

PEER-REVIEW REPORT

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Manuscript NO: 53729

Title: Reconstruction of Paprosky Type IIIB acetabular bone defects using a Cup-on-Cup technique, A Surgical Technique and Case Series

Reviewer's code: 00502860

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Academic degree: MD, PhD

Professional title: Professor

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<input type="checkbox"/> Grade B: Very good	<input type="checkbox"/> Grade B: Minor language	(High priority)	<input type="checkbox"/> Anonymous
<input type="checkbox"/> Grade C: Good	polishing	<input type="checkbox"/> Accept	<input type="checkbox"/> Onymous
<input type="checkbox"/> Grade D: Fair	<input type="checkbox"/> Grade C: A great deal of	(General priority)	Peer-reviewer's expertise on the
<input type="checkbox"/> Grade E: Do not	language polishing	<input type="checkbox"/> Minor revision	topic of the manuscript:
publish	<input type="checkbox"/> Grade D: Rejection	<input type="checkbox"/> Major revision	<input type="checkbox"/> Advanced
		<input type="checkbox"/> Rejection	<input type="checkbox"/> General
			<input type="checkbox"/> No expertise
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			<input type="checkbox"/> Yes
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SPECIFIC COMMENTS TO AUTHORS

Good study.

INITIAL REVIEW OF THE MANUSCRIPT

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<input checked="" type="checkbox"/> Grade C: Good	polishing	<input type="checkbox"/> Accept	<input type="checkbox"/> Onymous
<input type="checkbox"/> Grade D: Fair	<input type="checkbox"/> Grade C: A great deal of	(General priority)	Peer-reviewer's expertise on the
<input type="checkbox"/> Grade E: Do not	language polishing	<input type="checkbox"/> Minor revision	topic of the manuscript:
publish	<input type="checkbox"/> Grade D: Rejection	<input checked="" type="checkbox"/> Major revision	<input checked="" type="checkbox"/> Advanced
		<input type="checkbox"/> Rejection	<input type="checkbox"/> General
			<input type="checkbox"/> No expertise
			Conflicts-of-Interest:
			<input type="checkbox"/> Yes
			<input checked="" type="checkbox"/> No



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SPECIFIC COMMENTS TO AUTHORS

Dear Authors, I made all my comments with the text file. Please have a look inside this file to get them. Kind regards

INITIAL REVIEW OF THE MANUSCRIPT

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- ☐ No

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1Reconstruction of Paprosky Type 3 * ROMANB acetabular bone defects using

2a Cup-on-Cup technique, A Surgical Technique and Case Series

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23Reconstruction of Paprosky Type 3 * ROMANB acetabular bone

24 defects using a cup-on-cup technique, a surgical technique and case
25 series

26 Abstract

27 **Introduction** Paprosky type 3 * ROMANB acetabular bone defects are very
28 difficult to reconstruct. For severe defects, we developed a cup-on-cup technique. We
29 defined the tantalum metal (TM) revision shell with the peripheral titanium ring
30 removed as a TM-cup augment and the cementless hemispherical acetabulum
31 component combined with a TM-cup augment as the cup-on-cup technique. The
32 purpose of this study is to report the short-term results of patients with type 3 *
33 ROMANB acetabular bone defects reconstructed with the cup-on-cup technique.

34 **Methods** We retrospectively reviewed 6 patients (6 hips) with a mean age of 59
35 years who underwent acetabular reconstruction with the cup-on-cup technique
36 between January 2015 and January 2017. All acetabular bone defects were classified
37 as type 3 * ROMANB without pelvic discontinuity using the system of Paprosky.
38 All patients were followed up both clinically and radiographically for a mean duration
39 of 42.5 months.

40 **Results** The mean Harris hip score improved from 32.4 pre-operatively to 80.7 at
41 the last follow-up. The mean vertical position of the hip rotation centre changed from
42 60.9 mm pre-operatively to 31.7 mm post-operatively, and the mean horizontal
43 position changed from 33.6 mm pre-operatively to 38.9 mm post-operatively. Greater
44 trochanteric migration after extended trochanteric osteotomy occurred in 1 of 6 hips at
45 3 months. There was no evidence of component migration at the last follow-up.

批注 [1]: Such a technique is already in use; you may revise your sentence and write "... we developed our own cup-on-cup technique."

