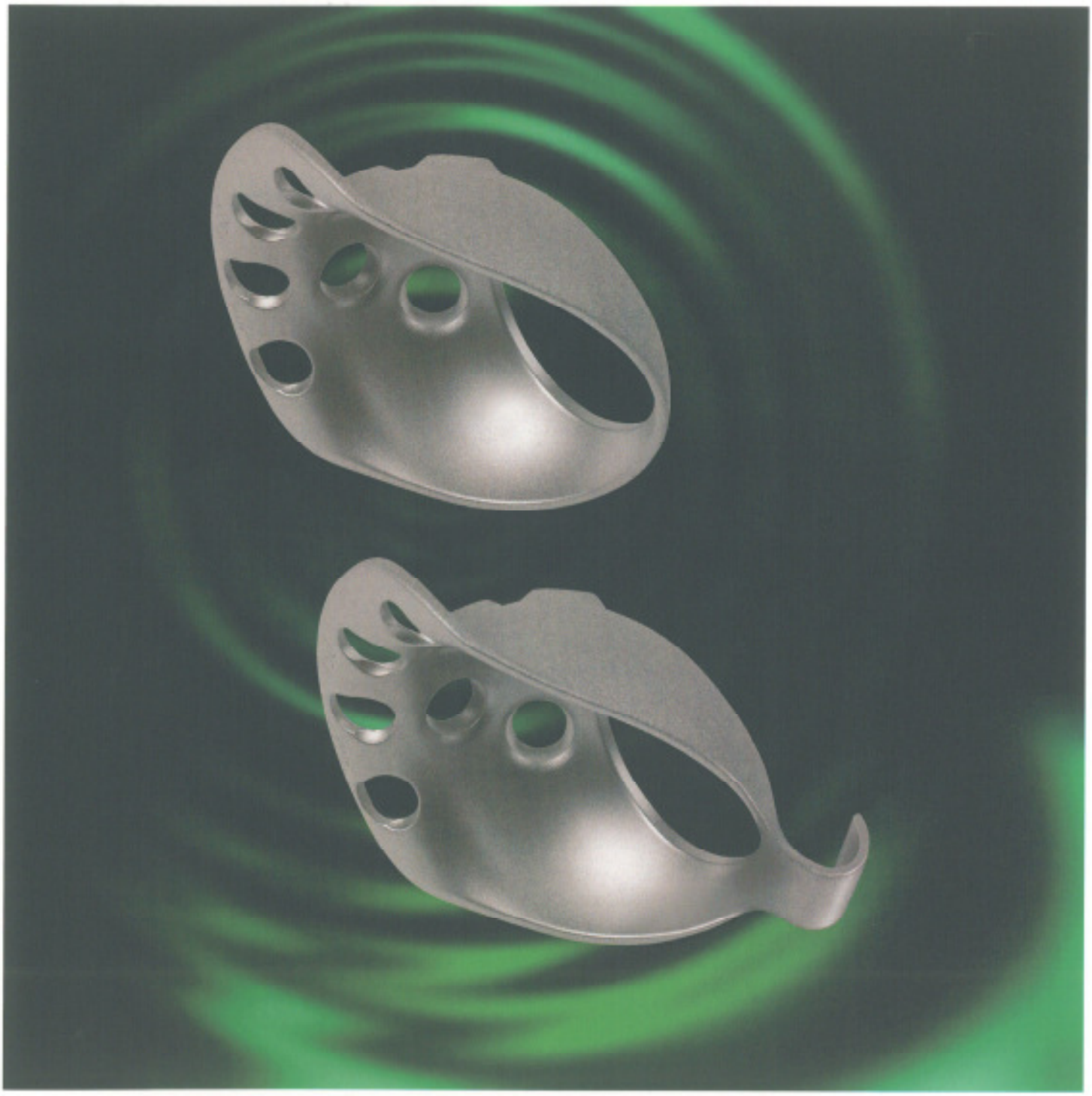
ARR-Titan

Acetabular **R**econstruction **R**ing



PETER BREHM

Precision in titanium for the well-being of mankind

CE 0197

DEVELOPMENT PARTNERS

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INTRODUCTION

The acetabular reconstruction ring (ARR) is shaped like the anatomical acetabular roof and is used to reinforce the osseous acetabular bearing, notably in the zone of stress. It is implanted mainly for greater stability under given conditions of anatomy and bone quality. The polyethylene cup is fixed with cement. Its positioning for optimum function is largely independent of the position of the reconstruction ring.

