Cosmetic outcomes of various skin closure methods following cesarean delivery: a randomized trial

Antonella Cromi, PhD; Fabio Ghezzi, MD; Alessandra Gottardi, MD; Mario Cherubino, MD; Stefano Uccella, MD; Luigi Valdatta, MD

OBJECTIVE: The objective of the study was to compare scar quality associated with different types of wound closure methods after cesarean section (CS).

STUDY DESIGN: Patients were randomized to have skin closure following CS with either staples or 3 different types of subcuticular sutures. Scar quality was evaluated 2 and 6 months postoperatively. The Vancouver Scar Scale, the Patient and Observer Scar Assessment Scale (POSAS), and a visual analog scale were used as scar assessment tools.

RESULTS: Of the 180 patients who were recruited, 123 successfully completed the study. No difference in both subjective and objective scar rating was detected across groups at either 2 months or 6 months. In the overall study population, objective scores correlated with patient rating, and correlation was strongest between the observer and patient components of the POSAS (r = 0.48).

CONCLUSION: In women undergoing CS, stapled wounds and those closed with subcuticular sutures result in equivalent cosmetic appearance of the scar.

Key words: cesarean delivery, cosmesis, healing, scar assessment scales, skin closure


Every year several million women worldwide acquire an abdominal scar as result of a cesarean delivery. Obstetricians often consider skin closure after a cesarean section as a trivial aspect of the procedure, because the skin scar is deemed the normal and inevitable price we pay for tissue repair. Moreover, the anatomical location of cesarean scars, which hide easily beneath underwear, and the generally held belief that all transverse suprapubic incisions heal about equally well further contribute to the underestimation by practitioners of the importance of scar appearance to patients.

Young women place supreme importance on cosmetic outcomes, but scarring can also affect patients in terms of symptoms (pain, tenderness, and itching) and has the potential to have a negative impact on overall quality of life, being a source of considerable distress, loss of self-esteem, and stigmatization.1,2

The final appearance and function of the healed skin is dependent on patient and wound factors, which are often outside the control of a surgeon, and technical factors, which are completely within the control of the surgeon and include closure material and technique of skin apposition. Methods of skin closure after cesarean delivery vary widely between obstetricians and are largely the result of surgeon’s personal choice.3

Despite increasing emphasis on evidence-based practice, there are few reliable comparative data on which to base closure method selection.4,5 There are exceedingly few clinical trials specifically comparing the healing outcomes associated with different closure techniques,6-9 and most suffer from poor methodology, including lack of rater’s blindness to treatment assignment, use of the authors’ own assessment scales, and follow-up time too short for proper evaluation of the final appearance of the scars.

In an attempt to provide obstetricians with evidence-based guidance for the choice of suture technique after cesarean delivery, we designed a randomized trial aimed to compare scar quality associated with different types of wound closure methods, using standardized and validated assessment tools that incorporate both observer and patient scar ratings.

MATERIALS AND METHODS

A single-institution, randomized, multidisciplinary clinical trial was designed to compare healing outcomes of Pfannenstiel incision after cesarean delivery using different skin closure methods. Between October 2006–March 2008, women undergoing cesarean section for any indication who were at least 18 years old and literate in Italian language were offered participation in the study.

Exclusion criteria included history of keloids, previous transversal suprapubic scars, tattoos in the area to be studied, known patient hypersensitivity to any of the suture materials used in the protocol, and a medical disorder that could affect wound healing (eg, diabetes mellitus, se-
were malnutrition because of anorexia nervosa, disorders requiring chronic corticosteroid use).

Consenting patients were randomized to have skin closure of their cesarean section wound with either staples (disposable Weck Visistaple; Teleflex Medical, Research Triangle Park, NC) or subcuticular running suture selected among 1 of the following 3 options, each of which entailed the use of a 3.0-caliber suture: (1) a midterm absorbable monofilament suture (Monosyn; B Brown, Aesculap, Tuttingen, Germany); (2) a nonabsorbable monofilament suture made of polyamide polymers (Dafilon; B Brown); or (3) a short-term synthetic absorbable braided and coated suture made of low-molecular-weight polyglycolic acid (Safil Quick; B Brown).

