

Hug Flap and Hamdi Hammock: Two Innovative Techniques for Enhancing Aesthetic Outcomes in Deep Inferior Epigastric Artery Perforator Breast Reconstruction

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Background: Achieving optimal aesthetic outcomes in deep inferior epigastric artery perforator (DIEP) flap breast reconstruction remains a challenge, often necessitating additional procedures for refinement. This study presents two innovative techniques (the hug flap and Hamdi hammock) aimed at enhancing breast projection and inframammary fold (IMF) definition in DIEP flap reconstruction.

Methods: The hug flap technique uses de-epithelialized caudal mastectomy skin to augment breast projection, whereas the Hamdi hammock uses a percutaneous purse-string suture to define the IMF. A retrospective review of 782 patients who underwent DIEP flap breast reconstruction between 2007 and 2023 was conducted.

Results: The hug flap group required significantly less additional fat grafting compared to other techniques (11% versus 27% and 22%). No total flap losses occurred in the hug flap group, and fat necrosis rates were low. The Hamdi hammock was used in 405 patients with a mean of two lipofilling sessions. Complications were minor and no stitches required removal.

Conclusions: The hug flap and Hamdi hammock techniques offer effective and safe methods for enhancing breast projection and IMF definition in DIEP flap reconstruction. These techniques may reduce the need for additional procedures and improve aesthetic outcomes. (*Plast Reconstr Surg Glob Open* 2024; 12:e6218; doi: 10.1097/GOX.0000000000006218; Published online 4 October 2024.)

INTRODUCTION

Breast cancer remains the leading cause of cancer among women worldwide, with significant mortality and morbidity. In 2020, it accounted for 2.3 million new cases and 685,000 deaths, with projections suggesting an increase to over 3 million cases and 1 million deaths by 2040.¹ The aftermath of treatments, such as mastectomy, significantly affects breast aesthetics, emphasizing the importance of reconstruction techniques that focus on patient satisfaction through the restoration of natural breast symmetry, thereby enhancing quality of life.²⁻⁴

The deep inferior epigastric artery perforator (DIEP) flap has emerged as the gold standard for autologous

breast reconstruction⁵ due to its ability to re-create an aesthetically pleasing breast and natural appearance and feel⁶ with long-term results.^{7,8} Historically, patient selection for DIEP flap reconstruction was more restrictive due to concerns about limited donor tissue, but advances in techniques now enable successful DIEP flap breast reconstruction in a wider range of patients, including those with lower body mass index (BMI) or prior abdominal procedures.⁹ However, since its introduction to the field of breast reconstruction, challenges persist in attaining the ideal aesthetic, often necessitating multiple procedures for enhancement of the volume, improvement of the projection, and definition of the inframammary fold (IMF).¹⁰ This approach is underpinned by the understanding that breast aesthetics are not universally defined but are influenced by individual patient anatomy, cultural perceptions, and personal preferences.^{11,12}

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Although the DIEP flap offers great outcomes in breast reconstruction, individual anatomy and patient preferences require customization to achieve the “ideal” result. Previously we have discussed in great detail the value of the “Ghent approach,” a three-step principle for breast shaping utilizing three key elements: the footprint, the conus, and the skin envelope of the breast.⁸ In line with this triptych, in this article we describe advancement practices we utilize in everyday practice that target two vital aspects of breast aesthetics: the projection and the IMF refinement.

METHODS

In this section, we describe two techniques we use frequently to achieve optimal aesthetic results in specific DIEP cases. These techniques are the hug flap and the Hamdi hammock.

The Hug Flap

Achieving sufficient central prominence, or “core projection,” is imperative for achieving an aesthetically pleasing breast form. While implant-based reconstruction remains prevalent, autologous methods tend to yield higher patient satisfaction due to their natural appearance and feel.¹³ Unlike implants, autologous tissue may lack intrinsic core projection, necessitating strategic surgical techniques to enhance this key aspect of breast shape during reconstruction. The “hug flap” (HF) technique is a straightforward and effective method for augmenting the projection of the breast during the inset of the DIEP flap.¹⁴ This technique involves utilizing the de-epithelialized caudal mastectomy skin to create the HF by folding the lateral and medial wings over the central part.