BIOMECHANICAL CONCEPT

The acetabular reconstruction ring is available in two different models. The acetabular roof ring is the basic model. At its caudal end the hooked ring is equipped with a shapeable hook that is anchored in the acetabular notch.

If more than one surface for the three-point anchorage needs to be replaced by a graft, the acetabular roof ring with caudal hook should be preferred because it increases the chances to achieve a high degree of primary stability and a trouble-free integration of the implant. At the same time, the hooked ring model ensures the anatomically correct positioning of the implant in cranio-caudal direction.

Either model is implanted to reinforce the osseous acetabular bearing. Care should be taken, from the surgical point of view, that it is always anchored at three points on a stable base bone or a stable graft that is able to withstand pressure.

When selecting the bone to be grafted, autogenous grafts should be used wherever primary stability of the implant must be ensured, i.e. in the cranial sections of the acetabulum. When the bone reconstruction can be allowed more time, allogeneic grafts may be used. An ideal secondary stabilization is achieved by osteointegration as the bone grows into the sand-blasted surface (roughness Rz = 40 – 60 µm).

The screw holes provided are placed in a way that the screws in the main load zone can only be inserted in the direction in which pressure is applied to the implant. This prevents that screws are inserted in the wrong direction or into the flexible sections of the ischium or the pubis.

The design of the screw holes allows to insert the screws in a variety of directions, and to counter-sink the screw heads deeply into the bored holes. The sharp protruding edges of the screw holes improve the primary stability.

As a rule, it is always possible to set a polyethylene cup with an external diameter equal to the ring size into the reconstruction ring.

INDICATION

1. Dysplasia of the osseous acetabulum
2. Reduced bone strength, e.g. in case of osteoporosis, inflammatory coxarthritic destruction or polyarthritis
3. Defect conditions following the loosening of artificial hip joint cups
4. Conditions after surgery in the acetabular area, e.g. pelvic osteotomies or plastic surgery of the acetabular roof
5. Protrusion coxarthrosis with reconstruction of the acetabular bottom
6. Remobilization of arthrodesed joints
7. Conditions following trauma, recent fractures, persistent osteolysis and atrophies as well as persistent fracture healing disturbances

CONTRA-INDICATIONS

Any condition in which no stable anchoring of the implant can be achieved.

SURGICAL TECHNIQUE

PLANNING THE OPERATION

Before surgery, the desired position is marked in an overview representation of the pelvis, taking into account the existing bone structures and, where necessary, an equalization of the leg length; this includes comparison of the contralateral bone structures.

ACCESS PATHS

a) Lateral access
b) Dorsal access
c) Ventral access

PREPARATION OF THE ACETABULUM

a) The acetabulum must be exposed.

b) All soft tissue, including cartilage, granulations and deposits of fatty tissue, must be removed. In case of revision surgery, all granulated tissue and remnants of cement must be carefully removed.

c) If the hooked ring model is to be installed, the acetabular fossa must be exposed as well. In certain cases it may be necessary to extend the transversal acetabular ligament over the notch, or to remove it altogether. **If spherical milling cutters can be used on the acetabulum, choose an implant with a nominal diameter of 2-4 mm smaller than the cutter last used.** The hook of the hooked ring is inserted into the acetabular notch and reshaped, if necessary, with straight-tipped forceps. The reconstruction ring should always be anchored in three places. Under ideal anchoring conditions, three evenly spaced support surfaces on grown bone are available. If one of the three support surfaces is replaced by a graft, it must be ensured that the graft is strong enough and inserted in a mechanically stable position between the grown bone and the reconstruction ring.

d) Where the bone of the acetabular bottom still exists, special attention must be paid to a good contact of the caudal part of the reconstruction ring with the osseous bottom. This ensures a centered position of the implant and allows to achieve an optimum rotation point for the cup.

