JPRS Journal of Plastic and Reconstructive Surgery
https://doi.org/10.53045/jprs.2024-0013
https://j-prs.jp/index.html

Original Research

Scar Healing after Breast Reconstruction: A 5-year Follow-up in Asian Patients

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Abstract

***Objectives*:** Hypervascularity, hypertrophy, and hyperpigmentation of breast scars often persist for several years after reconstruction. There are few reports on the long-term follow-up of postoperative scars after breast reconstruction. We previously reported that at 1 year after reconstruction, >30% of Asian patients showed abnormal scars. In this study, we followed these patients for as long as 5 years postoperatively.

***Methods*:** We followed 101 Asian patients who underwent immediate two-stage implant-based breast reconstructions between 2013 and 2017 and still had abnormal scars involving hypervascularity, hypertrophy, or hyperpigmentation at 1 year postoperatively. We conducted annual follow-up for an additional 4 years, assessing the time until improvement and performing statistical analysis of factors related to the persistence and healing of abnormal scars.

***Results*:** Hypervascularity improved in 12%, 37%, 68%, and 82% of patients at 2, 3, 4, and 5 years, respectively. Most cases improved between 3 and 4 years postoperatively. Among the patients with both hypervascularity and hypertrophy at 1 year, 36% had residual hypervascularity at 5 years compared with 9.8% of those with hypervascularity only at 1 year. Hypertrophy improved within 5 years in 56% of the cases. Hyperpigmentation improved within 5 years in only 21% of the cases. There was no significant association between abnormal scars and age or body mass index.

***Conclusions*:** Even in Asian patients with persistent hypervascularity of breast scars, most cases improve within 5 years after reconstruction. However, hypervascularity tends to persist in cases that also show hypertrophy. Compared with hypervascularity and hypertrophy, hyperpigmentation showed worse 5-year improvement.

Keywords

breast reconstruction, scar assessment, hypervascularity, hypertrophy, hyperpigmentation

J Plast Recontr Surg 2025; 4(1): 20-25
https://doi.org/10.53045/jprs.2024-0013

Introduction

In recent years, many patients with breast cancer undergoing mastectomy opt for breast reconstruction. In particular, the number of patients undergoing implant-based reconstruction has increased over the past decade, accounting for >75% of all patients undergoing breast reconstruction[1)]. Although mastectomy has a negative effect on a woman's body image and quality of life, breast reconstruction reduces these effects[2-4)]. Scars remaining after breast reconstruction significantly influence outcomes and patient satisfaction[5,6)]. In some patients, abnormal scars such as hypervascularity (redness) often persist for several years.

Asian patients tend to exhibit hypertrophy and hyperpigmentation after skin surgery because of their thicker skin, greater melanin content, and greater number of sebaceous glands compared with other populations[7)]. We previously reported that in Asian women, at 1 year after breast reconstruction, 37%, 12%, and 18% of cases showed hypervascularity, hypertrophy, and hyperpigmentation, respectively[8)]. However, there are few studies on the long-term follow-up of postoperative scars[9)]. In this study, we followed these patients up to 5 years postoperatively to examine the long-term changes in abnormal scars and determine the factors influencing scar progression.

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Received: March 13, 2024, Accepted: May 14, 2024, Advance Publication by J-STAGE: August 23, 2024