批注 [2]: Suggestion:
Replace "the" with "our"

批注 [3]: Please say:
"... of 42 months (=3.5 years)."

批注 [4]: "our"

46 **Conclusions** The short-term results suggest that the cup-on-cup technique could
47 be considered an effective management option for Paprosky type 3 * ROMAN B
48 acetabular bone defects without pelvic discontinuity.

49 **Keywords** total hip arthroplasty, trabecular metal, cup-on-cup, bone defect.

50 Introduction

51 Acetabular bone defects are becoming more common in revision total hip
52 arthroplasty (THA). The reconstruction of the defects may be a surgical challenge.
53 Several classification systems have described acetabular bone defects, but the most
54 helpful for developing surgical strategies is the Paprosky classification^[1, 2]. Paprosky
55 type 3 * ROMAN B defects are defined by “up and out” defects with more than 60%
56 of the acetabular rim compromised and superomedial migration of femoral head
57 greater than 3 cm^[1].

58 For the reconstruction of the defects, structural allograft has been used to initially
59 stabilise the cementless hemispherical acetabular component in the past decades^[3, 4].
60 However, due to the collapse, resorption, nonunion, loosening, and infection of the
61 grafts, the cementless acetabular component that lacked successful biological fixation
62 and bone graft incorporation became susceptible to loosening. The success rate of
63 structural allografts was approximately 65% in a series of systematic reviews of
64 the literature^[3-7]. The common causes of failures were as described above^[3, 6, 7].

65 To solve the above problems, “nonresorptive structural allografts”, namely,
66 trabecular metal (Zimmer, Warsaw, IN) augments, have been widely used during the
67 past decade^[8-12]. With high frictional characteristics, low modulus of elasticity, and

68high volumetric porosity (70 to 80%), the acetabular component and augment can be
69used with bone ingrowth propensity and can obtain long-term biological fixation [12-14].

批注 [5]: Suggestion:

"... posses high bone ingrowth potential ..."

70Therefore, multiple sizes and shapes of the acetabular augments emerged to adapt and
71reconstruct various acetabular bone defects. Hemispheric acetabular components with
72trabecular metal augments have been reported by many authors to be associated with
73excellent clinical results, such as acceptable post-operative hip function, low rates of
74aseptic loosening and other complications at mean follow-up ranging from 37 to 60
75months [9-11].

76 Many surgeons have utilized two trabecular metal augments to reconstruct the
77superomedial type 3 * ROMANB defects. However, the two largest trabecular metal
78augments cannot reconstruct the defects or restore the normal hip centre of rotation
79(COR) because the defects were too large. For the sake of solving the problem, we
80utilized a cup-on-cup technique to reconstruct the Paprosky type 3 * ROMANB
81acetabulum bone defects and restore the normal hip COR. We defined the tantalum
82metal (TM) revision shell that was removed from the peripheral titanium ring as a
83TM-cup augment and the cementless hemispherical acetabulum component combined
84with a TM-cup augment as the cup-on-cup technique.

批注 [6]: "our"

85 The purpose of this study is to report the short-term results of patients with type 3
86* ROMANB acetabulum bone defects reconstructed with the cup-on-cup technique.

批注 [7]: "our"

87Materials and Methods

88 We retrospectively reviewed 6 patients (6 hips) who underwent acetabular
89reconstruction for Paprosky type 3 * ROMANB acetabular bone defects with the

批注 [8]: "our"

90cup-on-cup technique from January 2015 to January 2017 (Table 1). There were 4
91females and 2 males with a mean age of 59 years (range from 29 to 73 years). The
92causes of revision surgery were aseptic loosening in 5 hips and a primary THA with
93severe defects because of posttraumatic acetabular comminuted fracture and infection
94in 1 hip. None of the participants had pelvic discontinuity. All patients were followed
95clinically and radiographically for a mean duration of 42.5 months (range, 36 to 52
96months). No patients were reported as lost to either clinical or radiographic follow-up.