Each patient was enrolled prior to the initiation of surgery and provided written informed consent to participate in this Research Ethics Board-approved study. All patients scheduled for an elective procedure were enrolled on admission on the morning of the procedure, whereas in case of cesarean delivery performed for emergency indications, participants were enrolled at the time that the decision to perform the procedure was made. Allocation to 1 of the 4 closure methods was on a 1:1 basis using a block-randomized computer-generated list. All participating surgeons were either attending obstetricians or senior residents and operated on patients in all skin closure groups.

A proportion of patients enrolled in the current study was included in a previous report from the study institution, addressing the method of expanding the uterine incision (blunt extension by separating the fingers in a transversal vs cephalad-caudad direction) at the time of cesarean delivery. With this only exception, the surgical steps up to the point of skin closure were accomplished in a standard fashion. Suture closure of subcutaneous fat was performed only in women with subcutaneous thickness of 2 cm or greater. The staples and nonabsorbable sutures were removed on the seventh postoperative day.

Follow-up included an initial appointment 8 weeks postoperatively, at which time initial healing results were evaluated and additional data regarding wound infection and any other adverse wound events were recorded. The cosmetic outcome of patient scars was assessed for a second time at 6 months after surgery. At each time point, the standardized scar assessment comprised the following: (1) classification of the scar using the categorization proposed by the International Advisory Panel on Scar Management; (2) objective scar rating using the Vancouver Scar Scale (VSS) and the observer component of the Patient and Observer Scar Assessment Scale (POSAS); (3) subjective scar rating using the patient component of the POSAS and a visual analog scale (VAS). A single observer, a plastic surgeon trained in the use of scar assessment scales, who was blinded to the method of skin closure, performed objective scar analysis.

In the Vancouver scale rated 4 physical characteristics of scars: vascularity, pigmentation, pliability, and height. Each variable contained ranked subscales that may be summed to obtain a total score ranging from 0–13, with 0 representing normal skin and 13 the worst scar. The Observer Scar Assessment Scale (OSAS) rated 5 variables: vascularity, pigmentation, thickness, relief, and pliability. Each variable used a 10-point scoring system, with 1 representing normal skin. Ratings of individual variables may be summed to obtain a total score ranging from 5–50, with 5 representing normal skin (Figure 2).

All patients, blinded to the observers’ scar rating, were asked to provide ratings of their scars using the patient component of the POSAS on the same day as the observers. The Patient Scar Assessment Scale (PSAS) consisted of 6 items on scar-related pain, itchiness, color, stiffness, thickness, and irregularity. Each item used a 10-point scoring system, summed to obtain a total score ranging from 6–60, with 6 representing normal skin with no associated symptoms. After these domains were scored, the patients were asked to rate their overall satisfaction with the appearance of their scars using a 10-point VAS, with 0 representing the worst and 10 the best expected appearance of their scars.

The primary outcome measure was POSAS summary score (PSAS and OSAS components) at 6 months postoperatively. Secondary outcome measures included VSS summary score and overall patient satisfaction assessed by a VAS.

At the time of study design, we carried out a systematic literature search in PubMed to identify studies of abdominal incision skin closure, and we were unable to find previously published data that we could use to make a reasonable assumption of the true effect size. Likewise, an estimate of the magnitude of cosmetic improvement for which patients would consider a change in treatment to be worthwhile was unavailable in the literature. Therefore, we performed a power analysis based entirely on a logical and realistic assessment of what could constitute a clinically important effect when evaluating surgical scar cosmesis.

We judged that it would make sense to test the clinically significant effect at a medium level of effect size. Sample size was calculated using a fixed-effects single factor design of F test (analysis of variance [ANOVA]) in *G*Power 3 software. Assuming α = 0.05, the probability of a β error = 0.20, and an effect size index F = 0.30, a sample size of 32 cases in each arm was found to be required. To account for an attrition rate of up to 40%, 45 patients were enrolled in each arm of the study protocol.