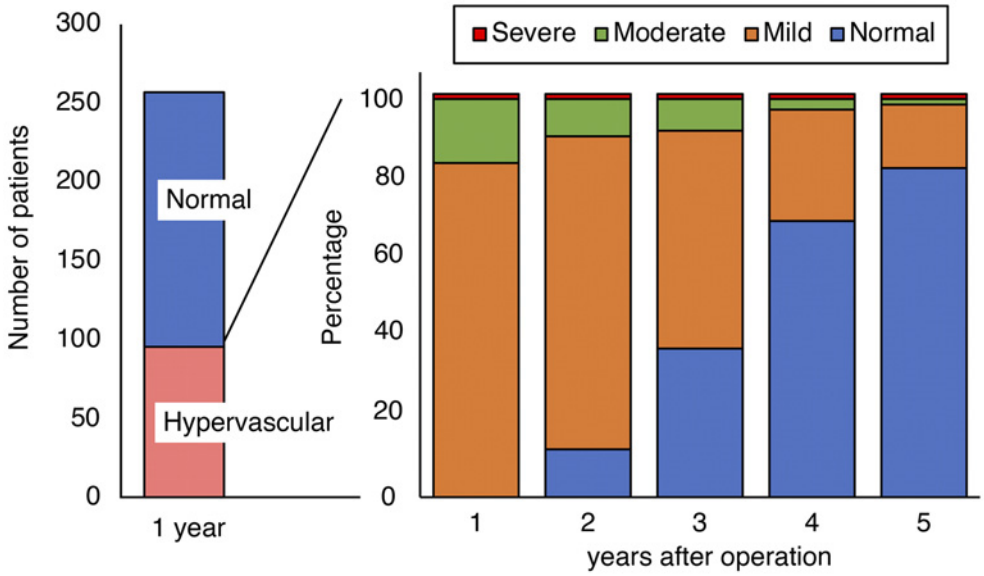

Figure 1. Improvement in vascularity. Hypervascularity was present in 37% of our original 257 cases 1 year postoperatively, but of the 76 cases with residual hypervascularity enrolled in this study, 5-year improvement in breast scars was observed in 82%.

Methods

This study was approved by the ethics committee of our institution. As we reported previously, among 257 patients who underwent immediate two-stage implant-based reconstruction for breast cancer at our institution between May 2013 and October 2017, 96 (37%), 32 (12%), and 49 (18%) patients had hypervascularity, hypertrophy, and hyperpigmentation in their breast scars at 1 year after reconstruction, respectively[8]. Among these patients with abnormal scars, 76, 25, and 34 patients with hypervascularity, hypertrophy, and hyperpigmentation were annually followed up for 5 years, respectively. The total number of cases was 101, as some patients had more than one issue. All enrolled patients were of Asian descent.

Two senior authors (R.M. and H.S.) performed the assessment using photographs taken every year postoperatively. We ranked the vascularity of each scar into four categories (normal, mild, moderate, and severe) according to the Vancouver Scar Scale (normal, pink, red, and purple)[10-12]. Hypertrophy and hyperpigmentation were simply judged to be present or absent. During the follow-up period, hypertrophy was treated with topical corticosteroids or surgical resection. Hypervascularity and hyperpigmentation were not treated because no efficient treatments were covered by health insurance in our country.

We performed statistical analysis on the relationship of clinical factors, such as age and body mass index (BMI), to long-term healing of scar abnormalities. All analyses were performed using JMP 12 (SAS, Cary, NC). Continuous variables were analyzed using Welch's *t*-test. The categorical variables were analyzed using χ^2 test. P values <0.05 were considered significant.

Results

Among the 101 patients followed for abnormal scars, 31 and 5 patients underwent chemotherapy and radiation, respectively. One patient underwent both treatments. All these treatments were administered within the first year after surgery and did not have a significant effect on the 5-year course of this study.

Among the 76 cases in this study showing hypervascularity at 1 year, 82% had improved to normal vascularity at 5 years. The percentage of cases with improved vascularity was 12%, 37%, 68%, and 82% at 2, 3, 4, and 5 years, respectively (**Figure 1**). Most cases improved between 3 and 4 years postoperatively (**Figure 2**). A comparison of ages between patients with residual hypervascularity at 5 years (n = 14) and those with improved vascularity (n = 62) showed no significant difference (49.4 years vs. 50.1 years, P = 0.77). Likewise, a comparison of BMIs between patients with residual hypervascularity at 5 years (n = 14) and those with improved vascularity (n = 62) showed no significant difference (21.7 vs. 22.3, P = 0.47).

