Removal of a Well-Fixed Cementless CLS Expansion Cup

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Summary: The purpose of this technical note is to present a novel technique to remove a well-fixed uncemented cementless System expansion acetabular cup; the technique is on the basis of its 6 flaps design. The use of metal cutting high-speed burr allows to dismantle the cup, piece by piece, by cutting each of the flaps from the dome portion of the implant, this facilitates the extraction of each piece from the bone bed while preserving host bone. Because the bone bed of the acetabulum is carefully prepared a new uncemented hemispherical cup may be implanted after removal of the cementless System expansion cup.

Key Words: acetabular cup—spotorno cup—total hip arthroplasty.

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The cementless System (CLS) uncemented total hip replacement system was designed by Lorenz Spotorno in 1984[1] and extensively used in Europe over the past 2 decades. In Mexico and other Latin American countries, it was a popular implant throughout the 90s and 2000s.[2,3]

Even though the stem has reported excellent long-term results in multiple published series, there is a high incidence of revision because of the failure of the cup. The cup has been reported to fail because of the breakage of the metal backing or severe polyethylene wear.[4–7]

The CLS cup consisted of an expansion shell, in the shape of a flattened hemisphere made of titanium alloy (Protasul 100, Ti-6Al-7Nb, Developed by Sulzer-Protek between 1978 and 1982 and approved for clinical use in 1985).[8] The shell was divided into 6 independent flaps that were joined at the dome portion of the implant. Each one of the flaps had 3 rows of 3 titanium spikes designed to engage the host bone. In later models, the outer surface of the shell was grit-blasted.[5] The outer diameter of the shell was slightly larger than the last reamer used. The shell was implanted in a "compressed" manner into the prepared acetabulum. To compress the 6 independent flaps a cup positioner that held each flap from the rim of the cup and tightened them together was used to deliver the cup into the acetabulum taking care to position it adequately regarding inclination and anteversion. With the implant in place, the positioner was removed that caused the flaps to expand because of the memory of the material. A metallic conical cup expansor was then introduced into the inner cup threads to further expand the cup producing the spikes on the outer surface of the flaps to engage in the acetabular bone. The expansor was then removed and a corresponding size liner was screwed into the inner threads of the cup (these inner threads were designed to expand the cup with the corresponding expansor and were also the locking mechanism for the polyethylene liner). The rim of the polyethylene liner had 6 peripheral holes designed to engage a screw-in tool.

The most important factor determining the success of acetabular cup revision is to preserve the remaining host acetabular bone stock, maximizing the contact of the new implant with living host bone to obtain a much favorable biological environment for osteointegration of the new implant and also a maximum degree of biomechanical stability for implant support.

We present a bone preserving removal technique for a well-fixed CLS expansion cup with polyethylene wear, which is on the basis of the design characteristics of the cup.

THE PROBLEM

Cementless cups usually consist of a titanium hemisphere with an outer rough surface for bone integration and an inner surface that houses a locking mechanism for the polyethylene liner. In the case of severe polyethylene wear with a well-fixed shell, a simple liner exchange may be performed.[9] If the liners for the specific cup are not available, then a modern liner may be cemented within the well-fixed titanium shell.[10] In the case of the CLS expansion cup, new replacement liners are not available in many markets and there is also the risk of failure of the shell because of the breakage of the flaps therefore removing the implant may be the best option.[5]

SURGICAL TECHNIQUE

In this example, we have a case of a well-fixed uncemented CLS right total hip replacement. The cup was revised because of severe polyethylene wear, with the titanium expansion cup was well fixed into the bone. An uncemented hemispherical cup with screws was used for revision (Fig. 1).

A direct lateral approach was used for exposure. After dislocation of the prosthesis, circumferential exposure of the rim of the CLS expansion cup was performed.

Using a high-speed lateral effect cutting burr (Midas Rex Legend Metal Tapered-Footed F2/8TA23), one of the peripheral holes of the polyethylene liner was expanded to accommodate a pencil tip impactor, the impactor was introduced into the expanded hole and tapped in a counterclockwise direction to unscrew the polyethylene liner from the fixed metal shell (Fig. 2). The inner surface of the well-fixed CLS cup was exposed. The most lateral flap of the cup was identified and a metal cutting burr (Midas Rex Legend Metal Cutter MC30) was used to cut this flap from the dome section of the implant, a thin osteotome was then used to remove the flap from the bone bed, leaving the rest of the flaps and the dome part of the cup fixed into the acetabulum. Removal of the mentioned flap also exposed de lateral bone-implant interface of the adjacent flaps that facilitated access to it (Fig. 3).

