PŮVODNÍ PRÁCE
ORIGINAL PAPER

Results Covering 20 Years Use of the Cement-free Zweymüller Alloclassic Total Endoprosthesis of the Hip Joint

Výsledky implantace necementované endoprotézy kyčle Alloclassic podle Zweymüllera po 20 letech

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ABSTRACT

PURPOSE OF THE STUDY

From an initial group of 206 hips in 190 patients we carried out a retrospective clinical and radiological control of 74 hips in 72 patients covering a period of 20 years.

MATERIAL AND METHOD

Indications in 74 operated hips evidenced 48 x (64,9 %) primary and 26 x (35,1 %) secondary coxarthrosis. The average age at the time of operation was 53 years (37 years – 68 years). All 72 patients with 74 hips received cement-free self-cutting Alloclassic screw cups of pure Titanium together with a cement-free square Alloclassic stem consisting of Titan-Aluminium-Niob alloy according to Zweymüller.

Regarding the technique of operation we used the approach after Watson-Jones in the supine position. As prophylaxis against thrombosis 40 % of the patients received derivates of heparine and 60 % had anticoagulant therapy with cumarine.

Prophylaxis against heterotopic ossifications were not carried out at this juncture in our department.

RESULTS

After an average post-operational examination lapse of 20 years we were able to examine 72 patients (37,9 %) with 74 hips (35,9 %) *clinically* and *radiologically*.

Further classification of the 72 patients records 47 females and 25 males. The average age at the time of operation was 53 years and at the time of post-operational check-up to 74 years. For the *clinical post-operational check-up* (n = 74) we used the *Harris Hip Score*.

Further evaluation shows 12 x (16,2 %) excellent results, 26 x (35,1 %) good and 29 x (39,2 %) fair results. In 7 patients (9,5 %) we had to observe poor results because of multimorbidity, although also in these cases stability of TEP had been achieved.

The radiological post-operational check-up of the 74 stable hips (35,9 %) shows an average *excentric position of the head* of *1,4 mm* (0 mm up until 4 mm) compared with 1 mm after 10 years.

Over an average of about 20 years we carried out an exchange of the inlay and the head because of excentric position of the head, which correlates to a rate of reoperation of 6,8 %.

DISCUSION

In 2000 and 2001 we published our 10 year results with cement-free Alloclassic screw cup and cement-free stem in 133 hips in 123 patients and compared our findings with those of other authors. After 10 years we saw only 3 % complications with cups and an overall re-operation rate of 6,7 %. The 20-year-results show in all cases stable components of both cups and stems. 5 patients (6,8 %) had to undergo re-operation with an exchange of inlay and head, whereby the components of the prosthesis themselves turned out to be stable.

An average polyethylene abrasion of 1 mm after 10 years compares with a value of abrasion of 1,4 mm after 20 years.

The 6,8 % rate of re-operation after 20 years indicates the excellent results of the use of cement-free Alloclassic total endoprosthesis system of the hip according to Zweymüller.

CONCLUSIONS

The biocompatible qualities of modern prosthesis material lead to a quicker and optimal bony incorporation of the prosthesis components. The excellent 20-year-results show a broad indicative spectrum, component stability of the prosthesis in all patients and therefore encourage the further use of cement-free hip implants in the future.

Key words: alloclassic – Total Endoprosthesis Systems after Zweymüller, 20-years-results.

INTRODUCTION

1979 the first implantation of a cement-free stem of Titanium-Aluminium-Vanadin alloy Ti6Al-4V/Protasul-64WF was carried out in Vienna by Prof. Dr. Karl Zweymüller (33). Up until 1985 the surface of cement-free Zweymüller stems showed a fine radiation, whereby the average grade of roughness read Ra = 0,001 mm. By the end of 1985 the higher drawn cement-free femur stem was developed, which consisted of Titanium-Aluminium-Niob alloy Ti-6Al-7Nb/Protasul 100 with an average grade of roughness Ra = 0,003 mm (31, 34).