97 Surgical technique

98 All surgeries were performed by one author (Zhou Y-G) at the General Hospital
99of the Chinese People's Liberation Army (Beijing, China). The classification of these
100defects was based on pre-operative radiographs, a 3D-printed model of the
101acetabulum and intra-operative assessment according to the Paprosky classification^[1].
102A standard posterior-lateral approach was used for each case. Extended trochanteric
103osteotomies (ETOs) were performed in 2 hips to remove the failed components,
104improve exposure, and assist in the balancing of soft tissue. Acetabular reconstruction
105began by removing the failed acetabular components, bone cement and any fibre-
106necrotic tissue. The superomedial defects in conformity with Paprosky type 3 *
107ROMANB were detected in 6 hips. Conventional hemispherical reamers of
108different diameters were used to detect the defects' shape and size; the latter were
109constrained by the anterior and posterior acetabular walls. Then, the shaped defects
110were inserted into a TM revision shell removed from the peripheral titanium ring
111(TM-cup augment), and the TM-cup augment was stabilised and secured against the

批注 [9]: Question:
Standard radiographs and computer tomography ?

批注 [10]: I do not understand what you are doing here.
Please write more clearly how you match the defect size
to the size of the TM-hemisphere you insert lateron

112 host bone by the screws. Next, hemispherical reamers of different diameters were
113 used again to shape the acetabulum by reaming the bone around acetabulum and the
114 TM-cup augment rim. Until the size of the reamer was constrained by the acetabular
115 walls and the augment or a stable 3-point fixation was achieved by the ischium and
116 the augment^[15], a cementless hemispherical acetabulum component (a Pinnacle or
117 trabecular metal revision component) was inserted. The cement was placed only
118 between the TM-cup augment and the cementless hemispherical acetabulum
119 component, and the rest of the surface of the acetabular component was in contact
120 with the host bone (Fig. 1). Additional screws were inserted through the holes in the
121 acetabular component to enhance the initial stability. In 4 of the 6 cases, additional
122 screws were inserted through both the acetabular component and the TM-cup augment
123 into the ilium to further enhance fixation. To do this, we needed to create additional
124 screw holes in the TM revision shell or the TM-cup augment with a high-speed burr.

125 The mean diameter of the TM-cup augment was approximately 50 mm (range
126 from 48 to 52 mm). The Pinnacle acetabular cup was used in 3 hips, and the TM
127 revision shell was used in the remaining hips. The mean diameter of the Pinnacle
128 acetabular cup was approximately 57 mm (range from 54 to 60 mm), and the TM
129 revision shell was approximately 57 mm (range from 56 to 58 mm). A mean of 4 bone
130 screws (range from 3 to 5) were used for each acetabular reconstruction, with a
131 median of 2 screws inserted through the acetabular component (range from 1 to 3) and
132 a median of 2 screws inserted through the TM-cup augment (range from 1 to 3).

133 Once the acetabular component and augment were secured, a liner was implanted

批注 [11]: Please describe more precisely if you use line-to-line fit or pressfit, where you place the screws, how you consider the size of the final cup etc.

批注 [12]: Do you mean "... the bone at the periphery of the acetabulum"?

批注 [13]: I guess that the TM-cup augment cannot be reamed, it is made out of tantalum, is it?

批注 [14]: I've got what you mean, but nevertheless I recommend to remove the word "cementless"; it is a somewhat confusing wording to use cement and talking about a cementless component; please focus on saying that you connect the TM-hemisphere that is use as an augment and the final cup with cement leaving the rest of the surface of the cementless cup to be covered by acetabular bone, or provide a sketch, Fig. 1 is not illustrativ enough

批注 [15]: Are the screws inserted into the cement and/or acetabular bone?

批注 [16]: I would not recommend such a technique at all, it does "contaminate" the surgical site with tantalum powder; if you continue to recommend, please provide information that such a surgical step is not disturbing the final result of the surgery in the longer run

批注 [17]: "... another 3 hips."

134into the acetabular component. A highly cross-linked polyethylene liner was used in 5
135hips, and a ceramic liner was used in 1 hip. The femoral head size was 32 mm in one
136hip and 36 mm in five hips (Table 2).

137 Post-operation recovery included partial weight bearing with the use of crutches
138for the first six weeks. Full weight bearing was allowed thereafter. Patients stayed in
139the hospital for a mean of 8.7 days (range from 7 to 10 days).

140 Clinical and radiographic assessment

141 Clinical and radiological evaluations were performed pre-operatively; at 3 months,
1426 months, and 1 year post-operatively; and annually thereafter. The functional results
143of the arthroplasty were recorded according to the Harris hip score (HHS)^[16]. A case
144was considered a clinical failure if the component was revised again or if the clinical
145score was worse than the pre-operative score.

