Assessment of rhomboid flap scars: A patient reported outcome study. A case series

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1. Introduction

Globally, one hundred million patients develop scars annually including 55 million from elective procedures [1,2]. Scar revision was the fourth most performed plastic surgery procedure in the United States in 2017 [3] making scar treatment market a multibillion-dollar industry [4].

The rhomboid flap is a popular local flap used to reconstruct defects in most parts of the body [5]. These are full-thickness cutaneous local flaps, relying on dermal-subdermal plexus blood supply [5,6] and rotate around a pivot point into an adjacent defect [5,7].

Its major benefit over primary closure is better distribution of tension around a pivot point into an adjacent defect [5,7]. The rhomboid flap advantages include easy design, excellent contour, texture, thickness, color match, and long-term good cosmesis. There is no patient reported outcome study in literature detailing patients’ perception of appearance and satisfaction of scar appearance.

Methods: We studied 100 consecutive rhomboid flaps performed in 73 patients by a single surgeon. After at least one year from flap completion, a validated published Patient Scar Assessment Questionnaire (PSAQ) by Durani et al. was completed for each flap.

Results: The median age was 73 years, with a range of 21 years–94 years. Gender breakdown was 65 flaps in males and 35 flaps in females. For appearance, there were significantly greater frequency of “very well-matched scar” patients compared to “well-matched scar” patients (p < 0.001). There were no “a little matched” or “poorly matched” patients. For satisfaction of appearance scores, there were significantly greater frequency of “very satisfied” patients compared to “satisfied” patients (p < 0.001). There were no “dissatisfied” or “very dissatisfied” patients. Although size of primary defect was not statistically significant (p 0.071), there was a trend towards better appearance scar match and scar satisfaction for smaller defects. Age was not statistically significant (p 0.086), there was a trend towards better appearance scar match and scar satisfaction among older patients. There was no significant difference in appearance match and satisfaction scores based on the gender (p 0.733). There were no post-operative complications.

Conclusions: Our study confirms, in experienced hands, the long-term patient perception of well-matched scar appearance and scar satisfaction with rhomboid flap technique. A significantly greater frequency of patients were “very satisfied” than “satisfied”, with no “dissatisfied” patients. There was no statistically significant difference based on age, gender, and size of the primary defect.

Keywords: Rhomboid flap, Limberg flap, Scar satisfaction, Scar appearance, Case series, Local flap

A S T R A C T

Introduction and importance: Local skin flap techniques, including rhomboid flap, have been developed to reconstruct cutaneous defects. Rhomboid flap advantages include easy design, excellent contour, texture, thickness, color match, and long-term good cosmesis. There is no patient reported outcome study in literature detailing patients’ perception of appearance and satisfaction of scar appearance.

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A R T I C L E I N F O

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Scalp Assessment Scale (POSAS) \cite{11,12}. In 2009, Durani et al. published a new scar assessment tool, called the Patient Scar Assessment Questionnaire (PSAQ), meant to be administered exclusively to scar patients, and focused on quantifying patient-centered outcome measures related to scar appearance, symptoms, consciousness, and satisfaction \cite{13}.

We chose PSAQ because its rigorously validated with proven high internal consistency and reliability. Subscales could be used independently of each other to allow assessment of scar change in specific domains. The results would help guide our discussions with future patients and set scar expectations.

2. Study design and methods

Ethical approval was obtained from the Institutional Review Board at University of Pittsburgh Medical Center, Pittsburgh, PA. In accordance with the Declaration of Helsinki, this study was registered with International Standard Randomized Controlled Trial Number (ISRCTN) number 12112103. https://www.isrctn.com/ISRCTN12112103.

A retrospective chart review of all consecutive records from September 01, 2019, through January 21, 2020, was completed to identify patients who underwent cutaneous excision followed by rhomboid flap closure. We contacted each patient and obtained a verbal consent to participate in the study. A telephone interview was conducted with each patient and questions from a prospective validated PSAQ questionnaire were asked. All lesions and scars were visible to the patients. Furthermore, all patients had good vision and were mentally alert to understand and answer the questions appropriately.

The results were entered into an Excel spreadsheet. Data collected included date of diagnosis, age, gender, race/ethnicity, location of flap/scar, size of primary cutaneous defect, and common postoperative wound complications such as bleeding, infection, dehiscence, flap loss, need for scar revision (Appendix 1).