Statistical analysis of healing outcomes data was performed with GraphPad version 5 (GraphPad Software, San Diego, CA). Normality testing (D’Agostino and Pearson test) was per-
formed to determine whether data were sampled from a Gaussian distribution. One-way ANOVA and a Kruskal-Wallis test were performed to compare groups of continuous parametric and nonparametric variables, respectively. A χ² test was used to analyze proportions. Secondary endpoints were to test convergent validity (agreement among independently gathered ratings) and to assess changes in scar rating over time. For these purposes, Spearman’s rho correlation and the Wilcoxon matched pairs test were used. A P < .05 was used as the cutpoint for significance.

Results

Of the 494 women undergoing cesarean delivery during the study interval, 271 did not meet the inclusion criteria, and 43, who were potentially eligible, declined to participate in the study protocol. A total of 180 patients were randomized and allocated to 4 intervention groups. Flow of participants through each stage of the randomized clinical trial is displayed in Figure 3. One hundred fifty-nine patients (88.3%) had an initial follow-up, and 123 subjects (68.3%) successfully completed the study with the final assessment of cosmetic outcomes. There were no significant demographic differences between the patients who adhered to the study protocol and those who were lost to follow-up through the end of the study. Multiple attempts were made in all cases to arrange further follow-up, without success.

The women in the trial groups were similar for baseline obstetric and demographic characteristics (Table 2). Parity and gestational age at delivery did not differ across groups. At the 2-month postoperative assessment, 1 patient in the absorbable braided suture group had developed wound infection, previously managed by drainage of pus and me-

TABLE 1
The Vancouver Scar Scale

<table>
<thead>
<tr>
<th>Scar characteristic</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vascularity</td>
<td></td>
</tr>
<tr>
<td>Normal</td>
<td>0</td>
</tr>
<tr>
<td>Pink</td>
<td>1</td>
</tr>
<tr>
<td>Red</td>
<td>2</td>
</tr>
<tr>
<td>Purple</td>
<td>3</td>
</tr>
<tr>
<td>Pigmentation</td>
<td></td>
</tr>
<tr>
<td>Normal</td>
<td>0</td>
</tr>
<tr>
<td>Hypopigmentation</td>
<td>1</td>
</tr>
<tr>
<td>Hyperpigmentation</td>
<td>2</td>
</tr>
<tr>
<td>Pliability</td>
<td></td>
</tr>
<tr>
<td>Normal</td>
<td>0</td>
</tr>
<tr>
<td>Supple</td>
<td>1</td>
</tr>
<tr>
<td>Yielding</td>
<td>2</td>
</tr>
<tr>
<td>Firm</td>
<td>3</td>
</tr>
<tr>
<td>Ropes</td>
<td>4</td>
</tr>
<tr>
<td>Contracture</td>
<td>5</td>
</tr>
<tr>
<td>Height</td>
<td></td>
</tr>
<tr>
<td>Flat</td>
<td>0</td>
</tr>
<tr>
<td>&lt;2 mm</td>
<td>1</td>
</tr>
<tr>
<td>2–5 mm</td>
<td>2</td>
</tr>
<tr>
<td>&gt;5 mm</td>
<td>3</td>
</tr>
</tbody>
</table>

Digital images obtained from patients enrolled in the study, showing different skin scar types, categorized according to the classification proposed by the International Advisory Panel on Scar Management.11 A, Immature scar. B, Hypertrophic scar. C, Mature scar.
chanical debridement of fibrin, and 2 pa-
tients (1 each in the staples and nonab-
sorbable monofilament arms) reported a
partial dehiscence, which was managed
conservatively. These complications
were resolved at the time of 2-month fol-
low-up visit.