Of the 25 patients with hypertrophy at 1 year postoperatively, 14 patients (56%) showed improvement within 5 years (**Figure 3**). The mean age of patients with (n = 11) and without (n = 14) residual hypertrophy at 5 years was 48.7 and 52.2 years, respectively. Although the difference was not significant (P = 0.27), younger patients appeared to be slightly more likely to have residual hypertrophy. There was no significant difference in BMI between patients with residual hypertrophy and those with improved hypertrophy at 5 years (21.3 vs. 21.3, P = 0.99).

Table 1 shows the relationship between hypervascularity and hypertrophy. Only 9.8% of patients without hypertrophy at 1 year had residual hypervascularity at 5 years, whereas 36% of patients with hypertrophy at 1 year had residual hy-

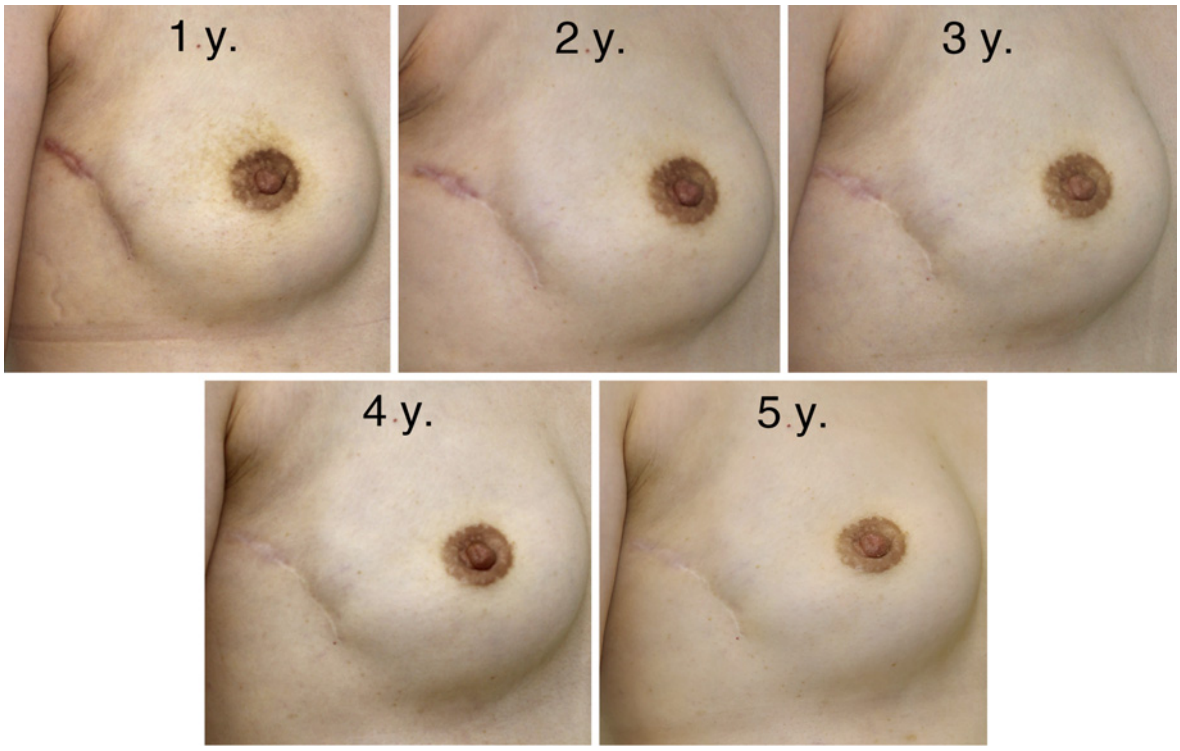

Figure 2. A representative case with improved vascularity. The scar showed mild vascularity at 1 year and improved to normal vascularity between 3 and 4 years postoperatively.