SCREWING IN THE IMPLANT

a) In a first step, the central screws are inserted, preferably along the terminal line, to achieve compression and a stable osteosynthesis.

b) The lateral screws are inserted for support. Lateral screws are only tightened lightly. If tightened to the maximum, the lateral screws may lose their hold and cause instabilities at the medial support.

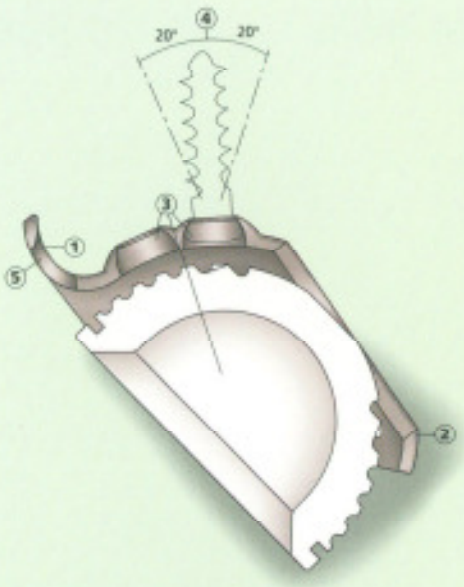
c) When inserting the screws, care must be taken to tighten the central screws with the maximum possible torque suitable for the bone quality. The peripheral screws may in the case of large grafted surfaces be treated as supporting screws and tightened only so far, until they make contact with the implant. When they are inserted, the behavior of the ring's medial support on the acetabular bottom should be observed. If the peripheral screws are tightened too much, there is the risk of the implant tilting to the outside and thereby losing its optimum stability.

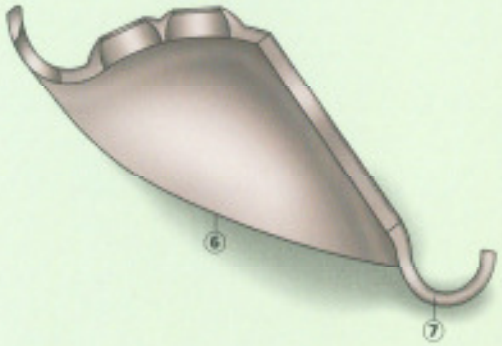
BONE GRAFTS

a) Preferably autologous spongiosa from the iliac crest.

b) As an alternative, frozen bank bone, in accordance with regulations.

c) Or autoclaved spongiosa as a mechanical placeholder.





Anatomically shaped cranial rim => optimum primary stability of grafted bone when reconstructing the acetabulum (see 1).

Elliptically shaped cutout in the bottom area; Purpose: allows to use grafted bone in the center of the acetabulum while ensuring high primary stability thanks to a large contact surface of the implant (wide bridge, see 2).

Sand-blasted rough surfaces facing the bone for optimum ingrowth of the bone into the implant.

Five central screw holes located at the smallest possible angle to one another to allow insertion of the screws into the ilium in the direction of the force vectors (see 3).

Recesses for the screw heads designed to allow a variation of 20° in all directions when inserting the screws (see 4).

Oblong-shaped screw holes in the cranial rim to ensure insertion of the screws at a flat angle in relation to the cranial rim (direction of force vectors).

Special cut of screw holes allows to position the screws at the flattest angle possible (see 5).

Flat bow-shaped curve of the implant (smallest possible angle to the entry level) (see 6) **to achieve:**
a) **maximum contact surface with the bone**, which aids integration into the bone.
b) **maximum contact surface with the cement**, which provides for durable fastening of the inserted cup.

