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The "Needle-splint" Technique: A Method of Accurate Apposition and Eversion during Microvascular Anastomosis

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Summary: We present the "needle-splint" technique, a microsurgical suturing technique that enhances micro-suturing technique, while ensures finer apposition and vessels walls eversion during the placement of sutures in microvascular anastomosis. This report demonstrates the usefulness of this technique in simple interrupted, continuous-interrupted, or multi-loops microsurgical suturing. It further allows direct visualization of the intra-wall-edges space and intimal sutures surface and could be utilized as a safety stabilizer to errors as it allows optimal vessels alignment while the needle curvature is acting as a "pusher" to separate the posterior wall during knot tying. *(Plast Reconstr Surg Glob Open 2020;8:e2611; doi: 10.1097/GOX.0000000000002611; Published online 17 January 2020.)*

INTRODUCTION

Ensuring end-to-end or end-to-side apposition in microvascular anastomosis is often initially taught through the simple interrupted suture technique. A multitude of suture techniques have since been proposed to enhance both efficiency and economy of technical maneuvres in microvascular anastomosis.[1,2] The authors present a novel technique, the "needle-splint" (NS) technique that leverages the already described continuous-interrupted suturing technique but ensures finer apposition and eversion during the placement of sutures in microvascular anastomosis.

TECHNIQUE

The NS technique is performed during the placement of the last few sutures in end-to-end or end-to-side microvascular anastomosis. It involves a further "bite" through both anastomosis vessel walls, while the needle is used as a "splinting" tool to enable stable eversion and accurate apposition and further acting as a "pusher" of the posterior wall during knot tying (Fig. 1).

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Step-by-Step

1. A gap in between previously places sutures is identified for the NS technique, always starting from the furthest/most difficult position, according to anastomosis set-up.
2. A new full-length suture is then selected (appropriate to the size of the vessel being anastomosed).
3. The continuous interrupted suture technique is employed with multiple concentric loops created through passing the suture through both vessel walls.
4. Before tying and cutting the loops, a further bite is taken of both vessel walls—the splint.
5. The splint is manipulated to ensure stable eversion and meticulous apposition between both vessel walls.
6. Once apposed and everted to the satisfaction of the operator, the loops are then cut and tied with further manipulation of the splint as needed.

DISCUSSION

The success of a sutured microvascular anastomosis is fundamentally technique dependent. Technical refinements and considerations aim to minimize the need for intraoperative revisions and prevent postoperative complications.[3] Surgical maneuvres during micro-suturing potentially predisposing to failure are related to exposition of adventitia and media in the neo-lumen, luminal occlusion linked to inversion of either walls or eversion, and neo-anastomosis wall thickening when adventitia is grabbed within the surgical knots. Further, instrument-tissue interaction and traumatic or non-meticulous tissue handling also influence microsurgical outcomes.[4] Onoda et al[5] demonstrated that small vessel end-to-end anastomosis is related to

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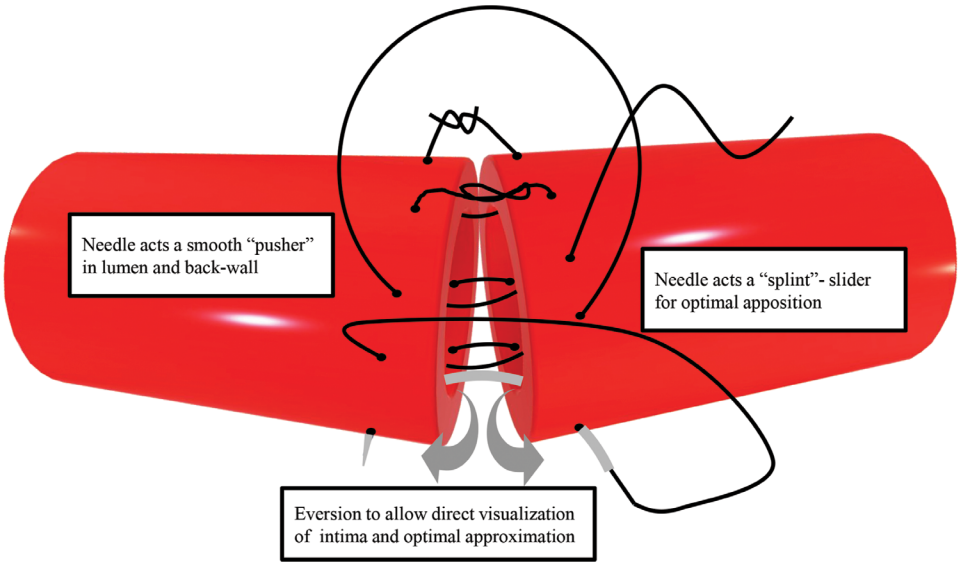