At 2 months all Pfannenstiel scars were
classified as either immature or hypertro-
phic. The proportion of scars classified as
hypertrophic did not vary across different
closure methods (2/45 [4.4%] vs 2/33
[6.1%] vs 0/40 [0%] vs 2/40 [5.0%] for
Monosyn, Dafilon, Safil Quick, and staples,
respectively; \( P = .52 \)). At 6 months all
cesarean scars were classified as either ma-
ture or hypertrophic. The proportion of
hypertrophic scars was similar across the
groups being investigated (11/32 [34.4%]
vs 10/28 [35.7%] vs 14/32 [43.7%] vs 12/31
[38.7%] for Monosyn, Dafilon, Safil Quick,
and staples, respectively; \( P = .87 \)).

No difference in both subjective and
objective scar rating was detected across
closure groups at either 2 months or 6
months (Tables 3 and 4). Correlations
between observer ratings using the VSS
and the OSAS, as well as correlations be-
tween observer and patient ratings, are
summarized in Table 5. Objective rating
improved significantly over time (rat-
ings at 2 months vs at 6 months were 25.4
\( \pm 7.3 \) vs 21.4 \( \pm 7.8 \) and 8.4 \( \pm 1.8 \) vs 7.4
\( \pm 1.9 \) for OSAS and VSS, respectively;
\( P < .0001 \)). Conversely, the time interval
between surgery and scar assessment did
not significantly influence patients’
opinion of their scars in this study (sub-
jective ratings at 2 months vs at 6 months
were 21.8 \( \pm 8.2 \) vs 21.1 \( \pm 7.4 \); \( P = .46 
\) and 7.4 \( \pm 1.8 \) vs 7.6 \( \pm 1.6 \); \( P = .34 \) for
PSAS and VAS, respectively).

**COMMENT**
The results of this study indicate that ce-
sarean section wounds closed by all 4
methods (staples or subcuticular sutures
with different material) had similar cos-
mesis at 2 and 6 months postpartum.

Three previous randomized trials,
which evaluated wound cosmesis of
Pfannenstiel incision in women under-
going cesarean section, who were ran-
FIGURE 3
Participant flow chart through the trial

Assessed for eligibility (n = 492)

Excluded (n = 312)
- Not meeting inclusion criteria (n = 269)
  - Previous suprapubic scar (n = 206)
  - Emergency procedure on admission (n = 18)
  - Inadequate Italian language (n = 33)
  - Diabetes, corticosteroids (n = 4)
  - Tattoos (n = 3)
  - History of keloids (n = 2)
  - Age <18 yrs (n = 43)
- Refused to participate (n = 43)

Randomized (n = 180)

Allocated to subcuticular suture with an absorbable monofilament (n = 45)
- Received intervention (n = 45)
  - Lost to 2-month follow-up (n = 0)
  - Lost to 6-month follow-up (n = 13)
- Analyzed at 6 months (n = 32)

Allocated to subcuticular suture with a nonabsorbable monofilament (n = 45)
- Received intervention (n = 45)
  - Lost to 2-month follow-up (n = 12)
  - Lost to 6-month follow-up (n = 5)
- Analyzed at 6 months (n = 28)

Allocated to subcuticular suture with an absorbable braided suture (n = 45)
- Received intervention (n = 45)
  - Lost to 2-month follow-up (n = 5)
  - Lost to 6-month follow-up (n = 8)
- Analyzed at 6 months (n = 32)

Allocated to staples (n = 45)
- Received intervention (n = 45)
  - Lost to 2-month follow-up (n = 5)
  - Lost to 6-month follow-up (n = 9)
- Analyzed at 6 months (n = 31)