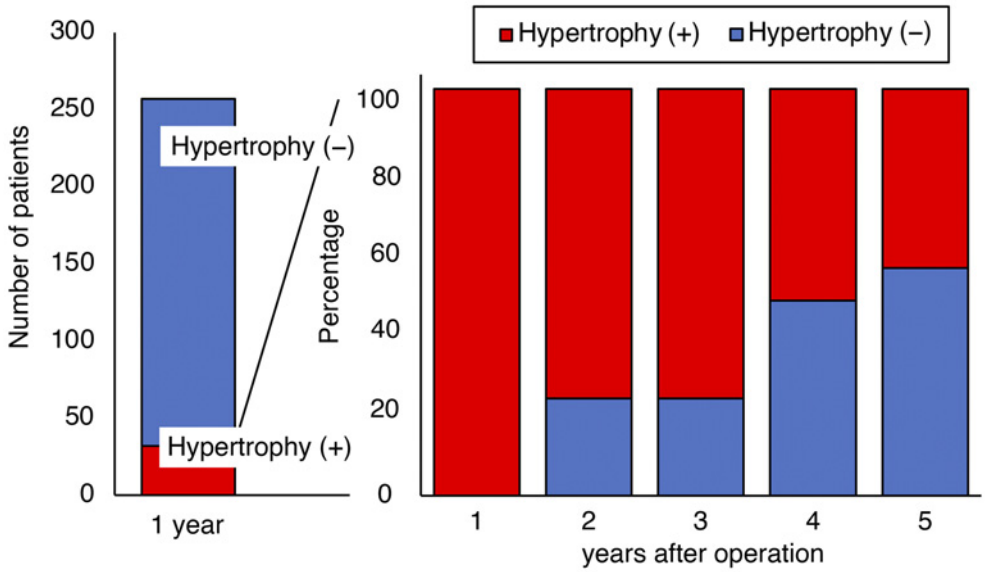

Figure 3. Improvement in hypertrophy. Of the present cases with hypertrophy at 1 year, 56% had improved within 5 years.

Table 1. Influence of Hypertrophy on Hypervascularity ($P < 0.05$).

	Hypertrophy at 1 year (–)	Hypertrophy at 1 year (+)
Hypervascularity at 5 years (–)	46 (90.2%)	16 (64.0%)
Hypervascularity at 5 years (+)	5 (9.8%)	9 (36.0%)

pervascularity at 5 years. A significantly higher percentage of patients with hypertrophy at 1 year showed residual hypervascularity at 5 years ($P < 0.05$) (**Figure 4**).

Out of 34 patients with hyperpigmentation at 1 year, only 7 patients (21%) showed no hyperpigmentation at 5 years postoperatively, whereas the remaining 27 (79%) had resid-