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The authors declare no conflict of interest.

For reprint requests, or additional information and guidance on the techniques described in the article, please contact Carlos Suarez-Ahedo, MD, at drsuarezahedo@gmail.com or by mail at National Rehabilitation Institute of Mexico, Adult Joint Reconstruction Service, Av. México-Xochimilco 289, Col. Arenal de Guadalupe, Mexico City 14389, Mexico. You may inquire whether the author(s) will agree to phone conferences and/or visits regarding these techniques.

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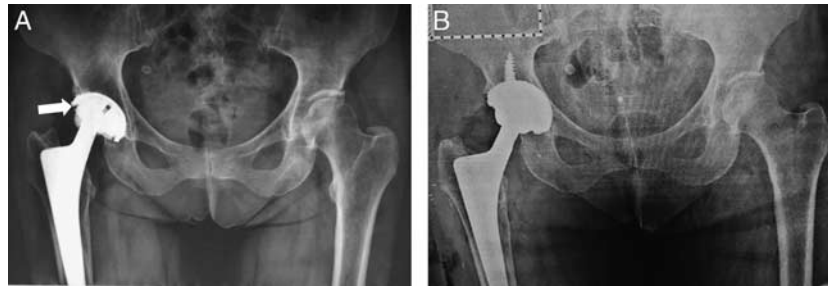

FIGURE 1. A, Preoperative AP pelvis view, a CLS uncemented total hip is on the right side. The white arrow points to a worn-out polyethylene liner in a well-fixed expansion shell. B, Postoperative AP pelvis view demonstrating an uncemented cup fixed with 2 screws. Note minimal bone loss after revision. A 32-mm head was used for the exchange. AP indicates anteroposterior; CLS, cementless System.

All 5 remaining flaps were subsequently removed using the same technique. Initially, cutting the flaps attachment to the dome section with the high-speed metal cutting burr, and then using the thin osteotome to remove the flap from the bone bed. After the removal of all the flaps was completed, the central dome portion was removed (Figs. 4, 5). When the cuts of the titanium shell are performed irrigation with saline solution is very important to prevent the generation of excessive heat during the process. After removal of the implant was completed, the acetabulum was carefully reamed using standard reamers taking care to preserve host bone. With the preservation of the acetabular columns and adequate host bone stock good press-fit technique using a cementless hemispherical cup can be achieved, similar to what happens with a primary cup fixation situation. Acetabular screws can be used to increase the initial stability of the cup in most of the revision cases. An uncemented press-fit hemispherical plasma-sprayed titanium cup with 2 screws was then reimplanted.

DISCUSSION

The aim of this technique is to cause minimal damage to the host acetabular bone stock while removing the well-fixed expansion cup. In the case of a well-fixed CLS expansion cup, standard techniques for cup removal may not adequately function because of the design of the cup. Cup extractors like the Explant system (Zimmer) are designed to cut the bone-implant interface with minimal bone loss, this is the case when a hemispherical cup is being removed. Because of the rows of spikes in each of the flaps of the CLS expansion cup, the afore-mentioned device may remove too much bone between the base of the outer shell surface and the tip of the spikes.