TABLE 2
Demographics by closure groups

<table>
<thead>
<tr>
<th>Demographic</th>
<th>Subcuticular suture with absorbable monofilament (n = 45)</th>
<th>Subcuticular suture with nonabsorbable monofilament (n = 33)</th>
<th>Subcuticular suture with absorbable braided multifilament (n = 40)</th>
<th>Staples (n = 40)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maternal age, y</td>
<td>33.3 ± 5.4</td>
<td>33.4 ± 4.5</td>
<td>34.1 ± 4.5</td>
<td>32.5 ± 4.8</td>
<td>.55</td>
</tr>
<tr>
<td>Nonwhite origin, n (%)</td>
<td>4 (8.9)</td>
<td>2 (6.1)</td>
<td>4 (10.0)</td>
<td>2 (5.0)</td>
<td>.82</td>
</tr>
<tr>
<td>Indication, n (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Malpresentation</td>
<td>12 (24.5)</td>
<td>14 (42.4)</td>
<td>11 (27.5)</td>
<td>7 (17.5)</td>
<td>.13</td>
</tr>
<tr>
<td>Fetal distress</td>
<td>19 (42.2)</td>
<td>9 (27.3)</td>
<td>14 (35.0)</td>
<td>13 (32.5)</td>
<td>.57</td>
</tr>
<tr>
<td>Dystocia</td>
<td>7 (15.5)</td>
<td>4 (12.1)</td>
<td>5 (12.5)</td>
<td>8 (20.0)</td>
<td>.76</td>
</tr>
<tr>
<td>Twin pregnancy</td>
<td>1 (2.2)</td>
<td>4 (12.1)</td>
<td>2 (5.0)</td>
<td>3 (7.5)</td>
<td>.34</td>
</tr>
<tr>
<td>Other</td>
<td>6 (13.3)</td>
<td>2 (6.1)</td>
<td>8 (20.0)</td>
<td>9 (22.5)</td>
<td>.22</td>
</tr>
<tr>
<td>Operating time, min</td>
<td>38.7 ± 12.2</td>
<td>37.8 ± 10.9</td>
<td>43.4 ± 11.0</td>
<td>38.9 ± 13.9</td>
<td>.36</td>
</tr>
<tr>
<td>Emergency procedures, n (%)</td>
<td>28 (62.2)</td>
<td>16 (48.5)</td>
<td>19 (47.5)</td>
<td>24 (60.0)</td>
<td>.42</td>
</tr>
</tbody>
</table>

Values are expressed as mean ± SD, median (range), or number (percent). One-way ANOVA and Kruskal-Wallis test were performed to compare groups of continuous parametric and nonparametric variables, respectively. A χ² test was used to analyze proportions.

domly assigned to subcuticular sutures or staples, yielded conflicting results. Frishman et al. showed that cosmetic outcome (using a 4-category scale, from excellent to poor) was superior in patients with subcuticular suture compared with staples, as rated by patients and non-blinded physicians. Moreover, the authors demonstrated that staples caused more pain than suture, both at discharge and at the 6-week postoperative visit. Gaertner at al. using a nonvalidated evaluation score, did not find a significant difference in wound cosmesis as assessed by a nonblinded observer between the staples group and the subcuticular suture group. Rousseau et al. took a digital photograph of cesarean section incision at 6 weeks postoperatively, and scars were evaluated by 3 independent blinded observers using an assessment tool created to measure the long-term appearance of scars. The investigators found that pain was significantly less in the staple group, whereas no difference was noted for incision appearance and women’s satisfaction.

In all of these studies, participants were invited to review their scars in the early phases of wound healing (4–6 postoperative weeks), when cellular processes that underlie scar remodeling and maturation are most active. The time point for Scar analysis should approximate the permanent long-term cosmetic result of the scar. We used 6 months as a follow-up time for the final scar analysis, because current wound-healing literature contends that the process of scar remodeling continues for at least 6 months following the creation of a wound.

An early event is thought to be a decrease in cellularity, particularly between 3–8 weeks after wounding. This occurs through the process of apoptosis affecting fibroblasts and endothelial cells and results in flattening of the scar and fading of the initial redness. It is believed that these wounds then undergo greatly reduced remodeling over the subsequent time period, with indefinite minimal remodeling that is lifelong.

The present study represents the first attempt to use validated assessment scales to evaluate the quality of the product of abdominal wound healing in obstetrical care. The need of generally accepted scar evaluation tools for evidence-based research and scar management has been debated extensively among dermatologists and plastic surgeons, who emphasized the necessity of including a patient-centered subjective component to scar assessment.