PSAQ is a completely patient-centered scar evaluation tool which uses a series of 39 questions to evaluate the patient perception of their scars. The original questionnaire reported five subscales (i.e., Appearance, Symptoms, Consciousness, Satisfaction with Appearance, and Satisfaction with Symptoms) with multiple categorical response items. Since subscales can be used independently of each other to allow assessment of scar change in specific domains, we focused on appearance and satisfaction with appearance (Appendix 2).

Each subscale consisted of a set of questions with 4-point categorical responses, scoring 1 to 4 points (where 1 point was the most favorable response and 4 was least favorable). It aims to capture patients’ assessment of the physical and symptomatic features of their scars as well as their subjective experience.

The appearance subscale captures patient observations of scar size, color relative to surrounding skin, height, radiance, and texture. The satisfaction subscale targets the same features as the appearance but instead focuses on patients’ satisfaction regarding those attributes. The following range of scores is possible for each subscale, with higher scores reflecting a poorer perception of the scar related to the domain being evaluated:

Based on Lipman et al.’s publication, the appearance and satisfaction with appearance subscales were each divided into four levels based on cumulative score \cite{11}.

\textbf{Inclusion criteria:} All consecutive patients 18 years and older who underwent reconstruction of cutaneous defect using a rhomboid flap between 9/1/2019-01/31/2020 by primary author. We estimated 100 patients who underwent rhomboid flap reconstruction during this period.

\textbf{Exclusion criteria:} Rhomboid flap performed in patients aged under 18 years, patients with incomplete data, deceased patients, and with non-rhomboid flap reconstruction.

\textbf{Potential risks and likelihood:} There were no adverse events or alternative treatments as this was a retrospective chart review.

Secondary outcome measured included the relationship of these scores with gender, ethnicity, and size of defect. We also measured the incidence of common complications, specifically bleeding, infection, dehiscence, flap loss and need for scar revision. Statistical analyses were performed a statistician at Gannon University, Erie, PA. Mann Whitney U test, Pearson’s correlation and binomial test were conducted on the collected data. This case series has been reported in line with the PROCESS Guideline \cite{14}.

3. Results

We approached 80 patients to participate in the study, out of which 73 acquiesced. 100 consecutive rhomboid flaps were performed in 73 patients. The indication for each defect was reconstruction of cutaneous defects. Age, gender, race, location, size, site of operation, appearance score, satisfaction score, and postoperative complications were recorded.

65 flaps were completed in males and 35 flaps were completed in female patients (Table 3). 99 flaps were performed in Caucasians and 1 flap in African American patient. The location of flap reconstruction was face 41% (Fig. 2), extremity 28%, trunk 22% and scalp 9%. The flaps were performed in office 98% and surgery center 2%. The size of the primary defect ranged from 0.5 cm × 0.5 cm - 4.5 cm × 4.5 cm.

The median age was 73 years and mean age was 71.1 year with a range of 21 years – 94 years. (Table 4) (see Table 1). For the purposes of this survey, an appearance score of 9 was termed “very well-matched”, and satisfaction score of 8, was termed “very satisfied”, appearance score of 18 was termed “well-matched”, and satisfaction score of 16, was termed “satisfied”, and appearance score of 36 was termed “poorly matched”, and satisfaction score of 32, was termed “very dissatisfied” (Table 2). For appearance scores, 90% of patients reported “very well-

<table>
<thead>
<tr>
<th>Subscale</th>
<th>Number of Scored Items</th>
<th>Minimum Score</th>
<th>Maximum Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appearance: How well does the scar match the surrounding skin?</td>
<td>9</td>
<td>9</td>
<td>36</td>
</tr>
<tr>
<td>Satisfaction with Appearance: How satisfied are you with way the scar?</td>
<td>8</td>
<td>8</td>
<td>32</td>
</tr>
</tbody>
</table>
matched scar”, 10% were “well-matched”, 0% “little-matched” and 0% “poorly-matched” (Table 5). For satisfaction of appearance score, 90% of the patients were very satisfied, 10% of the were satisfied, 0% “dissatisfied” and 0% “very dissatisfied” (Table 6).

### 3.1. Effect of size of primary defect with appearance and satisfaction of appearance score

For appearance, the scores were lower, mean 9.6, (denoting higher matched scar) for smaller primary defect (<1 cm × 1 cm) than larger primary defect (>1 cm × 1 cm) mean score 10.7 (Table 7). Mann-Whitney U test was used to examine if the average appearance and satisfaction scores were significantly different for those with smaller primary defect than larger defect. Mann-Whitney U was used instead of Student’s t because the data was not normally distributed. In general, the smaller the W number, less likely that it would have occurred by chance. Mann Whitney statistic was 842.0 with a p value was 0.071. This signifies that although there was a trend towards better matched scar appearance with smaller primary defects, but it was not statistically significant (Table 8).