Also in 1985 Zweymüller for the first time implanted a self-cutting conical screw cup of pure Titanium (1, 34). Already in May 1987 we started here in the Landesklinikum Waldviertel Zwettl – Austria to use systematically the cement-free Alloclassic total endoprosthesis of the hip joint.

The main advantages with the cement-free conical Titanium screw cup were in first line a primary tipping stability and the pre-tensioning of the implant (3). Another great advantage of the conical form of the cup was the stable and perfectly controllable polyethyleneinlay fixation. The good cutting qualities of the threading lamellas make a primary stable fixation possible and this in hard sclerotic bone as well as in soft osteoporotic bone. Long time research and examination and improvement in material have led to the following clinically successful combinations (5, 8, 12, 32).

– Pure titanium for cup and coverage of polyethylene-insert
– Polyethyleneinlay
– Aluminiumoxyde-ceramics Al2O3 Biolox for head of hip joint
– Titanium-Aluminium-Niob/Ti-6Al-7Nb/Protasul 100

In all our patients we used a 32 mm Biolox ceramic ball. By combining "low friction" and "low wear" in the material used, that is, in the gliding match of polyethylene ceramics – we could reduce the yearly abrasion from 0,1–0,3 mm to only 0,0 –0,1 mm (2, 4, 6, 7, 15, 16, 17, 22, 23, 24).

The compatibility of Titanium surfaces is of great importance for ingrowing of bone. Lintner et al. found out for instance, by several histological and microradiografic examinations, that up until a period of 2 years an enormous amount of newly grown bone-substance on the implant and its neighbourhood is being build up and therefore an optimal incorporation in the bone itself can be acquired (13, 14).

In the Orthopaedic Department of the Landesklinikum Waldviertel Zwettl – Austria from May 1987 until December 1989, 206 primary cement-free Alloclassic total endoprostheses of the hip joint according to Zweymüller system were implanted in 190 patients.

Following two retrospective studies in the years 2000 and 2001 we presented our 10 years results, having by then re-examined 133 hips (64,6 %) in 123 patients (64,7 %) (27, 28).

After 20 years we were now able to re-examine 74 hips (35,9 %) in 72 patients (37,9 %) about which we will report in the following.

MATERIAL AND METHOD

In the Orthopaedic Department of the Landesklinikum Waldviertel Zwettl – Austria, between May 1987 and December 1989, 206 primary cement-free Zweymüller Alloclassic total endoprostheses of the hip joint were implanted in 190 patients (Fig. 1a–1d).

On 88 occasions we operated the left side and 86 times the right side – 16 patients had operations on both side but at different times (Fig. 2a–2e). Further analysis shows that 118 patients were females and 72 male.

The following table shows our indications (Tab. 1). 145 hips (70,4 %) were operated because of primary coxarthrosis, 53 patients (25,7 %) suffered from secondary coxarthrosis and 8 patients (3,9 %) suffered from idiopathic necrosis of the head of femur and all of them received a cement-free total endoprosthesis of the hip.

The next table shows the indication of 74 operated hips after 20 years (Tab. 2).

The average age at the time of operation was 53 years (37 years to 68 years).

As technique in operation we used in all our patients the approach in supine position after Watson-Jones.

As prophylaxis against thrombosis 82 patients (40 %) received derivates of heparine, 124 patients (60 %) had anticoagulant therapy with cumarine.

Prophylaxis against heterotopic ossifications were not carried out at this juncture (29).

3 patients (1,5 %) suffered from **intraoperative complications**. Two of them (1 %) had an incomplete temporary paresis of the nervus Ischiadicus, later had a full remission. One patient (0,5 %) had a lateral fissure of the shaft and was treated with two cerclages.

RESULTS

After an average post-operational examination lapse of 20 years (19 – 21 years) we could examine in 72 patients (37,9 %) 74 hips (35,9 %) clinically and radiologically.

Further analysis indicates 47 females and 25 males; in 34 cases we operated on the right side, 36 times on the left and twice on both sides.