The surgical procedure begins by removing the entire mastectomy scar and de-epithelialization of the mastectomy skin. The surgeon also makes an incision across the IMF to allow for smooth positioning and stitching of the DIEP flap (Fig. 1A). Next, the medial and lateral portions of the de-epithelialized flap are lifted, with the central portion left attached to the underlying muscle fascia to preserve blood supply from muscular perforators and subcutaneous tissues. An incision is made along the preoperative marking of the IMF to allow for proper flap inset and edge suturing. (Fig. 1B). The base of the flap is typically 6-cm wide and centered at the breast meridian. A key step involves folding the flap in on itself like a criss-cross pattern. The medial third folds over the superior aspect of the middle section, whereas the lateral third folds over the inferior aspect (Fig. 1C). This doubles the thickness of the skin and creates more volume and projection in the lower central part of the breast. If even greater projection is desired, the medial and lateral wings of the flap can be further wrapped around and secured with absorbable sutures for additional augmentation (Fig. 1D). Finally, the DIEP flap is placed, and the HF is used to create the natural breast ptosis.

The Percutaneous Purse-string Suture

The IMF delineates the breast’s inferior border, and establishing a well-defined one is vital for symmetric and aesthetically pleasing outcomes in breast reconstruction.

Takeaways

Question: How can breast projection and inframammary fold definition be optimized in deep inferior epigastric artery perforator (DIEP) flap breast reconstruction?

Findings: In a retrospective review of 782 DIEP flap reconstructions, the hug flap technique significantly reduced the need for additional fat grafting compared with other methods. The Hamdi hammock, used in 405 patients, effectively defined the inframammary fold with minor complications.

Meaning: The hug flap and Hamdi hammock techniques are safe and effective methods for enhancing aesthetic outcomes in DIEP flap breast reconstruction, potentially reducing the need for additional procedures.

Although traditionally performed via open incision for direct IMF visualization,^{15–17} the percutaneous purse-string suture (Hamdi hammock) offers an innovative, minimally invasive technique for IMF creation and enhancement¹⁸

Two 2.0 polydioxanone sutures (PDS) are threaded around the breast footprint, based on the patient’s unique anatomy (Fig. 2). Small stab incisions using a 19-gauge needle or 15-blade scalpel are made, starting in the axilla for concealment of the final suture knot. The inferior stab holes should be placed below the intended IMF, depending on the amount of tissue recruitment from the upper abdomen (typically between 1 and 4 cm, usually around 2 cm). The suture is placed retrograde through a curved lipofilling cannula and tunneled subcutaneously (Fig. 3). In the first pass, it travels superficially under the deep dermis along the IMF and just superficial to the pectoralis muscle at the breast’s upper pole. The second pass runs deeper, along the breast’s lateral side and IMF and deep to the pectoralis major muscle along the superior pole. After the two passes, the sutures are tightened in a controlled-tension manner to achieve desired IMF definition and projection. Knots are buried deep subcutaneously under the lateral aspect of pectoralis toward the axilla. The incisions are closed with 5-0 nylon and dressed with Tegaderm, and Microfoam tape is placed to support the new breast shape. This technique facilitates recruitment of surrounding tissue as required to supplement final shape achieved through fat grafting. The whole process is demonstrated in Video 1. [See Video 1 (online), which shows the Hamdi hammock (percutaneous purse-string suture) technique for inframammary fold creation and enhancement of breast projection in DIEP flap breast reconstruction.]

For fat harvesting, we used a pulse-assisted 3-mm diameter Mercedes cannula (Mentor, Johnson & Johnson) connected to drain bottles. The harvested fat was processed using the Coleman technique. For fat injection, we used a 800-300 Khouri Injector, 14G x 15 cm, Curved, Luer Lock (Marina Medical Inc).