### 3.2. Effect of gender with appearance and satisfaction score

Mann Whitney U test was also used for examining the effect of

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**Table 2**

Levels of appearance and satisfaction with appearance subscales.

<table>
<thead>
<tr>
<th>Subscale</th>
<th>Level</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appearance</td>
<td>Very well matched</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Well matched</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td>A little matched</td>
<td>27</td>
</tr>
<tr>
<td></td>
<td>Poorly matched</td>
<td>36</td>
</tr>
<tr>
<td>Satisfaction with appearance</td>
<td>Very Satisfied</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>Satisfied</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>Dissatisfied</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>Very dissatisfied</td>
<td>32</td>
</tr>
</tbody>
</table>

**Table 3**

Frequencies for gender. 65% of responders were males and 35% were females.

<table>
<thead>
<tr>
<th>Sex</th>
<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>35</td>
<td>35</td>
<td>35</td>
<td>35</td>
</tr>
<tr>
<td>Male</td>
<td>65</td>
<td>65</td>
<td>65</td>
<td>100</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td>100</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Table 4**

Age, appearance, and satisfaction scores. Median age was 73 years and mean were 71.1 years.

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>Appearance</th>
<th>Satisfaction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Median</td>
<td>73.0</td>
<td>9</td>
</tr>
<tr>
<td>Mean</td>
<td>71.1</td>
<td>9.9</td>
</tr>
<tr>
<td>Standard Deviation</td>
<td>13.0</td>
<td>2.7</td>
</tr>
<tr>
<td>Minimum</td>
<td>21.0</td>
<td>9</td>
</tr>
<tr>
<td>Maximum</td>
<td>94.0</td>
<td>18</td>
</tr>
</tbody>
</table>

**Table 5**

Frequency Table for appearance score levels.

<table>
<thead>
<tr>
<th>Appearance Level</th>
<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very well matched</td>
<td>90</td>
<td>90</td>
<td>90</td>
<td>90</td>
</tr>
<tr>
<td>Well matched</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>100</td>
</tr>
<tr>
<td>A little matched</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>100</td>
</tr>
<tr>
<td>Poorly matched</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>100</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td>100</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Table 6**

Frequency Table for satisfaction with appearance score levels.

<table>
<thead>
<tr>
<th>Satisfaction Level</th>
<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very Satisfied</td>
<td>90</td>
<td>90</td>
<td>90</td>
<td>90</td>
</tr>
<tr>
<td>Satisfied</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>100</td>
</tr>
<tr>
<td>Dissatisfied</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>100</td>
</tr>
<tr>
<td>Very dissatisfied</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>100</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td>100</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

**Fig. 2.** A, B and C. Reconstruction of anterior thigh defect with rhomboid flap. A. Appearance of the cutaneous defect prior to excision. B. Appearance of the “broken” scar one day after excision. C. Appearance of the scar 1 year after excision. At one year, the scar is very well-matched and difficult to see.
gender on scores. For appearance, the mean score for women was 10.02 and for men it was 9.8 (Table 9). However, the W (Mann-Whitney Statistic) was 1162.5 and difference was not statistically significant. The p value was 0.733 (Table 10). For satisfaction with appearance, the mean score for women was 8.9 and for men it was 8.7 (Table 9). However, the W (Mann-Whitney Statistic) was 1162.5 and difference was not statistically significant. The p value was 0.73 (Table 10). This signifies that the patient’s gender did not have any effect on the appearance and satisfaction scores.

### 3.3. Effect of age with satisfaction and appearance score

Pearson’s correlation was used to determine effect of age with appearance and satisfaction scores. Appearance and Satisfaction scores show a perfect correlation ($r = 1.0$, $p < 0.01$). This means that all respondents who reported very well-matched scar appearance were also very satisfied with the scar. Age is almost significantly negatively correlated with appearance ($r = -0.173$, $p = 0.086$). But Pearson’s correlations suggest a p value of 0.086 (Table 11). Although not statistically significant, the trend suggests that older patients were more likely to report better matched scar appearance and higher satisfaction with the scar.

Two binomial tests were used to determine if patients scoring “9” for appearance (“very well-matched”) were significantly different from those scoring “16” (“well-matched”). Similarly, if patients scoring “8” for satisfaction (very satisfied) was significantly different from those scoring “18” (satisfied). The results prove a highly significant difference (90% versus 10%, $p < 0.001$) proving a significantly higher frequency of “very well-matched scar appearance” than “well-matched” scar appearance. Also, a significantly higher frequency “very satisfied” patients than even “satisfied” patients (Table 12).