Tab. 1. Indication of the primary group

Indication:
Primary coxarthrosis 145 x (70,4 %)
Secondary coxarthrosis 53 x (25,7 %)
Idiopathic necrosis of head of femur 8 x (3,9 %)

Tab. 2. Indication of the controlled group after 20 years

Indication:
Primary coxarthrosis 48 x (64,9 %)
Secondary coxarthrosis 26 x (35,1 %)
Idiopathic necrosis of head of femur 0 x

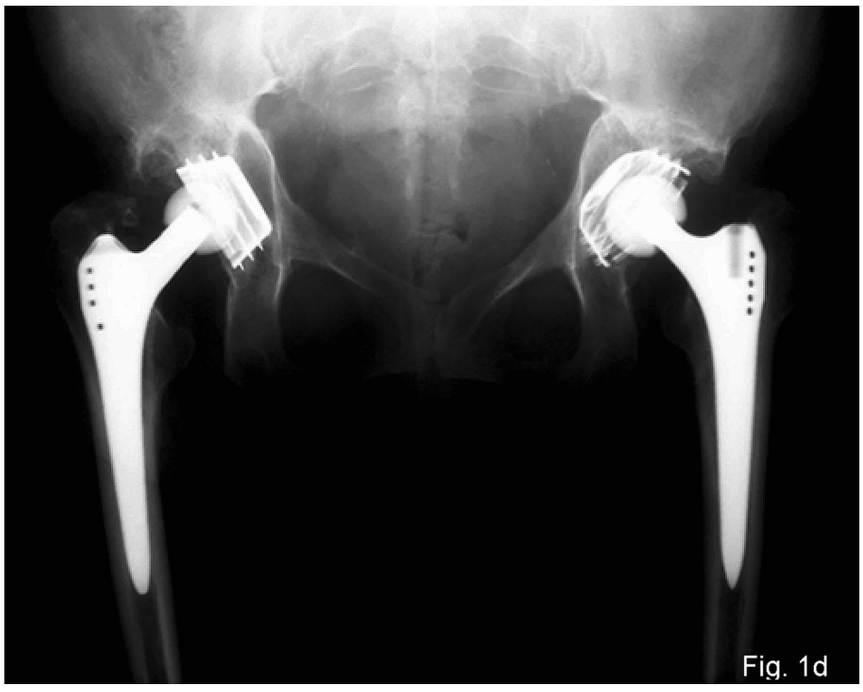

Fig. 1. Severe dysplastic coxarthrosis bil., St. p. Chiari-OP bil., 1989 (a); 1 week postop., 1989 (b); 20 years postop., 2009 (c); 20 years postop., 2009, St. p. TEP of the left hip, 1993 (d).

The average age at the time of operation was 53 years (37 – 68 years). The average age at the time of post operative check up lies at 74 years (57–85 years).

Compared with the 10 years retrospective study one can see, that after ten years we have controlled 133 hips (64,6 %) in 123 patients (64,7 %).

In the **clinically postoperative check ups** (n=74) we used the **Harris Hip Score** (Tab. 3).

Tab. 3. Clinically postoperative check ups using the Harris Hip Score

Harris Hip Score:		
Excellent	(100–91 points):	12 x (16,2 %)
Good	(90–81 points):	26 x (35,1 %)
Fair	(80–71 points):	29 x (39,2 %)
Poor	(< 70 points):	7 x (9,5 %)

Fig. 2. Severe coxarthrosis of the right side, 1988 (a); 1 week postop., 1988 (b); severe coxarthrosis of the lift side, 1989 (c); 1 week postop., 1989 (d); 20 years postop., 2009 (e).

The reason for fair or poor results lies in the acquired multimorbidity of the elderly patients and the other co-existing illnesses.

There is actually *no* significant difference in the results in patients with a more or less excentric position of the head (Fig. 3a – 3d).

The **radiological post-operative check up** of 74 hips (35,9 %) shows an **average of excentric positions of the head of 1,4 mm** (0–4 mm; Fig. 3c). 28 hips (37,8 %) showed abrasion of more than 1,5 mm and 46 hips (62,2 %) of less than 1,5 mm.