RESULTS

Our study included a total of 782 patients who underwent delayed breast reconstruction using free

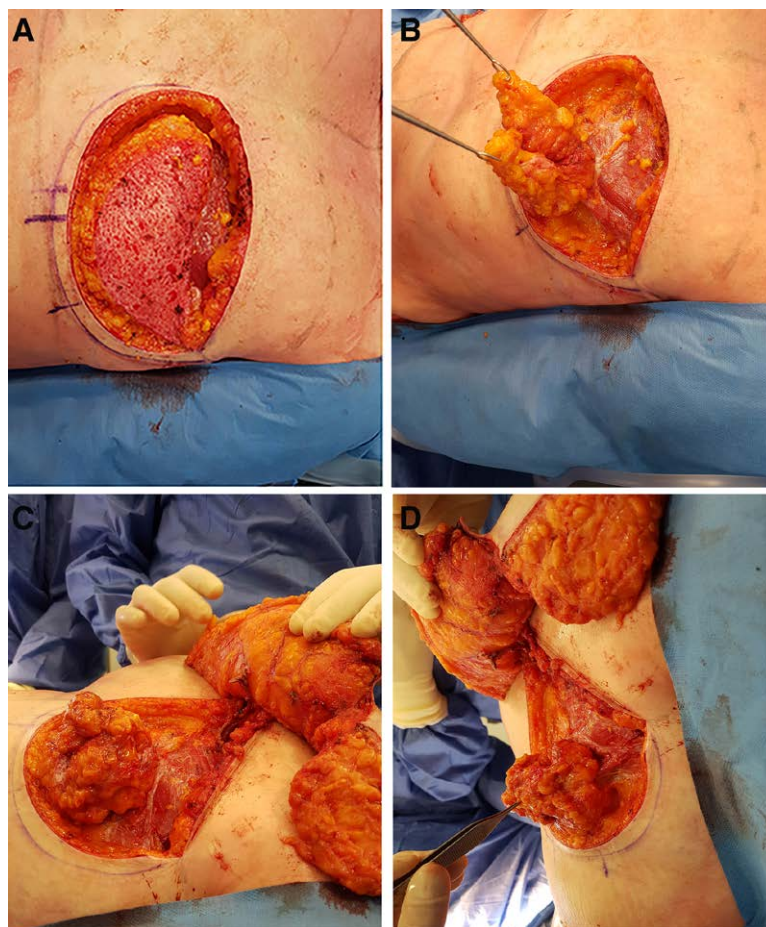


Fig. 1. Four photographs demonstrating the basic steps of the technique. A, Mastectomy scar excision, IMF marking, and skin de-epithelialization. Note the outlined caudal mastectomy skin zone that will be used to create the hug flap. B, Elevation of the hug flap. The de-epithelialized mastectomy skin flap is raised while maintaining its central base attachment to underlying muscle fascia to preserve blood supply derived from muscle perforators and the subcutaneous plexus. C, The hug flap in place. Notice the flap's criss-cross configuration. This helps centralize volume and augment projection in the lower pole of the reconstructed breast. D, Wrapping around the medial and lateral wings provides additional augmentation when greater projection is desired. In this example, this technique provided an extra 4 cm of projection to the flap's lower pole.

abdominal perforator flaps between 2007 and 2023. The HF technique was used in 151 cases, whereas de-epithelialization was used in 325 cases and undermining in 306 cases. [Table 1](#) summarizes the distribution of patients, fat grafting rates, and complications across these groups. Notably, the need for additional fat grafting was significantly lower in the HF group (11%) compared to the de-epithelializing (27%) and undermining (22%) groups. Overall complication rates were low across all groups, with a slightly lower rate in the HF group (2%) compared with the other techniques (3% each). Another importance notice is that there were no instances of total flap loss in the HF group. The HF technique was noted for its ability to enhance breast projection without the need for multiple revision procedures.

Since June 2011, the Hamdi hammock has been utilized in a total of 405 patients. This technique was used either in conjunction with lipofilling only (87 patients) or as part of flap breast reconstruction (318 patients). Mean age of the patients was 48 years (range, 29–68). A mean of two lipofilling sessions (range, 1–5) were performed. Eighty-one (20% of total) patients required a second Hamdi hammock procedure. The technique is mainly performed once only when it is used to enhance flap projection and/or to define the IMF fold. While 20% of patients were identified as potentially benefiting from a second hammock procedure, only 8% elected to proceed with the revision. The remaining 12% reported satisfaction with their results and chose not to undergo further surgery. Postoperative complications were minor. Four patients reported significant pain resolving within



Fig. 2. Stab holes are made with a 15-blade scalpel around the breast footprint. Two PDS sutures will be guided subcutaneously through these holes. The inferior stab holes should be placed below the intended IMF, depending on the amount of tissue recruitment from the upper abdomen (between 1 and 4 cm, usually around 2 cm). Illustration by Dr. Lisa Ramaut, used with permission.