Fig. 1. Illustration of end-to-end microvascular anastomosis with 4 completed interrupted sutures and 2 multi-loops, utilizing the continuous-interrupted micro-suturing technique, enhanced by the NS technique; demonstrating optimal apposition, eversion, and "pusher" role while maintaining direct visualization of the intimal surfaces.

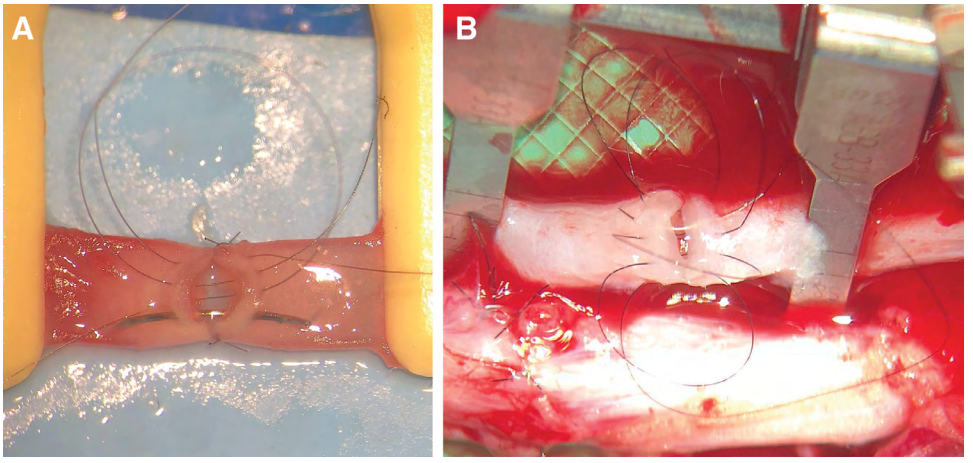

Fig. 2. A, The needle acting as an eversion splint to the vessel's walls while a second, third and fourth consecutive interrupted-continuous loops are demonstrated with the needle-splinting technique. B, End-to-end ulnar artery anastomosis performed via the NS enhanced continuous interrupted micro-suturing technique.

endothelial layer misalignment, leading to exposure of the sub-endothelial layers and is directly related to technical errors. Improved economy of surgical maneuvres has been demonstrated with the continuous, interrupted-continuous or the "airborne" techniques and consequently reduction in surgical ischemia and overall operating time, while demonstrating similar patency rates.[6–8]

This report demonstrates the usefulness of the NS technique in simple interrupted, continuous-interrupted, or multiple-loops microsurgical suturing. It further allows direct visualization of the intra-wall-edges space and intimal surface. The NS technique can be utilized as a safety stabilizer to prevent major errors (ie, back-wall stitch) as it allows optimal vessels alignment while the needle curvature is acting as a "pusher" to separate the posterior wall during knot tying. (Fig. 2)

Potential complications of the technique have been considered as being related to environmental factors or set-up, operator factors, and the size of selected needle or suture. The technique requires a moist environment to ensure appropriate glide of the needle through the vessel wall and prevent tears. When manipulating threads and driving the needle, if appropriate care is not taken, there is a potential risk of "cheese-wire" tears through the intima. Finally, the selection of the needle size and suture must correspond to the size of the vessels being anastomosed to ensure optimal eversion, to account for variance in the size of needle attached to each suture.

CONCLUSION

The NS is a microsurgical suturing technique that allows accurate apposition and secure eversion during microvascular anastomosis.

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