Arthroplasty Today 3 (2017) 164–166

Contents lists available at ScienceDirect

Arthroplasty Today

journal homepage: http://www.arthroplastytoday.org/

Surgical technique

Novel cemented cup-holding technique while performing total hip arthroplasty with navigation system

Hirokazu Takai, MD *, Tomoki Takahashi, MD, PhD

Department of Orthopaedic Surgery, Kumamoto Kinoh Hospital, Kitaku, Kumamoto, Japan

ARTICLE INFO

Article history:
Received 11 July 2016
Received in revised form
30 August 2016
Accepted 1 September 2016
Available online 6 October 2016

Keywords:
Total hip arthroplasty (THA)
Cemented cup
Navigation system

ABSTRACT

Recently, navigation systems have been more widely utilized in total hip arthroplasty. However, almost all of these systems have been developed for cementless cups. In the case of cemented total hip arthroplasty using a navigation system, a special-ordered cemented holder is needed. We propose a novel cemented cup-holding technique for navigation systems using readily available articles. We combine a cementless cup holder with an inverted cementless trial cup. The resulting apparatus is used as a cemented cup holder. The upside-down cup-holding technique is useful and permits cemented cup users to utilize a navigation system for placement of the acetabular component.

Introduction

Recently, navigation systems have been generally utilized in total hip arthroplasty (THA), and good results have been reported [1,2]. However, almost all these navigation systems have been developed for cementless cups. Cemented cups cannot be utilized in THA with a navigation system because they are not frequently used and are difficult to be held. We propose a novel cemented cup-holding technique for THA with a navigation system that uses a conventional ready-made cementless cup holder.

Surgical technique

The apparatuses and materials used were cemented cup (X3 RimFit cup, Stryker, Mahwah, NJ), cementless cup holder, cementless trial cup, and computed tomography–based navigation system (Stryker). All these were ready-made articles.

Normally, a cementless cup is attached to the cementless cup holder as shown in Figure 1a. In our technique, the cementless cup holder and cementless trial cup were used upside down (Fig. 1b). Fortunately, the outside of the marginal bump (Fig. 2a: white arrow) of the cemented cup has good conformity to the inside of the cementless trial cup margin. In this article, 54-mm cementless trial cup had suited 54-mm cemented cup (Fig. 2b). With this system, after the real cemented cup is opened, the best-fit trial cup should be sought. It is better to check if the trail cup matches the real cup size before the implantation. During the cementing of the implant, the upside-down cup holder can be used to keep and control the cemented cup at adequate angles (Fig. 2c). Then, THA could be performed with the navigation system as per usual practice (Fig. 3).

The patient was informed that we would use this technique and the data concerning the operation would be submitted for publication, and she provided consent.

Discussion

Inadequate component positioning during THA can result in bony/implant impingement, limited range of motion, dislocation, leg-length discrepancy, and muscle weakness, ultimately leading to patient dissatisfaction. Therefore, precise and appropriate implantation is considered essential for good outcome [3-5]. However, exact placement every time of the component is impossible. In recent years, numerous computer navigation systems have been introduced in order to optimize implantation accuracy in THA, with many authors reporting good results [1,2]. Unfortunately, almost all navigation systems have been developed not for cemented cups but for cementless cups.

No author associated with this paper has disclosed any potential or pertinent conflicts which may be perceived to have impending conflict with this work. For full disclosure statements refer to http://dx.doi.org/10.1016/j.artd.2016.09.001.

* Corresponding author. 6-8-1 Yamamuro, Kitaku, Kumamoto 860-8518, Japan. Tel.: +8 196 345 8111.
E-mail address: hirokazoid@hotmail.co.jp