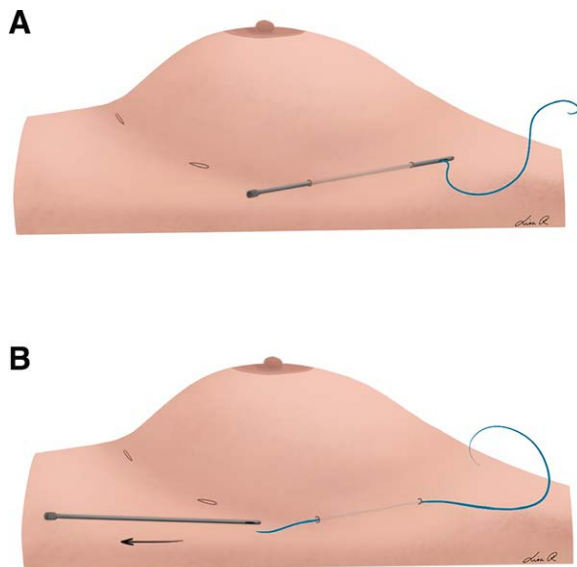


Fig. 3. A, The lipofilling cannula is inserted through the second axillary incision and passed subcutaneously to exit through the highest incision. It is flushed with normal saline to remove tissue remnants. B, The suture is inserted about 8 cm into the cannula tip before the cannula is withdrawn, pulling the suture through the trajectory in a retrograde fashion. This is repeated until the suture is placed around the circumference of the breast. Illustrations by Dr. Lisa Ramaut, used with permission.

3 weeks. Three thin patients had a palpable suture knot without exposure or infection. The average follow-up period was 40 months, ranging from 11 to 69 months.

Table 1. Summary of Patient Distribution, Fat Grafting Rates, and Complications by Reconstruction Technique

Technique	No. Patients	Fat Grafting Rate	Complications
Hug flap	151	11% (17)	2% (3)*
De-epithelializing	325	27% (88)	3% (10)†
Undermining	306	22% (67)	3% (9)†
Total	782	22% (172)	2.8% (22)

*Complications in the hug flap group included minor wound healing issues (2 cases) and seroma formation (1 case).

†Complications in the de-epithelializing and undermining groups included partial flap necrosis (3 cases each), wound dehiscence (4 cases in de-epithelializing, 3 cases in undermining), and hematoma formation (3 cases in de-epithelializing, 3 cases in undermining).

Of note, thus far, no stitches had to be removed, as PDS reaches complete resorption after 200 days, time that allows the newly positioned tissues enough time to adhere. Seven percent of the patients who presented with persistent skin tethering during the follow-up period were treated with rigotomies using a large 19-gauge needle and fat grafting, oftentimes under local anesthesia as day cases.

For both techniques, the average volume of fat transferred per session was 90 mL (range: 40–180 mL), with the specific volume tailored to each patient’s individual needs and tissue availability. The average number of fat grafting sessions was 1.8 (range: 1–3). Postoperative complications related to fat grafting were minimal. We observed fat necrosis requiring surgical intervention in three patients (1.7% of fat-grafted cases), which was successfully managed with limited excision. Minor contour irregularities were noted in eight patients (4.7% of fat-grafted cases) and were corrected with additional fat grafting during subsequent revisions. No cases of infection or oil cyst formation were recorded.

Case 1

A 49-year-old female patient with a BMI of 24 kg per m² presented for secondary autologous breast reconstruction following a previous mastectomy of left breast. A DIEP flap was used to achieve the desired breast reconstruction. The flap, weighing 540g, was meticulously shaped utilizing the HF technique to optimize symmetry and projection. The successful outcome resulted in the restoration of the breast mound without the requirement of supplementary fat grafting (Fig. 4).

Case 2

A 49-year-old woman with a BMI of 26 kg per m² underwent reconstruction of the left breast using a free DIEP flap. Postoperatively, she presented with a malpositioned IMF and lack of volume in the lower pole. The Hamdi hammock technique was used to redefine the IMF, and lipofilling was performed to augment the lower pole volume. The patient is shown in the supine position on the operating table, with the new IMF marked preoperatively based on the contralateral side. Intraoperative lateral and oblique views demonstrate a well-defined IMF and improved lower pole volume following the procedure (Fig. 5).