146 Standard radiological analysis was performed on serial anteroposterior (AP)
147radiographs of the pelvis and lateral views of the operated hip. The vertical position of
148the hip COR was measured from the inter-tear drop line to the centre of the femoral
149head, and the horizontal position was measured between the femoral head centre and
150the perpendicular line from the inter-tear drop line at the tear drop^[17].

151 The presence and evolution of radiolucent lines in the three zones of DeLee and
152Charnley were recorded^[18]. The component was considered unstable if a radiolucent
153line at last 1 mm wide crossed all three acetabular zones or if any component
154migration could be found. The fibrous stability of the component was characterized
155by a radiolucent line less than 1 mm wide that crossed two of the three zones, while

156the component was considered stable with the presence of bone ingrowth if the
157component was in close contact with the pelvic bone and no radiolucent lines were
158found in at least two of the three zones^[19]. Radiologically, a change in the abduction
159angle of the acetabular component of more than 10° or a change in the vertical or
160horizontal position of the component >6 mm were defined as loosening^[9]. The
161presence of osseointegration of the acetabular dome was evaluated according to the
162Moore criteria^[20]. Five radiographic signs were used: absence of radiolucent lines,
163presence of superolateral support, medial stress-shielding, radial trabeculae, and
164inferomedial support. When three or more signs were present, the positive predictive
165value of the radiographic test was 96.9%, the sensitivity was 89.6%, and the
166specificity was 76.9%.

167 The Ethics Committee of our hospital, the General Hospital of Chinese People's
168Liberation Army, approved the study protocol. All study participants provided written
169informed consent for the study.

170 Statistical analysis

171 All analyses were performed using SPSS software (Version 20; SPSS Inc.,
172Chicago, IL, USA). The paired-samples T test was used to compare the pre-operative
173and last follow-up Harris hip scores and the vertical and horizontal position of the
174COR. Statistical significance was accepted for P-values<0.05.

175 Results

176 Clinical outcome

177 The mean Harris hip score improved from 32.4±10.1 (range from 19.8 to 50.2)

批注 [18]: I recommend to remove this part; it is not only about the acetabular dome; in contrary, even loose acetabular components may gave the impression of osseointegration superiorly

批注 [19]: Statistics with 6 cases doesn't make any sense, just present your six cases!
Or, did you perform any power analysis?

批注 [20]: remove

178pre-operatively to 80.7 ± 5.6 (range from 71.5 to 87.5) at the last follow-up ($p<0.001$).
179Pre-operatively, five patients had severe pain, and one had moderate pain. At the last
180follow-up, four patients had no pain, and two had slight pain. Pre-operatively, three
181patients needed a cane for long walks and three needed full-time support with
182crutches. At the last follow-up, the six patients could walk unaided. Pre-operatively,
183five patients had a severe limp, and one had a moderate limp. At the last follow-up,
184five patients had no limp and one had a moderate limp.

批注 [21]: Suggestion:
"... all six patients ..."

185 Radiological outcome

批注 [22]: remove

186 The mean vertical position of the hip COR from the inter-teardrop line changed
187from 60.9 ± 7.5 mm (range from 50.8 to 70.2 mm) pre-operatively to 31.7 ± 8.8 mm
188(range from 25.2 to 49.3 mm) post-operatively ($p<0.001$). Post-operatively, the
189vertical position of five patients was less than 35.0 mm and that of one was 49.3 mm.
190The mean horizontal position of the COR from the teardrop changed from 33.6 ± 5.0
191mm (range from 28.5 to 39.5 mm) pre-operatively to 38.9 ± 5.0 mm (range from 32.7
192to 47.8 mm) post-operatively ($p>0.05$).

193 At the last follow-up, there was no evidence of component migration compared to
194the initial post-operative views. A radiolucent line was noted in 1 of the 6 hips, and in
195this case, there was a radiolucent line smaller than 1 mm seen in zone C 3 months
196after surgery. However, the radiolucent line remained stable, and no further
197progression was noted at the last follow-up. All the acetabular domes presented at
198least three or more signs of fixation, in accordance with the criteria of Moore (Fig. 2).

199 Complications

200 Greater trochanteric migration after ETO occurred in 1 of 6 hips at 3 months.
201 The patient had a moderate limp, but she was quite satisfied with the current condition
202 and did not expect for a surgery to fix the migrated greater trochanter.