Hook (see 7) provides a temporary increased primary stability and positions the reconstruction ring in the center of rotation.

CASE EXAMPLE 1

a+b) Inflammatory destructive cystic coxarthrosis on the right side in a 72-year old female patient.

c) Revision of the hip joint with synovectomy, removal of cysts and plastic spongiosa surgery, osteosynthesis by reconstruction ring and total hip joint replacement.

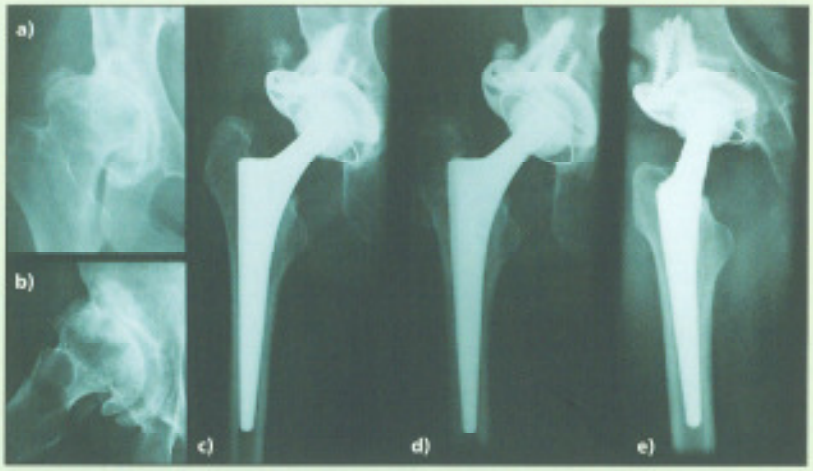
d+e) Follow-up examination 4 years after surgery – irritation-free integration of the grafted bone, stable fit of the implant.
The screws inserted in pressure direction into the acetabular roof are intact and show no signs of resorptive changes.

CASE EXAMPLE 2

a+b) Luxation coxarthrosis in A-P and Lauenstein projection, 45-year old female patient.

c) Reconstruction of the acetabular defect with a large modelled chip from the femoral head, additional spongiosa grafts in the cystic structural defects, stabilization by ARR-Titan reconstruction ring, cementless Vector-Titan stem.

d+e) Results 2 years after surgery:
The chip embedded in the acetabular bottom and balcony is integrated in the bone and structured, the screws are oriented in strain direction, the cementless shaft is integrated in the bone without any negative reaction; the patient is asymptomatic and able to lead an unhandicapped life.

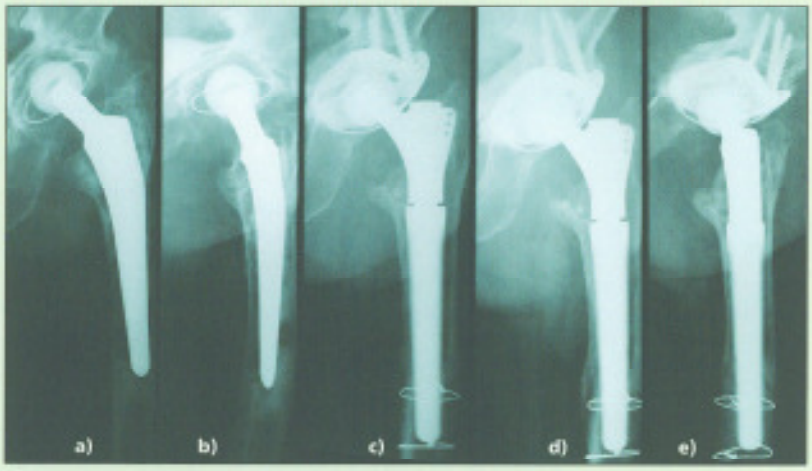


CASE EXAMPLE 3

a+b) 80-year old male patient – 2 views in A-P and Lauenstein projection. 12 years after prosthesis implant loosening of the cup and stem and extensive osteolysis in the cemented area.

c) Exchange surgery. Reconstruction of acetabular defects with autologous bone, partly with sterilized bank bone; osteosynthesis by ARR-Titan reconstruction ring, MRP-Titan revision prosthesis and MRP-Titan revision stem with diameter 23 mm, 140 mm length and 60 mm neck. Realignment of the stem curve in the lower osteolytic area.