Cup

The following tables (Tab. 4 and Tab. 5) give a synopsis of the size of cups and their relation to an excentric position of the head.

There is **no** significant difference between size of cup and excentric position of head visible.

The next table (Tab. 6) presents the **angular inclination** of the implanted cups.

No relation between cups angular inclination and excentric position of head can be found.

The following table (Tab. 7) gives a survey of cups and the relationship between inclination angle and dimension of abrasion.

The **radiological gauging** derives from following formula (Tab. 8):

Stem

In all 74 hips we implanted a cement-free Alloclassic stem after Zweymüller (second generation).

Fig. 3a. Severe coxarthrosis of the right side, 1989 (a); 1 week postop., 1989 (b); severe abrasion of polyethylene with excentric position of the head, 13 years postop., 2002 (c); control after exchange of the inlay and head, 2010 (d).

Next table (Tab. 9) gives a survey of the various sizes of stems:

In all our patients we never encountered **any stem-complications** (9, 10, 11).

The accurate radiological analysis shows in 27 % of the cases a typical building up of a border seam in the proximal zones without any loosening of the stem.

This rating shows no relation between the building up of a borderline seam on the shaft or on the other side of excentric position of head (19, 20).

Tab. 4. Sizes of the cup

52:	7 x
55:	19 x
58:	30 x
61:	13 x
64:	5 x

Tab. 5. Excentric position of the head

Excentric position of head > 1,5 mm	52:	0 x
n = 28	55:	8 x
	58:	14 x
	61:	4 x
	64:	2 x
Excentric position of head < 1,5 mm		
n = 46	52:	7 x
	55:	11 x
	58:	16 x
	61:	9 x
	64:	3 x

Tab. 6. Angular inclination of the cups

< 40 degree:	4 x	(5,4 %)
40-50 degree:	55 x	(74,3 %)
> 50 degree:	15 x	(20,3 %)
Excentric position of head < 1,5 mm (n = 46)		
< 40 degree:	3 x	(6,5 %)
40-50 degree:	33 x	(71,7 %)
> 50 degree:	10 x	(21,8 %)
Excentric position of head > 1,5 mm (n = 28)		
< 40 degree:	1 x	(3,6 %)
40-50 degree:	22 x	(78,6 %)
> 50 degree:	5 x	(17,8 %)

Tab. 7. Relationship between inclination angle of the cup and dimension of abrasion

Excentric position of head n = 74			
< 40 degree:	4 x (5,4 %)	< 1,5 mm:	3 x
> 1,5 mm:			1 x
40-50 degree:	55 x (74,3 %)	< 1,5 mm:	33 x
		> 1,5 mm:	22 x
> 50 degree:	15 x (20,3 %)	< 1,5 mm:	10 x
		> 1,5 mm:	5 x

Tab. 8. Formula of the radiological gauging

Measured abrasion : actual abrasion = measured diameter head : actual diameter head (32 mm)

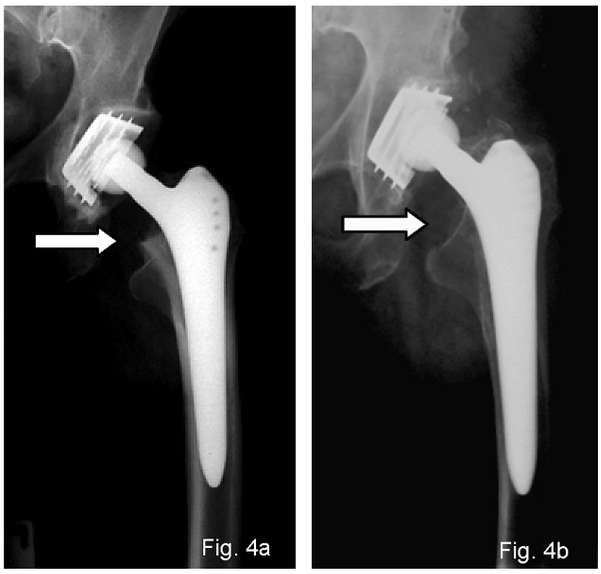

Fig. 4. Cementless hip prosthesis of the right side, 1 week postop., 1988 (a); 21 years postop., severe rounding-off of the calcar femoris (b).