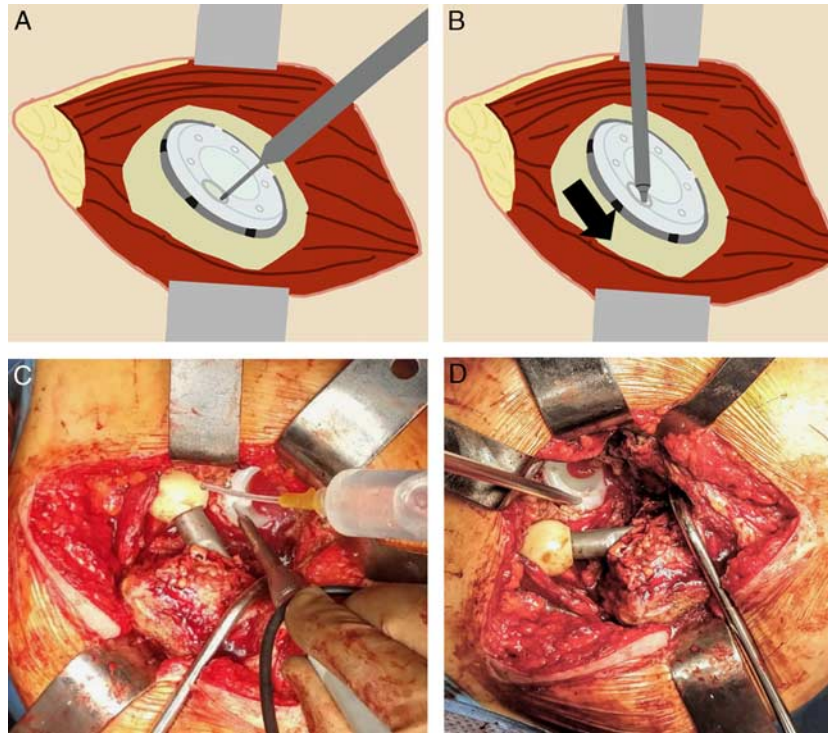

FIGURE 2. Schematic representation of removal of a polyethylene liner from a CLS expansion cup (A, B). A, A high-speed burr is used to expand one of the insertion holes to accommodate a pencil tip impactor. B, A pencil tip impactor is used to tap the liner from the expanded hole in a counter clock direction (black arrow) to unscrew the liner. C, Surgical photograph demonstrating one of the insertion holes at the liner rim as it is expanded with a high-speed burr. D, Surgical photograph demonstrating a pencil tip impactor as it taps the liner to unscrew it from the shell. CLS indicates cementless System.

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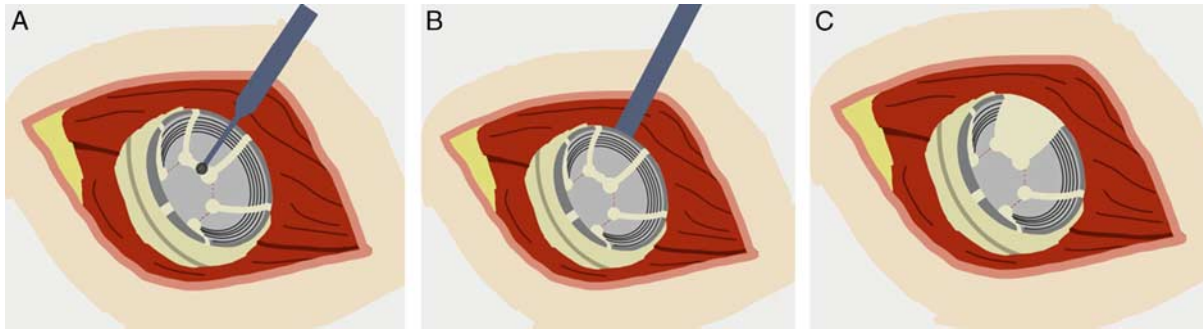

FIGURE 3. Schematic representation of the technique for cutting and removing a flap from a CLS expansion cup. A, A metal cutting burr is used to cut the flap from the center portion of the shell. B, A thin osteotome is used to remove the flap from the bone bed. C, With the flap removed access to the lateral interfaces of the adjacent flaps is also obtained. All of the flaps are subsequently cut off away from the dome area and removed with the same technique (red dots). CLS indicates cementless System.

Engaging the full hemisphere of the cup may be complicated by the spikes themselves and the flat dome cup design may also difficult to cut bone from the superior dome.

Because the cup is constructed in a relatively thin titanium alloy and the flaps are only fixed to the rest of the implant at the dome area, the cup can be removed by cutting each flap independently and disengaging them from their interface in separate pieces. Once the first flap is removed, the process is even easier because access is obtained to the lateral aspect of the interface of each one of the flaps. The dome portion of the cup is easy to