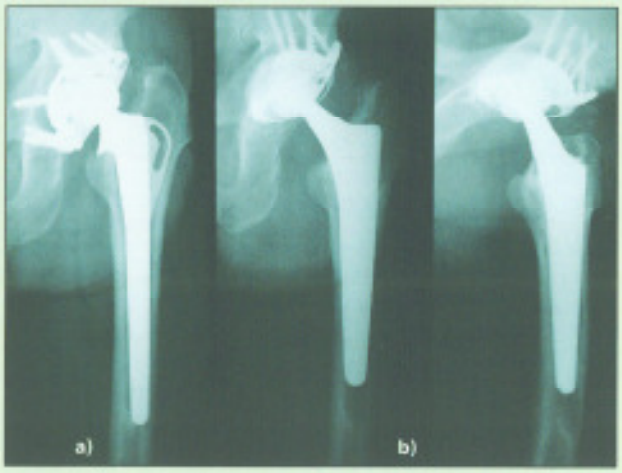
d+e) Follow-up examination 2 years after the implantation: Full distal and proximal ingrowth of the prosthesis, realigned zone in the bending range is stabilized by callosities. The acetabular bottom is able to withstand full load and the patient is asymptomatic.



CASE EXAMPLE 4

a) 68-year old male patient with loosening of the implant 6 years after cementless implant of endoprosthesis on left hip joint. Left leg now 2.5 cm shorter.

b) State after total replacement of left hip joint endoprosthesis including osteosynthesis by implanted ARR-Titan reconstruction ring and cemented polyethylene cup.
Cementless implantation of a Vector-Titan prosthesis.



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Article	Article No.	Size ø - PE cup
ARR - Acetabular Reconstruction Ring Titanium	58544-00	ø 44 mm
	58546-00	ø 46 mm
RT 12	58548-00	ø 48 mm
	58550-00	ø 50 mm
	58552-00	ø 52 mm
	58554-00	ø 54 mm
	58558-00	ø 58 mm
	58562-00	ø 62 mm

Art.-No.
58544-81

X-ray templates

Diameter of the acetabular reamer: 2 - 4 mm larger

Article	Article No.	Size ø - PE cup
ARR - Acetabular Reconstruction Ring with caudal hook Titanium	58644-00	ø 44 mm
	58646-00	ø 46 mm
RT 12	58648-00	ø 48 mm
	58650-00	ø 50 mm
	58652-00	ø 52 mm
	58654-00	ø 54 mm
	58658-00	ø 58 mm
	58662-00	ø 62 mm

Art.-No.
58544-81

X-ray templates

Diameter of the acetabular reamer: 2 - 4 mm larger

Article	Article No.	Size
Vektor Cup cemented UMHW Polyethylen	58144-00	ø 44 x 28 x 26 mm
	58146-00	ø 46 x 28 x 27 mm
	58148-28	ø 48 x 28 x 28 mm
	58150-28	ø 50 x 28 x 29 mm
	58152-28	ø 52 x 28 x 30 mm
	58154-28	ø 54 x 28 x 31 mm
	58156-28	ø 56 x 28 x 32 mm
	58158-28	ø 58 x 28 x 33 mm
	58160-28	ø 60 x 28 x 34 mm
	58148-00	ø 48 x 32 x 28 mm
	58150-00	ø 50 x 32 x 29 mm
	58152-00	ø 52 x 32 x 30 mm
	58154-00	ø 54 x 32 x 31 mm
	58156-00	ø 56 x 32 x 32 mm
	58158-00	ø 58 x 32 x 33 mm
	58160-00	ø 60 x 32 x 34 mm

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