A Prospective Comparison of Octyl Cyanoacrylate Tissue Adhesive (Dermabond) and Suture for the Closure of Excisional Wounds in Children and Adolescents

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Background: Recent studies suggest that the use of octyl cyanoacrylate tissue adhesive for closure of both traumatic lacerations and incisional surgical wounds results in a cosmetic outcome comparable to that achieved with conventional sutures. To date, no studies have looked at the use of tissue adhesive for higher-tension wounds, such as those created during cutaneous excisional procedures.

Objective: To compare the tissue adhesive octyl cyanoacrylate with standard suture for the closure of excisional wounds in children and adolescents.

Design: A prospective comparison with blinded assessment of cosmetic outcome. Twenty-eight wounds were closed with monofilament suture and 24 were closed with tissue adhesive. At approximately 2 months, photographs of the incisions were evaluated by 2 dermatologists blinded to the method of skin closure.

Subjects: Forty-two consecutive patients undergoing excisional dermatologic procedures at Children’s Hospital, San Diego, Calif. These 42 patients had a total of 52 wounds that were evaluated.

Main Outcome Measures: The cosmetic appearance of the wounds at 2 months, based on 2 validated wound scales: the Hollander Wound Evaluation Scale and a visual analog scale.

Results: There were no differences in early complications between the groups. The suture group scored higher on the visual analog scale (63.3 mm for suture vs 47.8 mm for tissue adhesive), and this difference was statistically significant ($P = .02$). The suture group also had a higher median score on the Hollander Wound Evaluation Scale, but this difference was not statistically significant ($P = .09$).

Conclusion: The cosmetic outcome of cutaneous excisional surgery wounds closed with standard suturing was found to be superior to that of wounds closed with octyl cyanoacrylate.

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The cyanoacrylate group of tissue adhesives has been studied for use in surgical procedures for over 40 years. These adhesives work by polymerizing in an exothermic reaction when contacting a fluid or basic medium, thereby forming a strong bond when applied to moist skin. For a number of years, the first widely used variety, N-butyl-2-cyanoacrylate, has been used safely throughout countries other than the United States. This particular adhesive is significantly less strong than conventional monofilament sutures and is not particularly flexible. More recently, a new tissue adhesive designed to address the limitations of the butyl-2-cyanoacrylate group, 2-octyl cyanoacrylate (Dermabond; Ethicon Inc, Norwood, Mass), has been approved by the Food and Drug Administration. Along with increased flexibility, 2-octyl cyanoacrylate has 4 times the breaking strength of N-butyl-2-cyanoacrylate, and it may therefore be indicated for use on a wider variety of wound types. In the United States, it is currently being used on children for the repair of lacerations, most often in the emergency department setting. Tissue adhesive is less time-consuming to apply than suture, leading to shorter, more efficient patient encounters with less need for nursing, monitoring, and sedation, resulting in lower costs to deliver care. In large studies, N-butyl-2-cyanoacrylate-repaired laceration wounds have been judged comparable to suture-repaired wounds in cosmetic outcome. In large studies, octyl cyanoacrylate has been shown to be a good alternative to conventional sutures for use on selected lacerations and incisions in both children and adults. Studies have taken place primarily in the emer-
SUBJECTS, MATERIALS, AND METHODS

SUBJECTS
Forty-two patients who underwent excisional dermatological procedures over a 2-year period were prospectively enrolled in the study. Diagnoses included congenital nevus, nevus sebaceous, blue nevus, compound nevus, pilomatrixoma, dermoid cyst, mastocytoma, lipoma, and hidradenoma. The parents and/or patients were offered the option of conventional sutures or tissue adhesive, and approximately the first 20 to accept the offer in each group were studied. All excisions and closures were performed by a board-certified pediatric dermatologist (B.B.C., I.F.E., S.F.F., or N.F.G.) at Children’s Hospital and Health Center, San Diego, Calif.

