Scar Occurrence With Use of Nano-Polished Blade vs Conventional Scalpel Blade on Facelift Patients: A Single Center Retrospective Study

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ABSTRACT

BACKGROUND:

Skin is the largest and considered the most vulnerable organ as it is continually exposed to external injury and assaults of our environment. Scarring is an anticipated and required process following tissue injury and signals a responsive immune system. Many of the scar mitigation options in today's modern world are available only after the initial inflammatory process has begun. Alternative approaches that could potentially minimize scarring beginning at the moment of incision are broadly understudied.

PURPOSE:

The primary purpose of this study was to investigate any difference in adverse scar occurence for cosmetic patients who underwent facelift surgery from January 2019 to July 2024 at a single surgical center.

METHODS:

Electronic medical records were reviewed to identify all potential surgical cases that met inclusion criteria. Dates reviewed were from January 2, 2019, to July 8, 2024. Data were split by surgical blade usage. For the current study the following groups were distinguished and separated with the goal of running statistical analysis: Conventional Blade Group: January 2, 2019 – July 30, 2021, and Nano-Polished Blade Group: August 1, 2021 – July 8, 2024. Patient characteristics were also collected to compare group differences at baseline.

RESULTS:

Groups had comparable baseline characteristics (P>0.05; >95% CI). Adverse scar occurrence requiring post-operative treatment was statistically significant between groups. The Conventional Blade Group had a scar occurrence rate of 12.3% compared to the Nano-Polished Blade Group of 1.8% (P=0.03; >95% CI).

CONCLUSION:

The use of nano-polished blades was shown to lessen the amount of adverse scarring occurrence in those undergoing facelift surgery by 86%.

BACKGROUND

Inflammation is considered an evolutionary process that has been widely studied and credited for the survival of the human organism.[1] The human body's immune system is understood to be the main driver in the initiation and resolution of inflammation which is brought about by factors such as tissue injury, infection, or tissue stress and malfunction.[2] The inflammatory response that is triggered following operative trauma is necessary for tissue repair to occur,[3] but can often leave scarring as part of the natural occurring wound healing process. Skin tissues undergo pathological changes following exposure to trauma and/or infection, which initiates enhanced collagen synthesis.[4] The increase in fibroblasts that is introduced to the injured area results in a disproportionate overflow of collagen, particularly in the extracellular matrix.[5] The cells of the immune system secrete cytokines which are glycoproteins, proteins, and polypeptides and serve as means of cell-to-cell communication in the event of inflammation.[6] One of the well-known and studied cytokines associated with wound healing is transforming growth factor β (TGF-β). This particular cytokine has been previously studied for its impact and diverse effects on scar development and maturation.[7] GF-β action stimulates fibroblasts to synthesize large amounts of collagen and is of particular interest when investigating the effect of an intervention on scar occurrence.

SURGICAL BLADE TECHNOLOGY

Conventional scalpel blades are instruments routinely utilized in invasive medical procedures to produce planned skin incisions of all depths for various intended reasons. The conventional disposable scalpel blade was invented in 1915 and has been a remarkably durable invention with few changes since its first implementation over a hundred years ago and is widely used today by multiple disciplines such as dermatology, cosmetic surgery, and general surgery. The conventional #10 and #15 shape disposable blades make up the majority of blades used for surgical incisions worldwide and contain a slotted base for attachment to a scalpel handle, a spine, and a cutting surface ground to an edge. Application of advanced semiconductor technology, applied to the medical device industry has led to the development of the nano-polished blade. Skin is considered to be the most vulnerable organ that is continually exposed to the external injury and assaults of our environment. Scarring is an anticipated and required process following tissue injury and signals a responsive immune system. Many of the options available in today's modern world are available after the initial inflammatory process has begun. Alternative approaches that could potentially minimize scar occurrence at the moment of incision are still broadly unstudied.

In today's modern world, more efficient and evolved surgical instruments are making inroads into the scientific arena. Revolutionary advancements in blade technologies have challenged the conventional blades available on the market by bringing about new and emerging evidence-based concepts and materials. Nano-polished, surgical blades have an average surface roughness up to 1,000 times less than conventional blades and are the first of its kind to be released to the market in more than 100 years.[8]

METHODS

This study used a retrospective study design and reviewed historical medical records for 114 consecutive patients undergoing facelift procedures from January 2, 2019, to July 8, 2024, without any patient exclusions. All procedures were performed by the same surgeon using the same technique, incision placements, and post-procedure protocol which included at least 1 year of follow-up post facelift. #10 and #15 shaped disposable blades were used throughout. Nano-polished blades utilized the #10 (GY-10) and #15 (GY-15) blades (Planatome, LLC, Phoenix, Arizona). The primary outcome investigated was the occurrence of adverse scarring requiring post-surgical intervention. Interventions included Kenalog injections, laser/red light therapy, and/or excision and closure for the reduction of hypertrophic or keloid scarring.

Upon completion of collection, the data were separated and analyzed by surgical blade type with the goal of performing statistical analysis: Conventional Blade Group: January 2, 2019 – July 30, 2021, and Nano-olished Blade Group: August 1, 2021 – July 8, 2024. Patient characteristics were also collected to analyze group baseline differences (Table 1). Statistical analysis was performed using Microsoft Excel v2501 (Microsoft Corp., Redmond, Washington).

RESULTS

Baseline Patient Characteristics

Table 1 describes the baseline patient characteristics. 114 patient medical records were reviewed to extract data. The Conventional Blade Group (n=57) was comparable to the Nano-Polished Blade Group (n=57) with regard to all mentioned patient characteristics (P>0.05). All baseline patient characteristics, including age (P=0.07; >95% CI), gender (P=0.16; >95% CI), ethnicity (P=0.67; >95% CI), smoking history(P=0.41; >95% CI), and comorbidities (P=0.21; >95% CI) were statistically similar between groups.