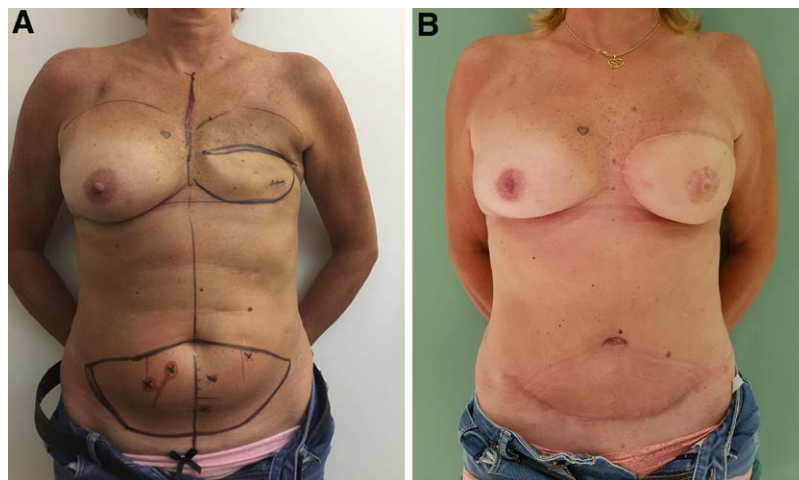


Fig. 4. Secondary breast reconstruction in a 49-year-old patient with DIEP flap and the hug flap technique achieved symmetrical projection without fat grafting. A, Preoperative. B, Two-year postoperative result.



Fig. 5. A 47-year-old woman who underwent reconstruction of the left breast by means of a free DIEP flap presented with a malpositioned IMF and lack of volume in the inferior pole. A, Preoperative picture showing the malpositioned IMF and volume deficit in the inferior pole of the right breast. B, Preoperative markings in which the new footprint is defined based on the contralateral side. The malpositioned IMF is marked in black color. Intraoperative lateral (C) and oblique (D) views of the end result using the Hamdi hammock and augmentation, with 90 mL of lipofilling demonstrating a well-defined IMF in correct level. The old IMF and retracted lower pole were released using extensive subcision.

