Intralesional Electrocoagulation With Insulated Microneedle for the Treatment of Periorbital Syringomas: A Retrospective Analysis

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Ga Ram Ahn, MD, MS; Guk Jin Jeong, MD; Jae Min Kim, MD, MS; Ji Yeon Hong, MD, MS; Kapsok Li, MD, PhD; Chang Kyun Lee, MD, PhD; and Beom Joon Kim, MD, PhD

Abstract

Background: Conventional treatment options for periorbital syringomas are often unsatisfactory because of inevitable surface damage from the procedure and frequent recurrence rate of the tumors.

Objectives: The authors sought to ascertain the efficacy and safety of intralesional electrosurgery utilizing a monopolar radiofrequency device with a single insulated microneedle for the treatment of periorbital syringomas.

Methods: A retrospective analysis was performed employing data from medical records, routine questionnaires, and clinical photographs of 55 patients with periorbital syringoma who underwent intralesional electrosurgery.

Results: Approximately one-half of the patients (50.9%) experienced marked resolution after 1 treatment. The lesion clearance rate increased and lesion severity decreased each time the treatment was repeated. No persistent therapy-related adverse event was found except transient erythema or crusting.

Conclusions: Intralesional electrosurgery with insulated microneedle is an effective and safe treatment option for periorbital syringomas.

Level of Evidence: 4

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Syringomas are common, benign, appendageal tumors derived from the intraepidermal eccrine ducts. The lesions appear as small, firm, flesh-colored or yellow papules often in multiples with symmetric distribution. They are histologically composed of small ductal structures lined by 2 rows of epithelial cells. The ductal structures lie within a fibrous dermal stroma, which may elongate, taking the shape of a tadpole or a comma.[1] The tumor depth ranges from 400 to 1200 μm and the diameter ranges from 50 to 100 μm.[2,3]

Syringomas typically present in early adulthood with a female predominance and are mostly found on the face, such as the lower eyelids; hence, there are is a great demand for aesthetic improvement.[4,5] Syringomas are benign and typically asymptomatic. The goal of treatment should be the improvement of cosmetic appearance via

Drs Ahn, Jeong, and J.M. Kim are residents, Dr Hong is a clinical instructor, and Drs Li and B.J. Kim are professors, Department of Dermatology, Chung-Ang University Hospital, Seoul, Korea. Dr Lee is a dermatologist in private practice in Seoul, Korea.

Corresponding Author:
Prof Beom Joon Kim, Department of Dermatology, Chung-Ang University Hospital, 102 Heukseok-ro, Dongjak-gu, Seoul 06973, Korea.
E-mail: beomjoon74@gmail.com

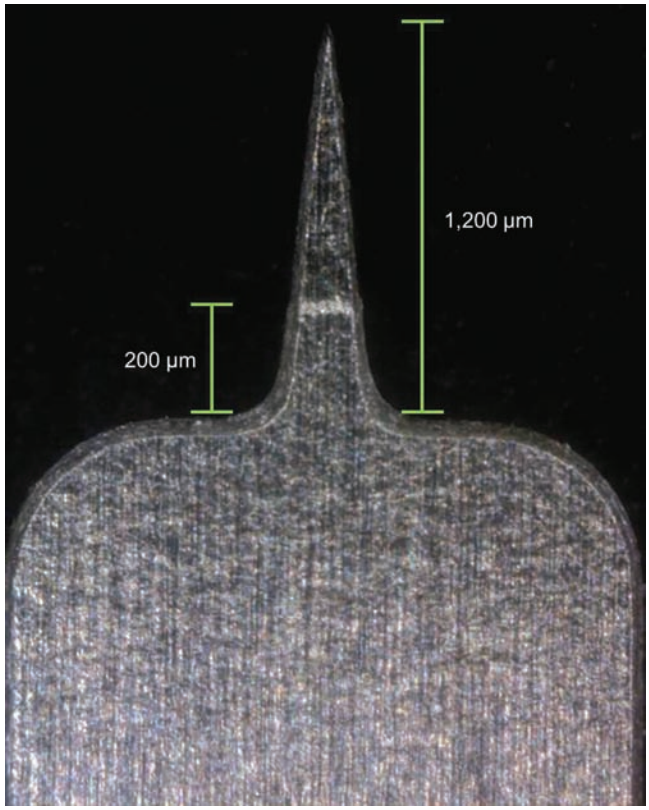


Figure 1. Magnified image of S-type microneedle.

size reduction rather than aggressive removal. Therefore, the selective destruction of dermal target lesions without damage to normal epidermal tissue would be the ideal treatment strategy.