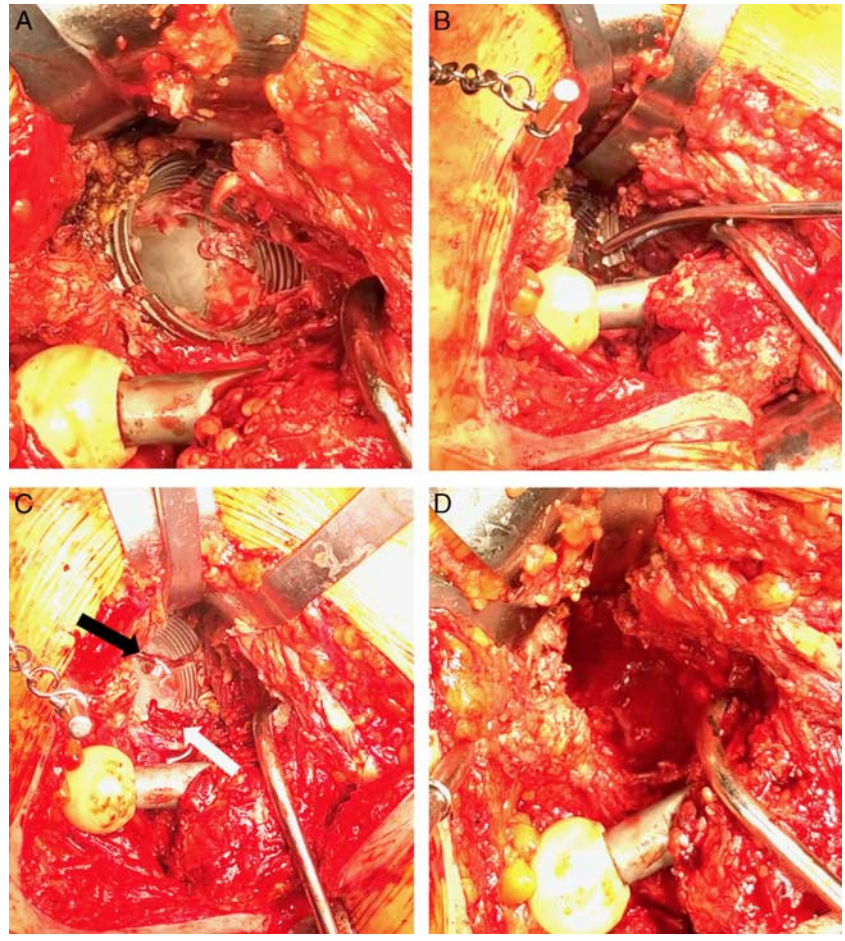

FIGURE 4. Series of surgical photographs demonstrating the removal of a well-fixed CLS expansion cup. A, The CLS expansion cup after removal of the polyethylene liner, note how the rim was fully exposed. B, One of the flaps as it is removed from the field with a Kocher clamp. C, The 2 most inferior flaps and the dome portion of the shell are visible (the rest of the implant was already removed). The black arrow points at the cut between the dome area and one of the remaining flaps. The white arrow points at the bone bed as it was exposed after removal of the cup flap in that section. D, The acetabular bone bed after complete removal of the implant, note how the acetabular rim was fully preserved. CLS indicates cementless System.

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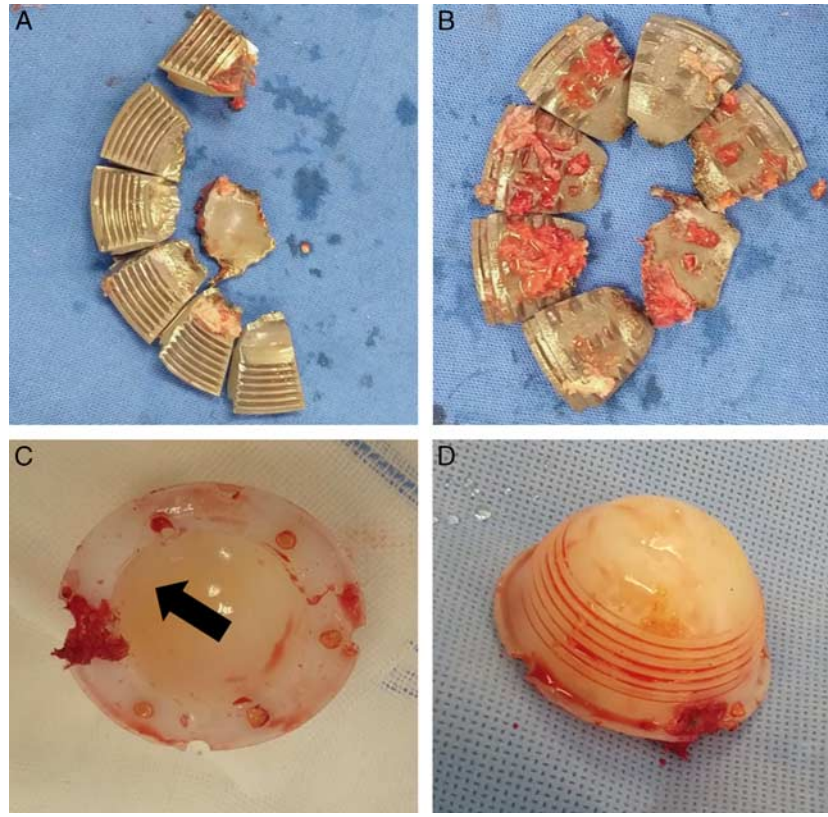