203 There were no cases of deep infection, deep venous thrombosis, nerve injuries,
204 pulmonary embolism or death as a result of the revision procedure.

205 Discussion

206 Management of Paprosky type 3 * ROMAN acetabulum bone defects is a
207 challenging and unique reconstructive procedure. Superomedial defects are very
208 common in revision THA. To address this problem, we used a novel cup-on-cup
209 technique with a cementless hemispherical acetabulum component and a tantalum
210 metal revision shell as a TM-cup augment. The TM-cup augment was implanted to
211 reconstruct the superomedial defects, and then the hemispherical acetabulum
212 component was implanted into the reconstructed acetabulum.

213 The TM augment was first introduced in 1997 and possesses a high coefficient of
214 friction and porosity^[14]. Moreover, TM offers good bioactive and biological bonds to
215 host bone, and its characteristics included a high volumetric porosity, which appeared
216 optimal for bone ingrowth, and a roughened surface micro-texture that provided a
217 scratch fit for increased initial stability upon implantation^[14, 21]. All the above
218 advantages of TM are why it is increasingly used in revision THA with severe
219 acetabular bone defects. Recently, many short-term reports have shown encouraging
220 results from using TM augments in type 3 * ROMAN acetabular defects (Table 3).
221 Gaizo et al^[10] reported that only one of 37 hips (2.7%) failed as a result of aseptic

批注 [23]: You did not mention any statistic test, significance level etc., so please remove the Statistic paragraph in the methods section

批注 [24]: Please revise:
"... are very common leading to revision THA." Such defects can also occur after revision, but then we speak about Re-revision.

批注 [25]: To me this technique is not novel, therefore I recommend to say "our own" (comment at the beginning of the manuscript)

批注 [26]: What is a "scratch fit" ? Do you mean "shear strength"?

批注 [27]: These are just "properties", advantages does mean more, namely it is a rating of proportions

loosening at a mean follow-up of 60 months (range from 26 to 106 months). Grappiolo et al^[11] reviewed 55 acetabular revisions with a mean follow-up of 53.7 months (range from 36 to 91 months) and reported three cases of revision for aseptic loosening (5.5%). However, Lingaraj et al^[8] and Sporer et al^[9] had no aseptic loosening in their studies. Moreover, recurrent instability was very common in many studies^[8-11]. Due to the severe defects, the unideal position of the acetabular component may result in recurrent instability. Utilizing a fluted and tapered modular stem may reduce the incidence of recurrent instability.

In our practice, we strived to restore the anatomical position of the hip COR to achieve effective functioning of the abductors. During the surgical procedure, in the presence of severe superior and medial migration of the hip COR, we utilized the TM-cup augment to reconstruct the superomedial defects and restored the normal position of the hip COR. The position of the hip COR was normal in 5 patients; we could not restore a normal hip COR in one patient due to the large superior defects. Finally, despite the large and severe size of the defects, we were able to use a medium cup size in all patients. The use of non-large cups could prevent impingement between the acetabular construction and soft tissue around the hip^[22].

In our study, we included patients with Paprosky type 3 * ROMAN B acetabulum bone defects without pelvic discontinuity. At a mean follow-up of 42.5 months (range from 36 to 52 months), none of 6 hips treated with the cup-on-cup technique failed due to aseptic loosening, and only one case had greater trochanteric migration after ETO. The cup-on-cup technique with a fluted and tapered modular

批注 [28]: Remove, this word is not needed.

批注 [29]: Recurrent instability is per se more common in revisions, please cite it in this way.

批注 [30]: What is an "ideal position"?
Do you mean the "genuine center of rotation"?

批注 [31]: Please remove this sentence; there is no evidence for such a conclusion; fluted and tapered stems are an established part of THA revisions, by itself they do not reduce at all instability, it is restored biomechanics that reduces instability

批注 [32]: Please revise:
As far as I understand you did restore the level of the hip joint to normal as referenced to the interteardrop line; restoring the COR means restoring all three dimensions, i.e. medio-lateral, antero-posterior and superior-inferior

批注 [33]: Do mean "... an average cup size ..."

批注 [34]: Suggestion:
"Preventing to use jumbo-cups could also prevent impingement ..."

批注 [35]: "our"

批注 [36]: "Our"

244stem was used in 5 patients, and a primary femoral prosthesis was used on one patient;
245none of the patients had recurrent instability. All of the components were available for
246biological fixation and osseointegration. All patients had excellent clinical results.