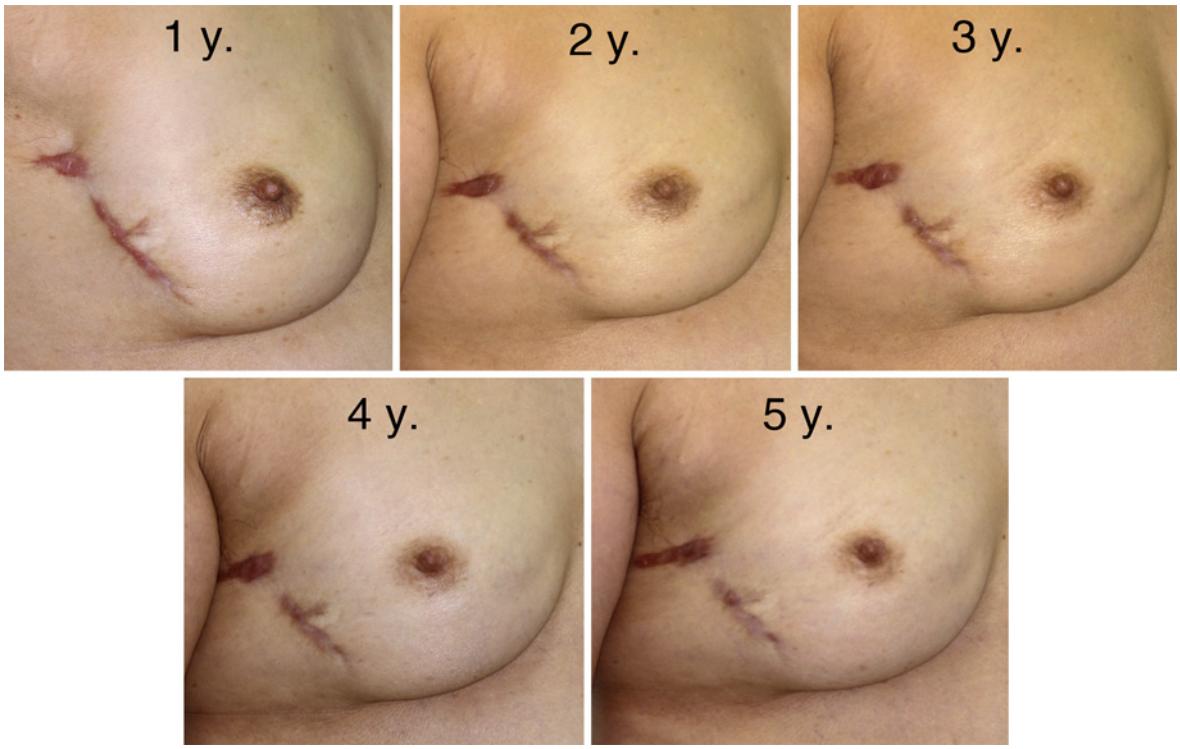

Figure 4. A representative case of hypervascularity and hypertrophy. The scar showed moderate vascularity and hypertrophy at 1 year. Although hypertrophy improved between 3 and 4 years, moderate vascularity remained even at 5 years postoperatively.

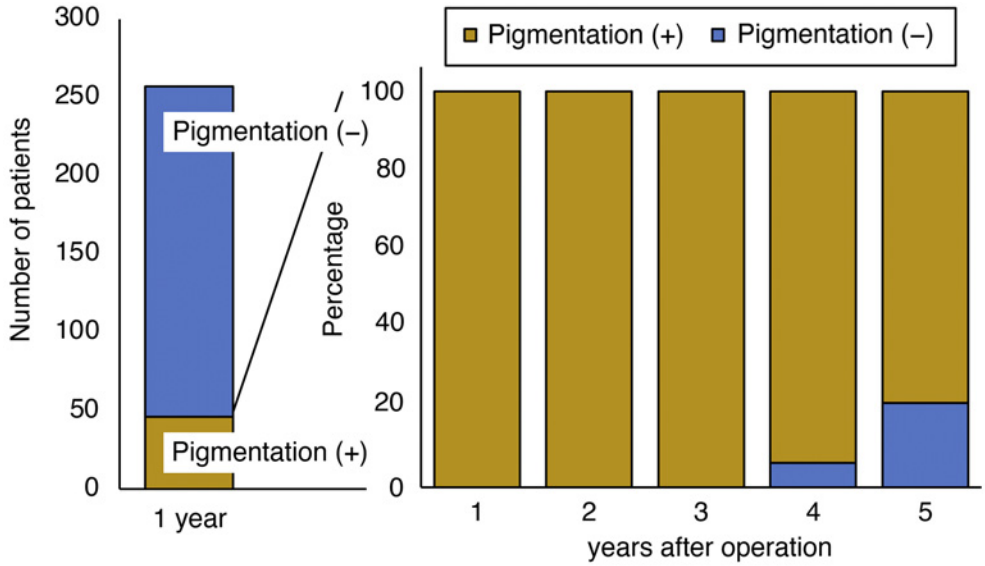

Figure 5. Improvement in hyperpigmentation. Hyperpigmentation remained at 5 years in 79% of the cases.

ual hyperpigmentation at 5 years (**Figure 5**). The ages of patients with (n = 27) and without (n = 7) residual hyperpigmentation were compared and were not significantly different (49.5 vs. 53.4, P = 0.43). We also compared the BMIs of patients with and without residual hyperpigmentation and found no significant difference (22.3 vs. 23.0, P = 0.69). A representative case of residual hyperpigmentation is shown in **Figure 6**.