http://dx.doi.org/10.1016/j.artd.2016.09.001

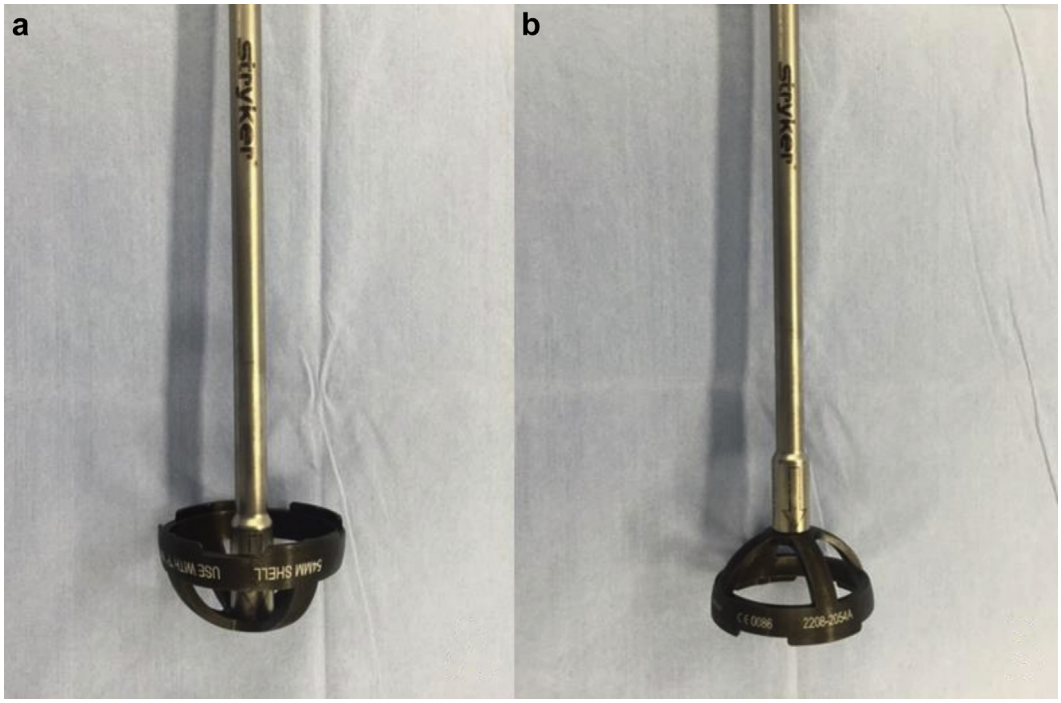

Figure 1. (a) Normal way of attaching the cementless trial cup to the navigation holder. (b) Attaching the cementless trial cup upside down. Upside-down cup-holding technique.

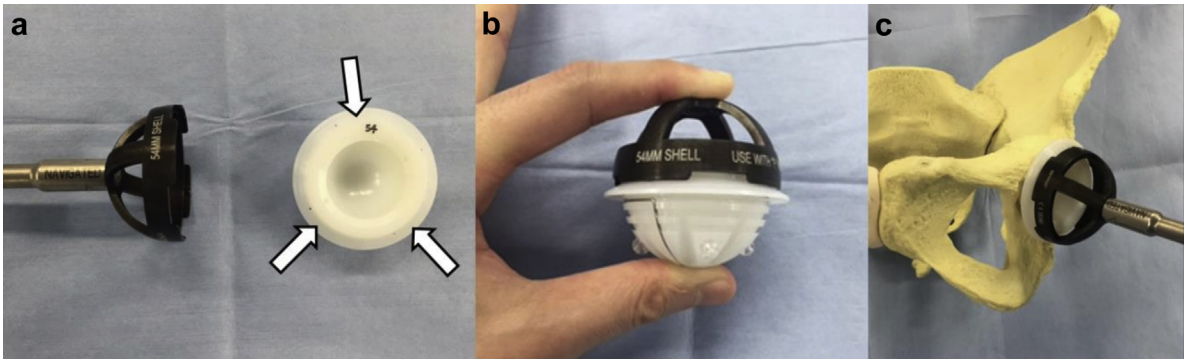

Figure 2. (a) The white arrows indicate the marginal bump of the cemented cup. (b) The size of the marginal bump of the cemented cup has good conformity to the inside of the cementless trial cup margin. A 54-mm cementless trial cup had suited a 54-mm cemented cup. (c) The upside-down cup holder can be used to keep and control the cemented cup to adequate angles.

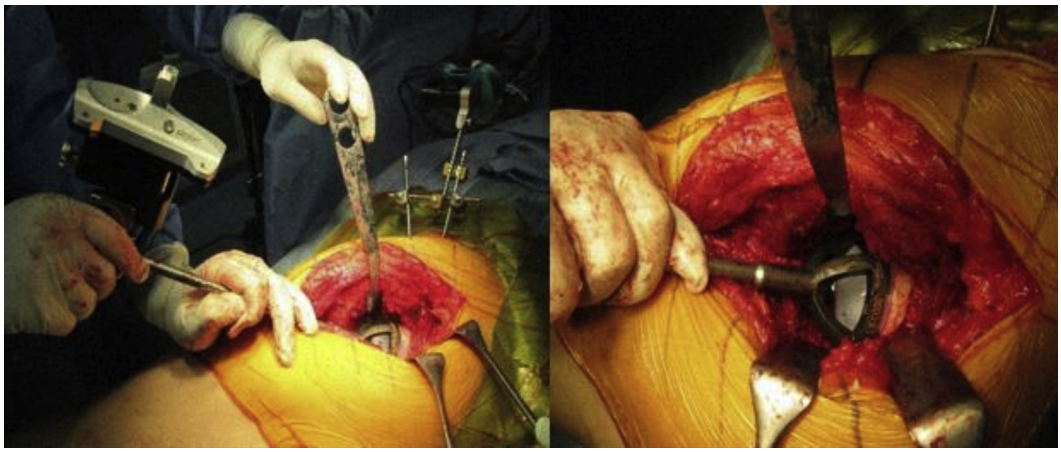

Figure 3. Intraoperative photograph of using the upside-down cup-holder technique with the navigation system.