批注 [37]: This is distributor marketing, that is not science, please remove this sentence.

247 Sheth and Paprosky recommended removing the peripheral titanium ring to
248facilitate the placement of screw holes at the periphery of a TM revision shell and
249gained screw access to the ischium and/or superior public ramus^[23]. We regarded the
250TM revision shell with a removed peripheral titanium ring as a TM-cup augment. We
251utilized the TM-cup augment to reconstruct the large type 3 * ROMANB
252superomedial defects and made additional screw holes in it with a high-speed burr.

批注 [38]: Please leave the rating to the reader, otherwise refer to a rating scale and present the number of cases you need to treat to come to this conclusion; please remove this sentence.

253Blumenfeld and Bargar described a cup-in-cup technique in which a large tantalum
254acetabular shell was placed onto supportive host bone in a cementless fashion and a
255smaller shell was cemented into the larger one, using the technique to restore offset in
256severe acetabular defects^[24]. There was no evidence of loosening or migration at an
257average follow-up of 28 months (range from 12 to 50 months). Based on the
258aforementioned report, we developed a cup-on-cup technique to reconstruct the type
2593 * ROMANB acetabulum bone defects. A smaller shell rode on the superomedial

批注 [39]: Please replace: "Blumenfeld" instead of "Blumenfeid"

260region of a larger one, instead of smaller shell was implanted into the larger one. The
261larger shell was reconstructed into the true acetabular region, which make it possible
262that the large head was used in the revision THA.

批注 [40]: "our"

批注 [41]: I know what you are presenting in your paper, but I do not understand the meaning of this sentence; please revise and make clearer

批注 [42]: Do you mean "... put into the true acetabular region"?

263 The cup-on-cup technique achieved better clinical results in our study, but two
264concerns existed with this technique. One was the TM particulates, which were
265caused by reaming the TM-cup augment rim, which may have an effect on the friction

266interface and may result in the increasing wear of the highly cross-linked polyethylene
267liner. During the surgical procedure, we used copious physiological sodium chloride
268solution to repeatedly wash off the particulates to minimize the damage. The other
269concern was the durability of the cementation between the augment and the acetabular
270component. We used a screw to fix the augment and acetabular component by making
271additional screw holes in the acetabular component or the TM-cup augment, which
272may prevent the failure of the cementation.

273 Additionally, cost may be a factor in the reconstruction of severe bone defects.
274The cost of the cup-on-cup technique was lower than that of using two conventional
275TM augments to reconstruct severe superomedial defects in China.

276 We acknowledge the limitations of our study. The first limitation is the
277retrospective design. Ideally, a randomized controlled trial should be performed
278comparing this type of reconstruction with other techniques, such as a structural
279allograft. Second, there was a very small number of patients in our study. Third, the
280follow-up was short, and further results are unknown.

281Conclusions

282 The cup-on-cup technique was an excellent choice to reconstruct severe
283superomedial defects and restore the normal hip COR. We will continue to use the
284technique and follow the patients to obtain long-term clinical results.

285Data availability

286 The data used to support the findings of this study are included within the article.

287Conflict of interests

批注 [43]: Do you expect higher PE wear (but also Ceramic !) after your revision THA when you've used the burr intraoperatively? If yes, I agree! And that's I would never use the burr to drill or shape Ta intraoperatively; you should not continue to recommending such doing anymore!

批注 [44]: Please revise:
"We judge our cup-on-cup technique to be an excellent choice ..."

批注 [45]: Please revise:
"... restore the level of the normal hip center of rotation."

288 The authors declare that they have no conflict of interests.

289 **Funding statement**

290 This work was performed by National Key Research and Development Program
291 of China (N.O.2017YFB1104104).

292

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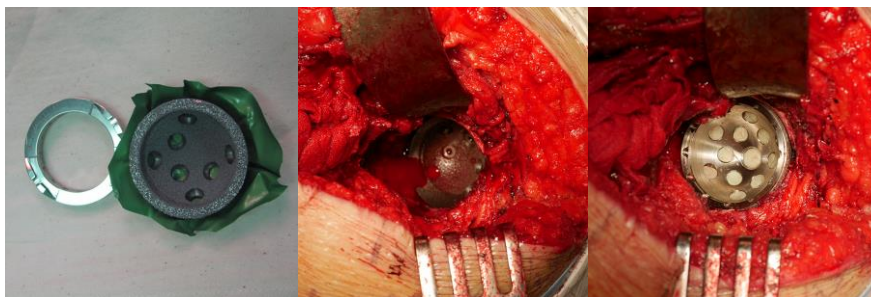
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Fig 1 The surgical Technique. **A** A TM revision shell was removed from the peripheral titanium ring. **B** The TM-cup augment was used to reconstruct defects during operation and the TM-cup augment rim was reamed. **C** A Pinnacle acetabular cup was implanted.