FIGURE 5. Photographs of the removed implants. A, Inner surface of the 6 flaps and the dome area. Note the tread pattern inside the flaps. B, Outer surface of the 6 flaps and the dome section. There are bone and fibrous tissue attached to some of the flaps. Note the 3 rows of 3 spikes in each of the flaps and the grit-blasted surface. C, The photograph demonstrates the inner surface of the polyethylene liner. The black arrow points to the worn area of the material. To the left, the burred surface at one of the rim holes is observed. D, Outer surface of the polyethylene liner, note the treads used to fix the liner to the shell.

remove after all the flaps have been extracted. Metal cutting high-speed burs are needed to perform the cuts of the titanium material connecting the existing slots with care not to cut too deep into the host bone. Because the burr may become dull over the process, having 2 or 3 metal cutting burrs may be advisable. Irrigation while performing the cuts should be always done to prevent excessive heat generation during the process. After the implant is removed from the acetabulum, we must ensure the preservation of the posterior column during the reaming in preparation of a new cementless hemispherical cup. The objective is to achieve biomechanical stability with an adequate press-fit technique with supplementary screws. Although the extent of viable host bone required to contact a cementless cup remains controversial, it is critical to prepare carefully with standard reamers until we can assure at least 70% of host acetabular bone contact for biomechanical stability. In cases when this cannot be achieved, other techniques ranging from the use of morselized bone graft, structural graft support, and trabecular metal inserts for augmented cup support have been described.

REFERENCES

1. Spotorno L, Romagnoli S, Ivaldo N, et al. The CLS system. Theoretical concept and results. *Acta Orthop Belg*. 1993;59(suppl 1):144–148.
2. Cario Méndez AG, Robles Uribe A, Figueroa Gama RA. Artroplastía total de cadera tratada con acetábulo CLS. *Rev Mex Ortop Traum*. 2000;14:452–456.
3. Macedo CA, Scheidt RB, Palma HM, et al. Spotorno® total hip arthroplasty. *Acta Ortopédica Brasileira*. 2008;16:217–222.
4. Chotai P, Siddaraju VKM, Shon WY, et al. Catastrophic rupture of a CLS spotorno acetabular expansion cup in a metal-polyethylene total hip arthroplasty: a case report and review of literature. *J Orthop*. 2011;8:e3.
5. Heilpern G, Parker B. The CLS uncemented expansion cup: six cases of component failure. *HIP Int*. 2004;14:28–33.
6. Callaghan JJ, Kim YS, Brown TD, et al. Concerns and improvements with cementless metal-backed acetabular components. *Clin Orthop Relat Res*. 1995;311:76–84.
7. Raymond PR, Gaston RD, Thomas MG. Uncemented total hip arthroplasty using the CLS Stem: a titanium alloy implant with a corundum blast finish. *J Arthroplasty*. 1996;11:286–292.
8. Semlitsch M, Weber H, Steger R. 15 years experience with the Ti-6Al-7Nballoyt for joint protheses. *Biomed Tech*. 1995;40:347–355.
9. Petis SM, Kubista B, Hartzler RU, et al. Polyethylene liner and femiral head exchange in total hip arthroplasty: factors associated with long-term success and failure. *J Bone Joint Surg Am*. 2019;101:421–428.
10. Stamenkov R, Neale SD, Kane T, et al. Cemented liner exchange with bone grafting halts the progression of periacetabular osteolysis. *J Arthroplasty*. 2014;29:822–826.

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