Table 1. Baseline Patient Characteristics

Patient population (57 per group)	Conventional blade (mean ± SD)	Nano-polished blade (mean ± SD)	*P*-value
Age (years)	58.7 ± 8.9	55.4 ± 10.1	0.07
Gender (0=male, 0.5=trans, 1=female)	0.86 ± 0.35	0.94 ± 0.23	0.16
Ethnicity (0=Hispanic, 1=non-Hispanic)	0.25 ± 0.43	0.28 ± 0.45	0.67
History of smoking (0=no, 1=yes)	0.11 ± 0.31	0.16 ± 0.37	0.41
Comorbidities (no. reported)	1.12 ± 1.28	1.51 ± 1.92	0.21

Procedure Breakdown

Table 2 breaks down the 114 facelifts into the detailed procedure(s) performed.

Table 2. Procedure Breakdown

Procedure type	Patients per type
Facelift - full	65
Facelift - lower	26
Facelift - mid	9
Facelift – mid and neck lift	4
Facelift - temporal	4
Neck lift	4
Facelift – mid and temporal	2

Scar Occurrence

An independent 2-sample t-test was conducted to determine if differences existed in scar occurrence requiring intervention between the Conventional and Nano-Polished Blade Groups. There were statistically significant occurrences of hypertrophic and undesirable scars amongst those patients who were operated on using the Conventional Scalpel Blade when compared to those patients who were operated on using the Nano-polished Blade (*P*=0.03;>95% CI) (Table 3).

Table 3 further describes the scar occurrence rate as percentages. The Nano-Polished Blade Group had a scar occurrence rate of 1.8% compared to the Conventional Blade Group, which had an unfavorable scar occurrence rate of 12.3% (*P*=0.03; >95% CI). Comparing occurrence rates, the Nano-Polished Blade Group resulted in an 86% reduction in unfavorable scarring over the Conventional Blade Group.

Table 3. Unfavorable Scar Occurrence

Unfavorable scars	Standard blade (n=57)	Nano-polished blade (n=57)	*P*-value
Number of occurrences (no.)	7	1	0.03
Percentage of occurrence (%)	12.3%	1.8%	
Mean ± SD	0.123 ± 0.33	0.018 ± 0.13	

DISCUSSION

Introduced by William Steward Halstead in the late 19th century, surgical techniques that minimize negative impact to the patient by reduced tissue handling and damage are a core principle toward achieving positive clinical outcomes. Previous literature highlights the need for further availability when it comes to more efficient blade options on the market. In the eye of the surgeon, 88% desire alternative options that will render an effective approach with minimal inflammatory response following incision.[9,10] The patient expectedly prefers an aesthetically pleasing scar at the end of their wound healing. Current findings point to a new option when undergoing the knife. A new and innovative option is available for both surgeons and patients who are concerned about the occurrence of undesirable scarring. These current findings are further supported by previous findings that reported a reduced tissue inflammation with up to 60% less collagen deposition and an 8 times lower production of TGF-β, which reported a 9 times greater wound closure at 3 days post-incision.[11] Sparse literature exists on how skin scars affect patients' physical and psychological health. The limited research has shed light on the detrimental effects that scarring after tissue injury can have on an individual's quality of life.[12] It has been found that facial scars can cause the

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DISCUSSION *(continued)*

patient a heightened level of self-consciousness and anxiety when compared to the general public.[13] The impact of the current study would help to alleviate such worries that are expressed by patients undergoing facelift surgery.

The numerous options that are currently available to treat scarring from tissue injury are considered after the development of the scarring process has initiated. Common approaches aim to minimize scarring after the incision has been made. It is well known for physicians to suggest modalities such as compression therapies along with medicinal topicals which aim to address the maturation of the scar. Nano-polished blade technology has introduced a new and novel approach to minimizing post-incision inflammation, which in turn lowers the incident rate of scar formation. In contrast to post-surgical treatments, the nano-polished blade has shown to be an effective tool to influence this issue at the time of surgery. The revolutionary findings of the current study could hold invaluable clinical importance for both the surgeon and the patient by offering an alternative for the patients who may have previously felt cornered to purchase the vast over-the-counter treatments that have many times rendered no real results. Overall, nano-polished surgical technology stands to provide the surgeon with an improved tool that can aid in furthering their approach toward surgical excellence with improved patient outcomes.

Despite its strengths, this single-center retrospective study has inherent limitations. The retrospective design can introduce selection bias, as patients were not randomized to each blade type. While the sample size is sufficient for an initial comparison and the 2 groups were proven statistically similar in a number of patient characteristics, a larger cohort would provide more robust estimates and allow for subgroup analyses (eg, by type of facelift). Looking ahead, a prospective, randomized controlled trial with a standardized follow-up period would provide stronger evidence of a causal relationship between nano-polished blade use and reduced scar occurrence. Patient-reported outcomes regarding scar appearance and quality of life would further help to validate the clinical benefits of this technology. Ultimately, these future investigations can refine our understanding of how to minimize scarring at the point of incision and improve outcomes for patients undergoing facial and other cosmetic procedures.

CONCLUSION

This significant research positively contributes to the area of surgical medicine by investigating the benefit of nano-polished surgical blades in a clinical setting. Although a reliable and commonly used tool in the field of surgery, conventional surgical blades contain flaws which impact inflammation and the occurrence of undesirable scarring in soft tissue. In this work, retrospective quantitative patient data were used to validate the use of nano-polished blades for the reduction in undesirable scarring when compared to conventional surgical blades.

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