Discussion

In this study, we investigated the sequential changes in breast scars after reconstruction. The patient's quality of life is affected by the outcomes of breast reconstruction, including the condition of the scar[3]. It is difficult to predict which scars will be disfiguring, and many clinicians have taken a prophylactic approach (such as considering incision location and postoperative compression)[13]. Regarding the evaluation

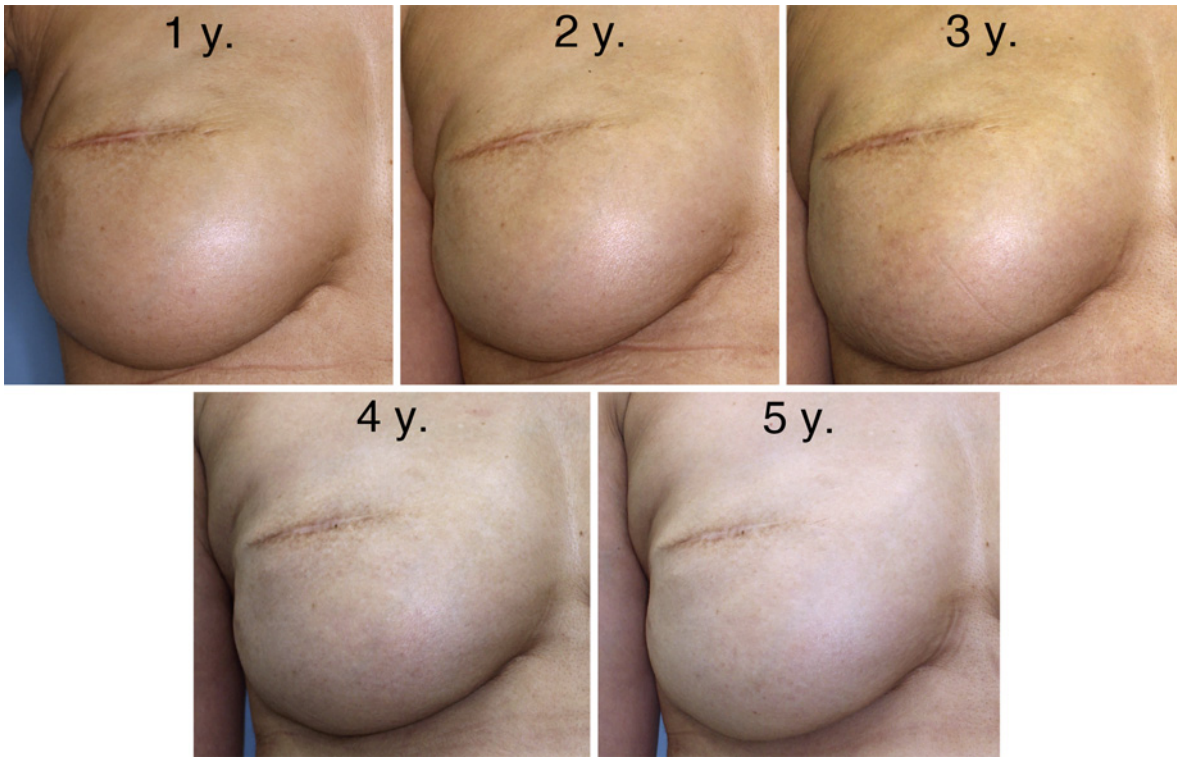

Figure 6. A representative case of residual hyperpigmentation. The scar showed mild vascularity and hyperpigmentation at 1 year. Although vascularity improved between 3 and 4 years, hyperpigmentation remained even at 5 years postoperatively.

of postoperative outcomes, there have been many reports on techniques and complications[14] but few on scars. To the best of our knowledge, this study is the first report of a long-term follow-up of breast scars after reconstruction.