PROCEDURES
The protocol was approved by the institutional review board at Children’s Hospital and Health Center. Patients were enrolled and informed consent was obtained. All surgical procedures were conducted in a similar manner using an elliptical incision, and in both the octyl cyanoacrylate and standard suture groups, wounds were closed using deep subcutaneous sutures. The skin was then closed with either a standard monofilament suture (4-0 to 6-0, depending on the anatomic location) or tissue adhesive per manufacturer’s specifications. After the procedure was completed, polysporin ointment, skin closures, and a nonadherent dressing were applied to the wounds of the sutured patients. No ointments or dressings were applied in the tissue adhesive group. Some patients underwent staged 2-part excisions; therefore, they had 2 procedures and 2 wounds to be evaluated at different times. Patients were booked for postoperative appointments at 2 weeks and 2 months. All patients were given standard printed instructions regarding wound care, and patients in the tissue adhesive group were given the standard wound care instruction sheet provided by Ethicon Inc and telephone numbers to call at the Children’s Hospital Dermatology Department if they had any problems. Sutures were removed in 5 to 14 days depending on the anatomic location, and tissue adhesive was removed by the patient or physician in 7 to 10 days.

RESULTS

Fifty-two wounds were evaluated in 42 patients. All patients returned for follow-up after 2 weeks to be evaluated for early complications. Twenty-nine (69%) of 42 patients returned for a 2-month evaluation, so that 38 (73%) of 52 wounds were given a VAS score. Six (27%) of 22 patients did not return for the 2-month follow-up in the tissue adhesive group, and 7 (27%) of 26 patients did not return in the suture group.

The groups were similar with regard to age, operative procedure, and surgical site, but there were slightly more women and nonwhites in the suture group (Table 1 and Table 2). There were no early complications, such as dehiscence or wound infection, in either group.

There was a statistically significant difference in the blinded VAS cosmesis scores between the groups, with sutures scoring higher (63.3 mm for sutures vs 47.8 mm for tissue adhesive; \(P = .02\)). The suture group also had a higher median score on the HWES, although this difference was not statistically significant (6 for sutures vs 5 for tissue adhesive; \(P = .09\)). There were more hypertrophic scars in the tissue adhesive group (5 for tissue ad-
hesive vs 3 for sutures, $P = .45$), although this difference was not statistically significant.

**COMMENT**

The use of tissue adhesive as an alternative to sutures continues to gain acceptance for the treatment of lacerations and incisions in children. There have been no reports of toxicity or carcinogenicity related to topical use of cyanoacrylate adhesives, even though they have been used for many years. Moreover, octyl cyanoacrylate has now been used in the United States for almost 2 years, and studies have shown that it has a superior speed of application and that patients prefer it to sutures, with no reports of adverse effects.

There have been reports suggesting acceptable cosmetic outcome of wounds closed with use of tissue adhesives in repair of simple lacerations and surgical incisions under low tension. The use of octyl cyanoacrylate for closure of wounds under higher tension has been appropriately limited, as octyl cyanoacrylate only just approaches the tensile strength of a 5-0 suture. At this time, it is marketed as a replacement only for sutures that are smaller than 5-0 in diameter. We are unaware of the evaluation of wounds under higher tensions that have been closed with octyl cyanoacrylate. The scales used as outcome measures in this study have been proven to be valid outcome measures of cosmesis in laceration repair. Based on our results, it appears that the cosmetic outcome was significantly better in those treated with conventional sutures (Table 3). This was reflected both in a statistically significant difference in the VAS score in favor of the suture group and in a higher but not statistically significant HWES score for the suture group, with more patients achieving optimal cosmesis. A difference on the VAS of at least 12 to 15 mm has been shown to be the minimal clinically important difference, and the scars in the suture group in our study more than achieved this difference. A trend toward more hypertrophic scars was seen in the tissue adhesive group.
In this study, we hypothesized that sutures would be a superior means of closure compared with tissue adhesive because the wounds were under higher tension. Since octyl cyanoacrylate only approaches the strength of a 3-0 to 4-0 suture, it follows that any wound for which a 3-0 or 4-0 suture might be used would not be appropriate for tissue adhesive at its current strength, particularly when optimum cosmesis is a main concern.