批注 [46]: This is unclear; please revise;
My suggestion is:
"... and the bone above the TM-cup augment was reamed to catch the final cup" or something like that.

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Fig 2 29-year-old man with posttraumatic acetabular fracture and recurrent infection.

批注 [47]: Do you mean
"posttraumatic acetabular defect"?
A posttraumatic fracture would mean an another fracture

A Pre-operative radiograph. **B** Post-operative radiograph showing reconstruction with the cup-on-cup technique. **C** At the 36-month follow-up, the implants were stable.

批注 [48]: "our"

Table 1. Patient demographics data

Patient	Age (years)	Gender	Height (cm)	Weight (kg)	Initial diagnosis	Prior surgeries
1	73	F	157	53	Femoral neck Fracture, Lt.	2014 THA
2	57	F	152	73	Osteonecrosis, Lt.	2006 THA
3	29	M	180	98	Posttraumatic acetabular comminuted fracture, Lt.	2012.09.21 Internal fixation, 2012.09.29 debridement×3(2012.09, 2012.10, 2014.09), 2015.01 debridement+ Antibiotic-PMMA beads
4	60	F	160	65	Osteonecrosis, Lt.	2002 THA
5	67	M	178	82	Osteoarthritis, Rt.	2005 THA
6	69	F	157	69	Osteoarthritis, Rt.	2009 THA

F: female, M: male, Lt: left, Rt: right, THA: total hip arthroplasty, PMMA: polymethyl methacrylate.

Table 2. Implants used

Patient	TM-Cup augment diameter (mm)	Acetabular component	Total number of screws	Liner	Femoral head diameter (mm)
1	48	54mm Pinnacle	3	HXLPE	36
2	52	58mm Pinnacle	3	ceramic	36
3	48	58mm TM revision shell	5	HXLPE	36
4	50	56mm TM	4	HXLPE	32

		revision shell			
5	52	60mm Pinnacle	4	HXLPE	36
6	48	58mm TM revision shell	5	HXLPE	36

TM: trabecular metal, HXLPE: Highly Cross-Linked Polyethylene.

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Table 3. Comparisons of studies reporting reconstructions for Paprosky type acetabulum bone defects with tantalum metal augments

Study	Number and Paprosky type	Reconstruction technique for defects	Mean follow-up	Mean post-operative hip score	Failure resulting from aseptic loosening	Other complications requiring reoperation
Lingaraj et al ^[8]	17 A 6 B without pelvic discontinuity	21 TM shell-augment 1 TM shell alone 1 acetabular component-cage	41 months (range, 24 to 62)	Harris hip score 75.7 (range, 53 to 100)	0	2 recurrent instability, 1 early infection with irrigation and debridement
Sporer et al ^[9]	28 A	The TM shell-augment in all cases	3.1 years (range, 1 to 4)	The modified Merle d'Aubigne and postel 10.6	0	1 recurrent instability
Gaizo et al ^[10]	37 A	The TM shell-augment in all cases	60 months (range, 26 to 106)	Harris hip score 81.5 (range, 27.0 to 99.8)	1 (2.7%)	5 recurrent instability, 4 infection with irrigation and debridement, 2 periprosthetic femoral fracture
Grappiolo et al ^[11]	42 A 13 B without pelvic discontinuity	The TM shell-augment in all cases	53.7 months (range, 36 to 91)	Harris hip score 90.5 (range, 61 to 100)	3 (5.5%)	1 recurrent instability
Current study	6 B without pelvic discontinuity	The cementless acetabulum component and TM-Cup augment in all cases	42.5 months (range, 36 to 52)	Harris hip score 80.7 (range, 71.5 to 87.5)	0	1 greater trochanteric migration

TM: trabecular metal.