INTRODUCTION

In plastic surgery, there is concern regarding deformations following suturing, such as dog-ear formation. Use of the fusiform ellipse excision technique is the standard method for excising skin tumors; it allows primary closure, resulting in a simple scar. To avoid dog-ear formation, the long axis of the fusiform ellipse should be ≥3 times the transverse dimension and the angle formed by the 2 lines at both ends should be <30°. We devised a pinwheel-shaped incision technique for skin tumor excision that could reduce the scar size.

METHODS

Patients

We included 50 patients [55 cases; 23 men and 27 women; mean age, 39.8 years (range, 9 months–91 years)] who underwent surgery using our pinwheel-shaped incision technique between January 2016 and December 2018. This study was approved by the Japanese Red Cross Akita Hospital ethics committee (no. 720), and written informed consent was obtained from the study participants, including consent to participate and to publish the findings.

Surgical Method

The suture line (l) was marked through the center (o) of the tumor and aligned with the skin lines, such as relaxed skin tension lines (Fig. 1). It is often necessary to slightly curve the suture line to follow the skin lines. On the line, points a and b were placed equidistant from o. The distance from a and b to o should be the same as the transverse diameter of the excision area surrounding the tumor. From a and b, 2 tangential lines were drawn to the excision area periphery on both sides of the tumor. On the excision area periphery, points a´ and b´ were placed, which were the middle points between the tangency points and intersection points of ao or bo. The final

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excision area was defined by the excision area periphery, tangential lines, and $a a'$ and $b b'$ that formed a pinwheel shape around the tumor. The tumor was initially resected along the pinwheel design, followed by dermis suturing at the center of the incision line. This technique allowed for a flexible first/center suture point within the target zone (red zone). The excessive skin arising on both sides of the suture line was trimmed. In most cases, the amount of the excessive skin to be removed after suturing was not the same on both sides. After trimming, the dermis and skin were sutured from both ends. This technique is shown in Video 1. (See Video 1 [online], which displays the technique of this method in 2 cases. The first is of a 13-year-old teenage boy with a forearm nevus, and the second case is of a 10-month-old boy with a nevus in orbital area, requiring a flexible first/center suture point.) The length-to-width ratio was calculated using the width before the operation and the suture length at the end of the operation.

**RESULTS**

Table 1 presents the details of all patients. The operation site was primarily the face, and the maximum tumor width was 48 mm. There were no postoperative complications, and no patient required reoperation because of dog-ear formation. The postoperative suture line length was $2.1 \pm 0.2$ (mean ± SD) times the tumor width.

**Case Report**

A 1-year-old boy had a nevus cell (18 × 11 mm) on the right side of the forehead. The pinwheel-shaped incision technique devised by us was used for tumor excision (Fig. 2A). The tumor was resected along the design, and then the dermis was sutured at the center of the incision line, which was determined with care to avoid right eyebrow distortion (Fig. 2B). After trimming the excessive skin arising on both sides, from both ends, sutures were placed. The suture line length was 23 mm, and the postoperative suture line length was 2.1 times the tumor width. The postoperative scar was inconspicuous 6 months following the surgery, with no eyebrow distortion (Fig. 2C).
DISCUSSION

The skin waste can reach up to 230% relative to the original circular area when using the fusiform ellipse excision. We observed that this excess skin resection is the reason for the long suture length. To avoid unnecessary skin resection, we did not perform complete resection during the first step; this helped in reducing the length-to-width ratio by 2.1 times on average (Table 1). The low skin waste helped reduce tension on the wound, leading to less scar expansion.

In fusiform ellipse excision, the wound closure direction is perpendicular to the major axis; sometimes the wound closure direction is unsuitable, particularly when the lesion to be resected is closer to a body part with a free edge such as eyelid and lip; therefore, it is necessary to consider the wound closure direction to avoid contracture deformity and distortion. This technique allows flexible wound closure without changing the suture line direction. In such a case, the first suture point deviates from the center point at the line and the suture line presents a slightly S-shaped curve. The S-shaped skin resection technique is sometimes used to change the wound closure direction, but the length of the suture line in our technique was shorter than that reported in the conventional S-shaped technique. In contrast, the figure-of-8 suture approach aims to shorten the suture line, wherein the wound closure direction is perpendicular to the major axis and there is a possibility of ischemia at the wound edge. As our technique does not need a special suturing approach, such as the figure-of-8 suture approach, it is unlikely to cause ischemia.

The essential step in our technique is suturing from both ends to the center after skin trimming because the lengths of the 2 lines from the end to the first suturing point are unequal. A wound with unequal sides can be closed by equally dividing the excised skin of the longer side without dog-ear formation. Such a suturing approach occasionally causes fine wrinkling around the suture line that usually disappears in 2 weeks. The only limitation of our new technique is that the surgical procedure is slightly prolonged compared with the conventional method.

CONCLUSIONS

Our novel pinwheel-shaped incision technique allows shortening of the length-to-width ratio compared with that required in the conventional method and helps avoid dog-ear formation. We successfully performed this technique and confirmed its usefulness.

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PATIENT CONSENT STATEMENT

Parents or guardians provided written consent for the use of the patients’ image.

REFERENCES

1. Charles HT. Techniques and principles in plastic surgery. In: Charles HT, Robert WB, Sherrell J, et al, eds. Grabb and Smith’s Plastic Surgery. 6th ed. Philadelphia: Lippincott Williams and Wilkins; 2007:3–14.
2. Jeffrey W, Norman W. Plastic surgery techniques. In: Bahman G, Elof E, John AF, eds. Plastic Surgery: Indications and Practice. Vol. 1, 1st ed. Philadelphia: Saunders; 2009:3–118.
3. Raveh Tilleman T, Tilleman MM, Krekels GA, et al. Skin waste, vertex angle, and scar length in excisional biopsies: comparing five excision patterns–fusiform ellipse, fusiform circle, rhomboid, mosque, and S-shaped. Plast Reconstr Surg. 2004;113:857–861.
4. Mizunuma M, Yanai A, Tsutsumi S, et al. Can dog-ear formation be decreased when an S-shaped skin resection is used instead of a spindle skin resection? A three-dimensional analysis of skin surgery techniques using the finite element method. Plast Reconstr Surg. 2000;106:845–848; discussion 849.
5. Raveh TT. Direct closure of round skin defects: a four-step technique with multiple subcutaneous and cutaneous “figure-of-8” sutures alleviation dog-ears. Plast Reconstr Surg. 2004;114:1761–1767.
6. Dog-ear repair and closure of sides of unequal length. In: Stegman SJ, Tromovitch TA, Glogau RG, eds. Basics of Dermatologic Surgery. Chicago, London: Year Book Medical Publishers; 1982:69–72.