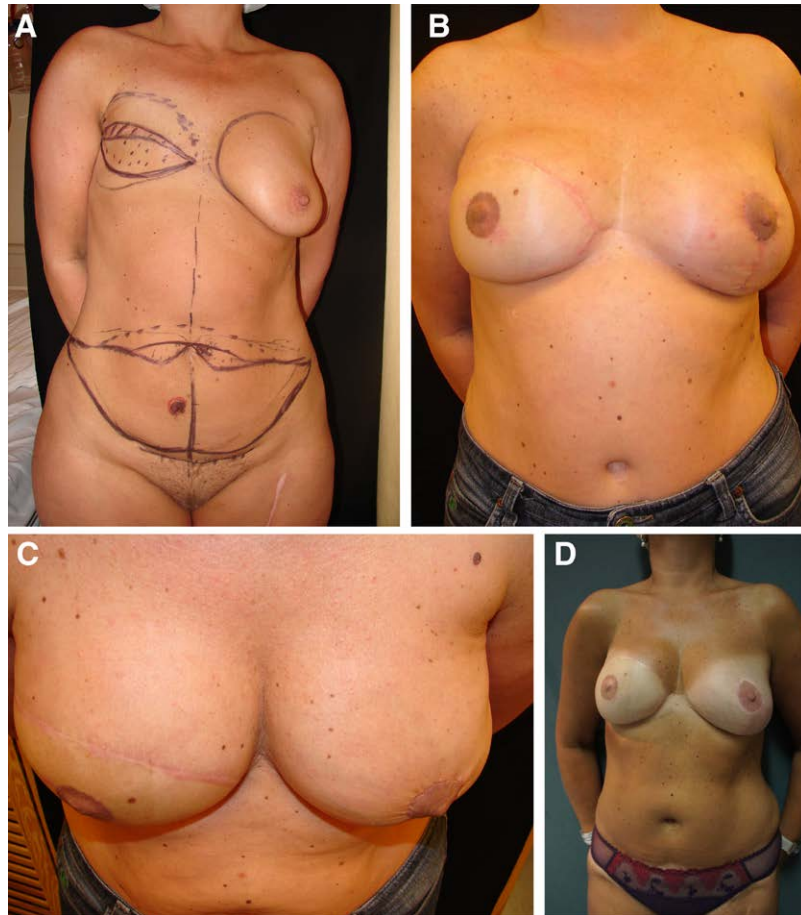


Fig. 6. Long-term outcomes of DIEP flap breast reconstruction using the hug flap technique, fat grafting, and Hamdi hammock. A, Preoperative view of a patient seeking delayed breast reconstruction using a DIEP flap and hug flap technique. The patient had fat grafting and Hamdi hammock technique in a second stage. Photographs of the patient in anteroposterior (B) and bird's eye (C) views demonstrate initial symmetry and equal breast projection. D, Same patient at 7-year follow-up, highlighting long-term results and IMF definition.

Case 3

A 47-year-old female patient, with a BMI of 23 kg per m², sought delayed right breast reconstruction following a previous mastectomy. A DIEP flap was chosen for the reconstruction procedure. To enhance breast projection and achieve optimal symmetry, the HF technique was used during the initial DIEP flap surgery. Subsequent refinements included fat grafting and the Hamdi hammock technique for optimal inframammary fold definition. Follow-up over a seven-year period demonstrates a successful, long-lasting outcome with excellent patient satisfaction (Fig. 6).

DISCUSSION

The evolution of breast reconstruction techniques reflects an increasing focus on achieving optimal aesthetic outcomes that significantly impact patients' quality of life.¹⁹ Although the DIEP flap has become a gold standard in autologous breast reconstruction, challenges persist in attaining ideal aesthetics, often necessitating

multiple procedures for volume enhancement, projection improvement, and IMF definition.²⁰

Various approaches have been developed to enhance DIEP flap outcomes, including anthropomorphic measurements,⁸ preoperative shaping patterns,²¹ mathematical formulas,²² three-dimensional analysis,^{23,24} and intraoperative techniques.^{15–17, 25,26} However, these methods often lack long-term validation or require specialized equipment and expertise. Our study introduces two innovative techniques—the HF and Hamdi hammock—designed to address these challenges.

The HF technique, utilizing de-epithelialized caudal mastectomy skin, simplifies the process of achieving optimal breast volume and shape. Our results in 151 cases demonstrate its efficacy and safety, with no observed instances of fat necrosis or increased DIEP flap-related complications. However, meticulous surgical technique is crucial to avoid potential complications such as pedicle rotation or kinking.

The Hamdi hammock offers a minimally invasive approach to IMF definition, enhancing overall breast

shape and projection. Both techniques are relatively easy to execute, requiring no specialized equipment beyond a traditional lipofilling cannula, and allow for adjustments in follow-up sessions if needed.

Although our experience shows promising results, we acknowledge the limitations of our study. The absence of a randomized controlled trial against established methods limits our ability to draw definitive conclusions about superiority. Future research should focus on comparative studies and long-term follow-up.

The success of these methods depends on careful patient selection, considering factors such as mastectomy skin quality and quantity, donor site tissue availability, and patient expectations. Contraindications include inadequate skin or tissue, active smoking, and medical comorbidities that increase surgical risk.

Enhanced aesthetic outcomes in breast reconstruction positively impact patients' psychological well-being and overall quality of life.^{3,19} By providing tools to achieve more natural-looking and symmetrical breast reconstructions, the HF and Hamdi hammock techniques have the potential to significantly contribute to patients' postmastectomy recovery and satisfaction.

CONCLUSIONS

The evolution of aesthetic refinements in DIEP flap shaping and modeling reflects a nuanced understanding of breast reconstruction's complexities. The HF and Hamdi hammock techniques, along with the strategic use of lipofilling, represent significant advancements in our ability to achieve natural-looking, symmetrical breast reconstructions postmastectomy. By addressing the limitations of previous methods and focusing on the individual needs of patients, these innovations offer hope for improved quality of life and satisfaction among breast cancer survivors. As we continue to refine these techniques and explore new avenues for aesthetic enhancement, the collaboration between surgeons, patients, and researchers remains vital in the ongoing quest for excellence in breast reconstruction.

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DISCLOSURE

The authors have no financial interest to declare in relation to the content of this article.

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