There are several limitations to this study. Patients were not randomized, with the parents given the option to choose the method of skin closure. This may have led to undetected bias in the assignment of the type of closure. However, the study was performed prospectively, using consecutive patients all considered appropriate for tissue closure by either method by attending dermatologists with similar training in laceration repair. It is also important to note that use of tissue adhesive was not limited to the face and trunk, but also included higher-tension areas, such as the extremities. While there was no significant difference between treatment groups in trunk/extremity vs facial lesion distribution, the results may not be the same as they would be in a study limited to facial wounds under low tension. It is unfortunate that 100% follow-up was not achieved, although an equivalent number of patients was lost in each group. Finally, a criticism could be made that wounds were not evaluated long enough to determine ultimate cosmesis, yet histologic studies report no difference in wound healing characteristics between these 2 types of wounds, making it unlikely to see differences in a year that were not apparent at 2 months.

In conclusion, it is clear from the literature that cyanoacrylate derivatives, such as octyl cyanoacrylate, are safe and effective when used for appropriate lacerations and incisions. Based on this study, it appears that tissue adhesive may not be as effective in achieving optimal cosmesis for excisional wounds and wounds that are generally under greater tension, particularly those that would normally be closed with a 3-0 or 4-0 suture. At present, it seems appropriate to suggest that the use of octyl cyanoacrylate tissue adhesive in excisional procedures and higher-tension wounds be restricted to previous indications until large, randomized clinical trials can be conducted.

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REFERENCES


Table 1. Patient Demographics for the 2 Study Groups

<table>
<thead>
<tr>
<th></th>
<th>Tissue Adhesive</th>
<th>Suture</th>
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<tbody>
<tr>
<td>Mean age, y</td>
<td>7.0</td>
<td>7.7</td>
</tr>
<tr>
<td>Nonwhite, No. (%)</td>
<td>7 (32)</td>
<td>11 (42)</td>
</tr>
<tr>
<td>Female, No. (%)</td>
<td>10 (45)</td>
<td>17 (65)</td>
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Table 2. Sites of Operative Incisions for the 2 Study Groups

<table>
<thead>
<tr>
<th>Site</th>
<th>Tissue Adhesive, No. (n = 24)</th>
<th>Suture, No. (n = 28)</th>
<th>Total No. (%) (N = 52)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Face</td>
<td>2</td>
<td>5</td>
<td>10 (19)</td>
</tr>
<tr>
<td>Ears</td>
<td>0</td>
<td>1</td>
<td>1 (2)</td>
</tr>
<tr>
<td>Scalp</td>
<td>0</td>
<td>1</td>
<td>1 (2)</td>
</tr>
<tr>
<td>Neck</td>
<td>4</td>
<td>2</td>
<td>6 (12)</td>
</tr>
<tr>
<td>Trunk</td>
<td>11</td>
<td>7</td>
<td>18 (35)</td>
</tr>
<tr>
<td>Extremity</td>
<td>7</td>
<td>9</td>
<td>16 (31)</td>
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Table 3. Clinical Outcomes for the 2 Study Groups*

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Tissue Adhesive (n = 24)</th>
<th>Suture (n = 28)</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean VAS score</td>
<td>47.75</td>
<td>63.25</td>
<td>.02</td>
</tr>
<tr>
<td>Optimal wound score, No. (%)†</td>
<td>9 (37)</td>
<td>16 (57)</td>
<td>NA</td>
</tr>
<tr>
<td>Median HWES score</td>
<td>5</td>
<td>6</td>
<td>.09</td>
</tr>
<tr>
<td>Hypertrophic scar, No. (%)</td>
<td>5 (21)</td>
<td>3 (11)</td>
<td>.45</td>
</tr>
<tr>
<td>Infection, No.</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

*VAS indicates visual analog scale; HWES, Hollander Wound Evaluation Scale; and NA, not analyzed.†Patients who received the highest possible HWES score (6).