Tab. 9. Sizes of the stem

1:	2 x	7:	5 x
2:	2 x	8:	4 x
3:	7 x	9:	3 x
4:	20 x	10 S:	2 x
5:	17 x	11 S:	2 x
6:	9 x	12 S:	1 x

A loss in bone density with a roundingoff of the calcar femoris is found more frequently together with an excentric position of the head of more than 1,5 mm, than in cases with an excentric position of head of less than 1,5 mm (Fig. 4a, 4b).

Next table (Tab. 10) shows a survey of alterations of the calcar femoris:

The stem shows 14 times (18,9 %) a varus position with an average of 3 degrees,

58 times (78,4 %) a neutral position and twice (2,7 %) a valgus position with an average of 4 degrees (Tab. 11).

The next table (Tab. 12) shows position of stem in relationship to excentric head position (18, 24)

The position of the stem has *no* significant effect upon the degree of excentric head position.

The following table (Tab. 13) shows relationship between **length of head** and **dimension of abrasion**.

A further table (Tab. 14) represents the dimensions of the various degrees of heterotopic ossifications (Fig. 5a–5c) (29).

Reoperations

Following an average time of 20 years we carried out an exchange of inlay and head because of the excentric position of the head in 5 hips (= 4 patients; 6,8 %).

Tab. 10. Alterations of the calcar femoris

Density loss and rounding-off of calcar femoris
29 x (39,2 %)
with excentric position of head > 1,5 mm n = 28 : 13 x (46,4 %)
with excentric position of head < 1,5 mm n = 46 : 16 x (34,8 %)

Tab. 11. Position of the stem

Varus:	14 x	(18,9 %)
Neutral:	58 x	(78,4 %)
Valgus:	2 x	(2,7 %)

Tab. 12. Relationship between the position of the stem and the excentric head position

With excentric position of head > 1,5 mm: n = 28	Varus	7 x (25,0 %)
	Neutral	20 x (71,4 %)
	Valgus	1 x (3,6 %)
With excentric position of head < 1,5 mm: n = 46	Varus	7 x (15,2 %)
	Neutral	38 x (82,6 %)
	Valgus	1 x (2,2 %)

Tab. 13. Relationship between the length of the head and the dimension of abrasion

Diameter of head: 32 mm (n = 74)		
Length of head:	S:	21 x (28,4 %)
	M:	39 x (52,7 %)
	L:	14 x (18,9 %)
With excentric position of head > 1,5 mm (n = 28)		
	S:	9 x (32,1 %)
	M:	14 x (50,0 %)
	L:	5 x (17,9 %)
With excentric position of head < 1,5mm (n = 46)		
	S:	12 x (26,1 %)
	M:	25 x (54,3 %)
	L:	9 x (19,6 %)

Tab. 14. Heterotopic ossifications

Heterotopic Ossifications: n = 74				
Arcque:	0:	39 x (52,7 %)	Brooker:	0: 22 x (29,7 %)
	I:	25 x (33,6 %)		I: 29 x (39,2 %)
	II:	9 x (12,2 %)		II: 15 x (20,2 %)
	III:	1 x (1,5 %)		III: 7 x (9,4 %)
				IV: 1 x (1,5 %)

Tab. 15. Harris Hip Score of the reoperated patients

Harris Hip Score:		
Excellent	(100-91 points):	0 x
Good	(90-81 points):	1 x
Fair	(80-71 points):	3 x
Poor	(< 70 points):	1 x (chronic polyarthritis, immobility)