The VSS and the POSAS, developed in recent years, are both valid tools for lin-

<p>| TABLE 3 | Scar assessment results at 2 months following cesarean delivery |
|-----------------|-----------------|-----------------|-----------------|-----------------|</p>
<table>
<thead>
<tr>
<th>Variable</th>
<th>Subcuticular suture with absorbable monofilament (n = 45)</th>
<th>Subcuticular suture with nonabsorbable monofilament (n = 33)</th>
<th>Subcuticular suture with absorbable braided multifilament (n = 40)</th>
<th>Staples (n = 40)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>VSS score</td>
<td>8.2 ± 1.9</td>
<td>8.3 ± 1.8</td>
<td>8.4 ± 1.4</td>
<td>8.8 ± 1.7</td>
<td>.32</td>
</tr>
<tr>
<td>POSAS score</td>
<td>26.0 ± 7.3</td>
<td>24.1 ± 6.8</td>
<td>25.3 ± 6.3</td>
<td>25.7 ± 7.6</td>
<td>.67</td>
</tr>
<tr>
<td>PSAS</td>
<td>22.1 ± 10.0</td>
<td>22.9 ± 8.8</td>
<td>21.0 ± 6.9</td>
<td>21.8 ± 7.4</td>
<td>.82</td>
</tr>
<tr>
<td>VAS score</td>
<td>7.7 ± 1.9</td>
<td>6.9 ± 2.3</td>
<td>7.8 ± 1.5</td>
<td>7.2 ± 1.6</td>
<td>.09</td>
</tr>
</tbody>
</table>

Values are expressed as mean ± SD. Kruskal-Wallis test was used for statistical analysis.

<p>| TABLE 4 | Scar assessment results at 6 months following cesarean delivery |
|-----------------|-----------------|-----------------|-----------------|-----------------|</p>
<table>
<thead>
<tr>
<th>Variable</th>
<th>Subcuticular suture with absorbable monofilament (n = 32)</th>
<th>Subcuticular suture with nonabsorbable monofilament (n = 28)</th>
<th>Subcuticular suture with absorbable braided multifilament (n = 32)</th>
<th>Staples (n = 31)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>VSS score</td>
<td>7.7 ± 1.6</td>
<td>6.9 ± 2.1</td>
<td>7.2 ± 2.2</td>
<td>7.6 ± 1.6</td>
<td>.42</td>
</tr>
<tr>
<td>POSAS score</td>
<td>20.6 ± 7.6</td>
<td>21.3 ± 8.4</td>
<td>20.3 ± 7.0</td>
<td>23.5 ± 8.1</td>
<td>.35</td>
</tr>
<tr>
<td>PSAS</td>
<td>19.3 ± 7.5</td>
<td>22.2 ± 8.0</td>
<td>20.7 ± 6.4</td>
<td>22.6 ± 7.3</td>
<td>.26</td>
</tr>
<tr>
<td>VAS score</td>
<td>8.0 ± 1.7</td>
<td>7.4 ± 1.6</td>
<td>7.6 ± 1.4</td>
<td>7.3 ± 1.6</td>
<td>.34</td>
</tr>
</tbody>
</table>

Values are expressed as mean ± SD. Kruskal-Wallis test was used for statistical analysis.
ear scar evaluation, and both were found to have acceptable internal consistency, interobserver reliability, and agreement.12-15,18,19 The POSAS offers the advantage of incorporating patient self-assessment of scar-related symptoms and physical characteristics. In a study aimed to test the POSAS on 100 linear scars, when the total scores that patients and observers assigned to scars were compared, it was found that the patients thought worse of their scars than the observers did.15

Our results are consistent with this earlier finding, and it must also be noted that in our study population, despite objective improvement in the quality of scars over time, the patients’ opinions of their scars did not change significantly at the late assessment. This can be attributed in part to itching and pain, which are very uncomfortable for the patient also in the long term, although invisible to the observer, but suggests also that the patient’s own view of the scar may be influenced by emotional reactions, changes in body image, and psychosocial factors.