Finally, patients were asked about common post-operative complications, specifically bleeding, infection, flap loss, dehiscence or need for scar revision. And out of 100 flaps, there were no instances where a post-operative complication was reported (Table 13).
offers the ability to select individual subscales without affecting reliability or validity. Economopoulos et al. elected to include only the appearance, symptoms, and consciousness subscales in their questionnaire [25]. Similarly, we chose two subscales, appearance, and satisfaction with appearance, to limit the time required of respondents and enhance the response rate.

Since the remodeling phase of skin wound healing lasts up to one year [26], we waited at least one year after the flap reconstruction for questionnaire completion. The mean age was 71.1 year with a range of 21 years–94 years. Although not statistically significant, older patients were more likely to report better matched scar appearance and higher satisfaction with the scar. Most flaps were performed in an office setting under local anesthesia with the size of primary defect ranging from 0.5 cm × 0.5 cm–4.5 cm × 4.5 cm. Statistical analysis revealed there was a trend towards better matched scar appearance for smaller primary defects than larger defects, but this was not statistically significant. Similarly, there was a trend towards better satisfaction for smaller defects than larger defects but again not statistically significant.

Out of 100 flaps, approximately two-thirds were males and 99% of the flaps were performed in Caucasians. Data analysis signified that the patient’s gender did not have any effect on the appearance and satisfaction scores. The face was the most common location followed by extremity, trunk and finally the scalp was the least common area.

All patients who reported very well-matched scar appearance were also very satisfied with the scar. For appearance, a significantly higher “very well-matched” (90%) scores than well-matched” scores were reported. Similarly, a significantly higher (90%) patients were highly satisfied than satisfied (10%) of patients. There were no dissatisfied or very dissatisfied patients. The patients did not report any common postoperative complications, specifically, bleeding, infection, dehiscence and need for scar revision. The possible explanation is that all procedures were elective, office-based procedures and were performed by the senior author who has personally performed thousands of similar procedures with well-developed post-procedure instructions and follow-up.

4.1. Limitations

This study is a single center retrospective study with a relatively small study group, which may affect the generalizability of the results. But there is no similar study reported in the English literature. Furthermore, 99% flaps were performed in Caucasians. Even though this is based on our region’s demographics and referral patterns, majority of cutaneous malignancies do occur in Caucasians. However, the ethnic diversity of the world may affect the applicability of the results. The authors believe that in expert hands, these results may be reproducible in diverse populations, but further studies are needed. The mean age of our cohort is 71.1 years but again, cutaneous malignancies are seen more commonly in older individuals. Although any surgical procedure has potential for complication. Individuals with lesser experience may not see similar results. It takes a very long time to administer PSAQ, increasing user frustration and demotivation. This was the reason we chose two subscales, to shorten the time it took to complete the questionnaire. Finally, there is no control group. But this is a patient reported outcomes study and the aim is to evaluate patient’s own perception of their rhomboid scar.

4.2. Future

Larger patient reported outcome studies are needed to validate the findings of this study. In addition, more patient-centered tools are needed to understand the reasons of a patient’s dissatisfaction with their scar and help direct treatment options to improve patient experience.

5. Conclusion

Scar appearance and satisfaction are important in plastic surgery patients. Durani’s PSAQ is a validated, reliable, scar assessment tool for conveying patients’ opinion. We found, regardless of size of defect, location on the body, gender and age of the patient, a rhomboid flap reconstruction performed by an experienced surgeon results in a scar which in long term is very well matched to surrounding skin and results in very high patient satisfaction. We believe patient rhomboid scar perceptions may help physicians improve communication, education, and medical decisions.

Ethical approval

Institutional Review Board approval from UPMC.

Funding

No funding was received.

Author contribution

Ajaipal S. Kang, MD: Surgeon, author, interviews to obtain information, manuscript. Kevin S. Kang, BS: Manuscript.

Registration of research studies

Name of the registry: ISRCTN.
Unique Identifying number or registration ID: 121112103.
Hyperlink to your specific registration (must be publicly accessible and will be checked): https://www.isrctn.com/ISRCTN121112103.

Guarantor

Ajaipal S. Kang, MD.

Consent

Informed patient consent was obtained from each participant and accompanying images. The data was anonymized, and study is retrospective. Ethical committee gave permission for publication of this case series.

Provenance and peer review

Not commissioned, externally peer reviewed.

Financial disclosure

None.

Declaration of Competing interest

None.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.amsu.2022.103328.
References