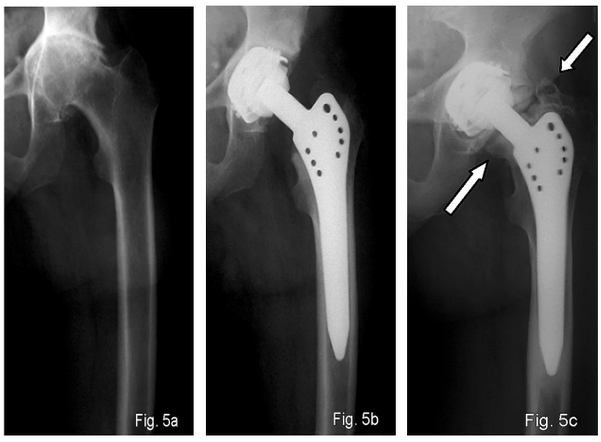

Fig. 5. Severe central coxarthrosis of the left side, 1989 (a); 1 week postop., 1989 (b); 20 years postop., severe heterotopic ossifications (c).

The **clinical postoperative check-up** (Tab. 15) of the reoperated patients, according to Harris Hip Score gives the following survey.

DISCUSSION

In the Landesklinikum Waldviertel Zwettl, Austria we started already in 1987 to implant Zweymüller cement-free Alloclassic total endoprostheses of the hip joint. Between May 1987 and December 1989 we implanted 206 primary cement-free Alloclassic total endoprostheses of the hip joint in 190 patients. We operated all of these patients in the supine position with an approach according to Watson-Jones.

At that time we did not exercise prophylaxis against ossification, but nevertheless noticed an Arcque 0 stage in 52,7 % of all our cases. When we compare the results after 20 years with the 10 year results, we find in the 10 year group also an Arcque stage 0 in about 50 % of the cases (29). Perioperatively we treated over a period of 3 days prophylactically with antibiotics.

We started to mobilize the patients on the third day after the operation, with sitting on the edge of bed, later partial, and then maximum loading of the operated leg.

The **10 years results** of the use of cement-free screw cup and of the rectangular cement-free Zweymüller stem, were published in two retrospective studies in the years 2000 and 2001 in comparison with other authors (9, 10, 21, 25, 26, 30).

After 10 years we had to take note of a complication rate in 4 cases (3 %) (30).

Also after 10 years we registered one breakage of the titanium cup, then one loosening of the cup without deviation or change of position and one loosening of the implant with alteration of the position. Another patient had to be reoperated because of delayed infection together with septical loosening after six years.

In an analysis of the cement-free stem we found after 10 years only one complication, but this not specifically prosthesis, but originating from a delayed infection. This patient was treated in a two session reoperation with exchange of the prosthesis.

Subsequent examination of our **20 year results** shows a reoperation rate of 6,8 %. After an average of 20 years we had to reoperate 5 hips in 4 patients, and in all these cases we had to exchange inlay and head, because of an excentric position of the head.

Fortunately, we could even after 20 years control quite a number of patients, clinically and radiologically. We examined 72 patients (37,9 %) with 74 hips (35,9 %).

Our retrospective study after ten years showed an average of polyethylene abrasion of **1 mm**. The radiological evaluation after 20 years showed an average excentric head position of 1,4 mm, of which 37,8 % had an abrasion higher than 1,5 mm and 62,2 % of less than 1,5 mm.

In our 20 years study we did not find a single case of fatigue fracturing or also any loosening of cups or stems.

CONCLUSION

After an average post-operational examination lapse of 20 years we were able to examine clinically as well as radiologically 72 patients (37,9 %) with 74 hips (35,9 %).

In all patients we used a cement-free Alloclassic screw cup of pure titanium and a cement-free Alloclassic stem of Titanium-Aluminium. Niob alloy after Zweymüller, and applied the Watson-Jones technique of operation.

Comparing the 20 year control with the 10 year results we found in all our patients stable components of the prostheses. Biocompatible material permits a quicker incorporation in the bone structure through the body's natural bone cells.

We could see this osseous healing process also in elderly patients suffering from osteoporosis so that we really have a broad indication for a cement-free implantation.

The excellent long time results confirm our procedure and encourage over a very broad spectrum of indication use of cement-free hip implants.

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