An ideal skin closure technique would not only produce appropriate skin approximation and adequate healing but would also be quick, technically simple, and inexpensive and would minimize pain and wound complication and maximize patient’s satisfaction. Many studies have shown the superiority of staples for speed closure.7,8,20 However, speed of placement was not an outcome of interest to this study, because the impact on the operative time may not be so important unless the wound closure time is a significant proportion of the operation time. However, a faster wound closure method is well liked by operators and theater staff and may be attractive for patients when surgery is undertaken under regional anesthesia.

Moreover, another potential benefit from using staples instead of sutures is a reduction in the risk of needlestick injury to the surgeon and assistant. Alternatively, absorbable suture, with the lack of requirement for its removal, can improve patient satisfaction. Furthermore, although not within the remit of this study, suture closure can be achieved more economically than stapled closure. However, when taking into account the overall cost of a cesarean delivery procedure, this difference in cost may be of less significance.

We acknowledge potential limitations of the current study. First, attrition rate was even higher than that anticipated at the time of study design. Although participants before surgery agreed to be enrolled in an intent-to-follow protocol, a great proportion of them were unable to confirm willingness to return for the follow-up for the sole purpose of esthetic analysis of their scars. The first few postpartum months are a critical time for a woman, who is often overwhelmed by stresses of finding time to manage personal, family, and occupational tasks. Perhaps protocol adherence would have been better if postoperative visit by obstetricians and formal scar assessment by the plastic surgeon were scheduled concomitantly. However, compromise power analysis showed that for a beta/alpha ratio q = 4, and effect size index F = 0.30, a total sample size of 123 patients gave us 79.5% power to reject the null hypothesis.

Second, our sample size does not allow detecting differences in relatively infrequent occurrences, such as wound infection or major cosmetic defects (ie, keloid formation). Third, we did not examine the effect of related closure techniques such as subcutaneous tissue approximation. Last, cosmetic outcome associated with different skin closure techniques in the presence of a previous scar has yet to be investigated.

In conclusion, the results reported herein show that in women undergoing cesarean delivery there are no long-term differences in cosmetic outcomes between stapled wounds and those closed with subcuticular sutures using different materials. Therefore, the final decision about the choice of method and suture materials should be made balancing patient comfort (eg, not having to remove sutures) and surgeon needs (time saving with staples may not be of importance in an elective setting but may be more relevant in an emergency situation in the setting of a busy labor and delivery unit).

### REFERENCES


9. Rousseau JA, Girard K, Turcot-Lemay L, Thomas N. A randomized study comparing skin closure in cesarean sections: staples vs subcu-

### TABLE 5

<table>
<thead>
<tr>
<th>Variable</th>
<th>Spearman r</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>VSS score vs OSAS score</td>
<td>0.58</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>OSAS score vs PSAS score</td>
<td>0.48</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>VSS score vs PSAS score</td>
<td>0.32</td>
<td>0.004</td>
</tr>
<tr>
<td>OSAS score vs VAS score</td>
<td>−0.29</td>
<td>0.013</td>
</tr>
<tr>
<td>PSAS score vs VAS score</td>
<td>−0.28</td>
<td>0.002</td>
</tr>
</tbody>
</table>

VSS, Vancouver Scar Scale; POSAS, Pa-

### TABLE 5

Correlations between different scar assessment scales and between observer and patient ratings in the overall study population

<table>
<thead>
<tr>
<th>Variable</th>
<th>Spearman r</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>VSS score vs OSAS score</td>
<td>0.58</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>OSAS score vs PSAS score</td>
<td>0.48</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>VSS score vs PSAS score</td>
<td>0.32</td>
<td>0.004</td>
</tr>
<tr>
<td>OSAS score vs VAS score</td>
<td>−0.29</td>
<td>0.013</td>
</tr>
<tr>
<td>PSAS score vs VAS score</td>
<td>−0.28</td>
<td>0.002</td>
</tr>
</tbody>
</table>

OSAS, Observer Scar Assessment Scale; POSAS, Patient and Observer Scar Assessment Scale; PSAS, Patient Scar Assessment Scale; VAS, visual analog scale; VSS, Vancouver Scar Scale.