Compared with other ethnic groups, Asians have thicker skin, higher melanin content, and more sebaceous glands, resulting in increased sebum secretion[7]. Their tissue is characterized by increased fibroblast proliferation and more vigorous collagen and fibroplasia during wound healing, which reportedly predisposes such individuals to hyperpigmentation and scar formation[15,16]. Considering that an increasing number of Asian patients are undergoing reconstruction after mastectomy[1], surgeons need more information about the postoperative course of breast scars.

Postoperative hypervascularity is one of the main complications of surgical scars and generally resolves spontaneously as the scars mature. However, it persists for several years in some patients. Pulsed dye lasers are effective for treating hypertrophic scars and hypervascularity[17]. Hypervascularity of scars is thought to be the result of dilated capillaries within collagen fibers and has some histological similarities to simple hemangioma[18]. Treatment with a pulsed dye laser should be considered in patients with prolonged hypervascularity after breast reconstruction.

Butzelaar et al. reported that the risks of hypertrophic scars include young age, bacterial colonization, and skin extension and that chemotherapy and smoking are not risks[19]. Conversely, Mahdavian Delavary et al. reported that younger patients and nonsmokers are at a higher risk of developing hypertrophic scars[20]. In our study, younger patients showed a tendency toward hypertrophy, although the difference was not significant. Postoperative scarring may be influenced by various factors such as incision site, skin type by race, suture tension, and wound closure technique[21]. A comparative study involving more cases would be beneficial.

Asian skin types are known to be more prone to hyperpigmentation and scar formation in surgical scars[7]. We previously reported that patients experiencing skin necrosis after initial surgery were more likely to develop hyperpigmentation[8] and that patients with large breasts had an increased likelihood of hyperpigmentation because of a higher probability of skin necrosis[22]. We believe that in most cases, hyperpigmentation occurs because of inflammation around the scar. In this study, most patients with hyperpigmentation at 1 year were shown to exhibit hyperpigmentation even after 5 years, regardless of BMI or age. Hyperpigmentation can be treated with hydroquinone, tretinoin, or picolaser[23,24], and such treatments should be considered as early as possible for patients with hyperpigmentation after breast reconstruction.

Our study had some limitations. The scar scale was used for simplicity; however, it is not a quantitative measurement, and some bias cannot be excluded. The assessment of hypertrophy and hyperpigmentation, judged to be present or absent, was extremely subjective. All patients were treated and followed up at a single institution. Further studies are required to examine the detailed characteristics of abnormal scars after breast reconstruction and to identify factors influencing healing, such as specific treatment regimens.

Conclusions

Asian patients with abnormal scars after breast reconstruction were annually followed up for 5 years. We found that even if hypervascularity remains in the breast scar 1 year after reconstruction, improvement can be expected within 5 years in most cases. However, hypervascularity is more likely to persist in cases that simultaneously have hypertrophy. Hyperpigmentation shows poor improvement even 5 years postoperatively.

Author Contributions: R.M. analyzed the data and wrote the manuscript. T.S. and M.I. performed the operations and followed up with the patients. A.T. supervised the study. H.S. designed the study, performed the operations, followed up with the patients, and supervised the study.

Conflicts of Interest: There are no conflicts of interest.

Ethical Approval: The ethics committee of Kyorin University (H30-179) reviewed and approved the study.

Consent to Participate and Consent for Publication: Patients were provided with the opportunity to opt out.

Disclaimer: Akihiko Takushima is the Editor in Chief of Journal of Plastic and Reconstructive Surgery. He was not involved in the peer-review or decision-making process for this paper.

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