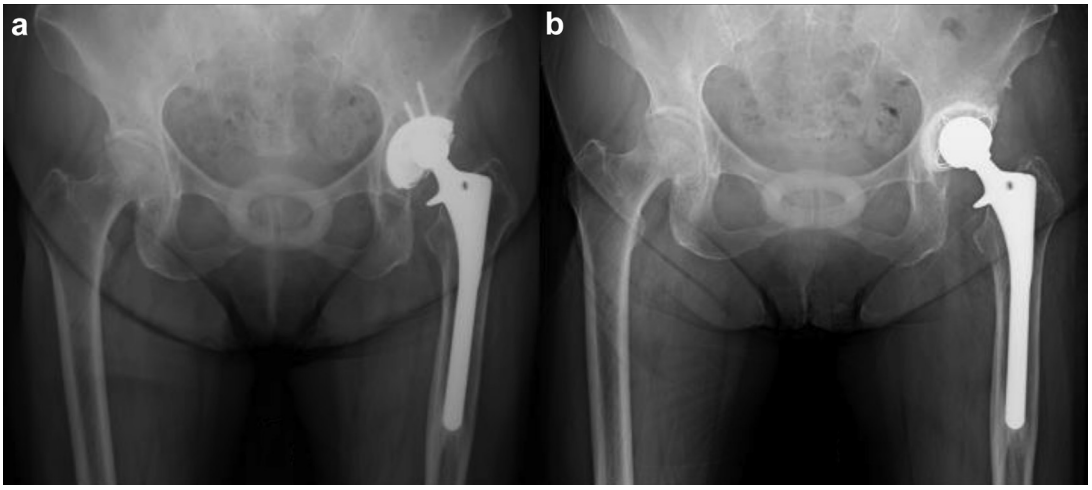

Figure 4. (a) A preoprative radiograph of the primary total hip arthroplasty with a cementless cup, obtained 15 years after implantation. (b) A postoperative radiograph of revision THA with a cemented cup using the upside-down cup-holder technique with the navigation system.

We focused on the marginal bump of the cemented cup (Fig. 2a). Fortunately, the outside of the marginal bump of the cemented cup has good conformity to the inside of the cementless trial cup margin in this product (Fig. 2b). Thus, it depends on the shape of the cemented cup that whether this upside-down cup-holding technique can be utilized or not. Only neutral cemented cups can be used with this technique, however, elevated liner cups cannot. It is also the limitation of this article that we have not tested the other shaped cemented cups manufactured by other companies.

The advantage of our technique is that all the materials are ready made and it does not require any special apparatus. Undoubtedly, the upside-down cemented cup holder cannot hold the cup as rigidly as a normal cementless cup holder can; however, rigid holding of the cup is not absolutely necessary in the cemented implantation during THA. No matter how carefully the operator checks the angle on the monitor of the navigation system, a minor error invariably results at every time of impact on the cementless cup [6]. By contrast, a cemented cup is easily controlled to the most adequate angle by moving the holder slightly while watching the monitor of the navigation system before the cement sets. In this sense, the cemented cup may be more suitable for the navigation system compared to the cementless cup.

Furthermore, the combination of the cemented cup and navigation system is more useful for revision cases [7,8]. A massive bone defect is sometimes caused by the removal of the primary implanted cup; in that case, the frequency of using a cemented cup has increased. A navigation system is more necessary owing to the lack of standard landmarks of the pelvis for adequate implantation in revision cases. We can attain adequate cemented cup implantation by using the navigation system even in revision cases (Fig. 4).

An important point in using the upside-down cup-holding technique is that it allows for determining which cementless trial cup best fits the actual implant before cementing it. Moreover, it is most important to know that the upside-down cup-holding technique can control only cup anteversion and inclination and cannot be used to determine the implantation depth of the cemented cup by using the navigation system.

We need further investigation to elucidate the accuracy or the long-term outcome in this technique.

Summary

The upside-down cup-holding technique is simple and permits cemented cup users to utilize a navigation system for THA using only readily available articles. This is believed to yield a good result in THA.

References

[1] Iwana D, Nakamura N, Miki H, et al. Accuracy of angle and position of the cup using computed tomography-based navigation systems in total hip arthroplasty. Comput Aided Surg 2013;18(5-6):187.
[2] Sugano N, Takao M, Sakai T, Nishii T, Miki H. Does CT-based navigation improve the long-term survival in ceramic-on-ceramic THA? Clin Orthop Relat Res 2012;470(11):3054.
[3] Dorr LD, Malik A, Dastane M, Wan Z. Combined anteversion technique for total hip arthroplasty. Clin Orthop Relat Res 2009;467:119.
[4] Lewinnek GE, Lewis JL, Tarr R, Compere CL, Zimmerman JR. Dislocation after total hip-replacement arthroplasties. J Bone Joint Surg Am 1978;60:217.
[5] Widmer KH, Zurfluh B. Compliant positioning of total hip components for optimal range of motion. J Orthop Res 2004;22:815.
[6] Chawda M, Hucker P, Whitehouse S, et al. Comparison of cemented vs uncemented acetabular component positioning using an imageless navigation system. J Arthroplasty 2009;24(8):1170.
[7] Kuroda K, Kabata T, Maeda T, et al. The value of computed tomography based navigation in revision total hip arthroplasty. Int Orthop 2014;38(4):711.
[8] Nakamura N, Nishii T, Kitada M, Iwana D, Sugano N. Application of computed tomography-based navigation for revision total hip arthroplasty. J Arthroplasty 2013;28(10):1806.