Conventional treatment options, such as CO_2 laser,[6-12] surgical excision,[13] and dermabrasion,[14] often result in persistent postprocedural adverse events such as scarring and dyspigmentation. The key cause of these unwanted side effects is damage to the epidermis. In conventional management of syringomas, the accumulation of these disfiguring side effects is inevitable because the treatment requires repetitive procedures due to the recurring tendency of syringomas. This is challenging for dermatologic surgeons who want to provide satisfactory clinical results to their patients.

Karam et al[15] and Hong et al[16] attempted intralesional electrosurgery with a single microneedle radiofrequency device (SMNR) to overcome the disadvantages of conventional therapies. Both reports showed fine clinical results, sparing epidermal damage. SMNR recently emerged as one of the most popular techniques to treat periorbital syringomas in Korea because of its favorable efficacy and patient satisfaction. However, there is no large study, to our knowledge, evaluating the efficacy and safety of intralesional electrosurgery until now. Therefore, we report the utilization of a SMNR for the treatment of periorbital syringomas.

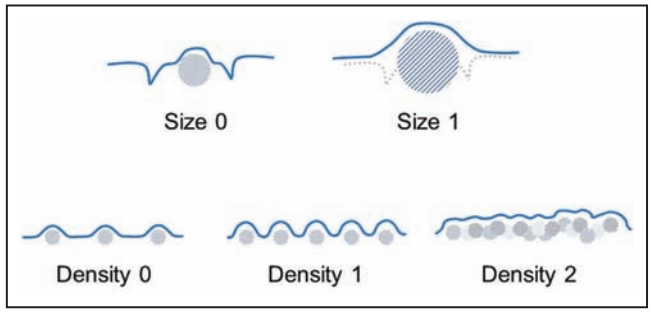


Figure 2. Illustration demonstrating the size and density category of the Periorbital Syringoma Severity Index scoring system.

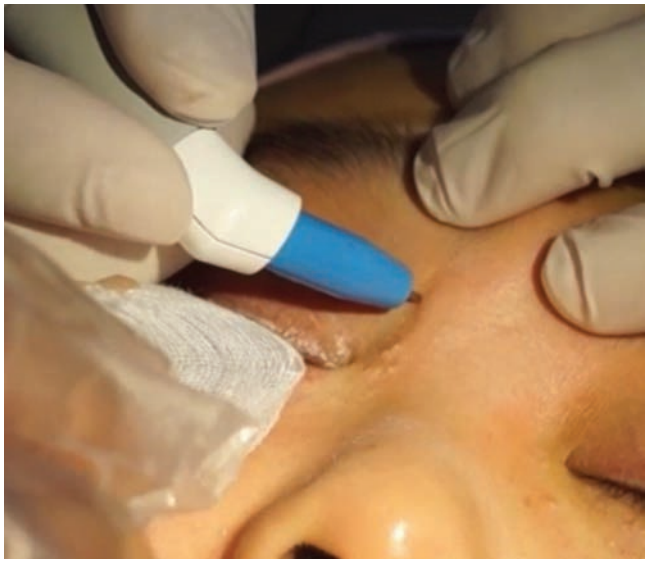
METHODS

Patients and Treatment

This retrospective study was approved by the Institutional Review Board of Chung-Ang University Hospital (IRB No. 1807-007-16187) and was in accordance with the Declaration of Helsinki. Every patient who received SMNR at least 3 times for treatment of periorbital syringomas from January 2016 to December 2018 was reviewed. Cases with insufficient clinical photographs (in terms of quantity or quality) were excluded from the analysis.

As per protocol, visit schedules were progressed in almost the same pattern. For every visit day, digital photographs of each patient were obtained before treatment using the same camera settings, patient positioning, and room lighting. At the second visit, every patient was requested to sign and answer a routine paper form questionnaire that included subject-rated global improvement 5-point scale based on the percentage of lesion clearance (grade 0: worsened; grade 1: minimal improvement or 0-25% clearance; grade 2: moderate improvement or 25-50% clearance; grade 3: marked improvement or 50-75% clearance; grade 4: near-total improvement or >75% clearance) and experienced adverse events (type and duration).

Local anesthesia was administered with lidocaine cream (EMLA, Astra Pharmaceuticals, Westborough, MA) and bicarbonate-buffered lidocaine-epinephrine injection. A 1-MHz monopolar radiofrequency (RF) device (AGNES, AGNES Medical Co., Korea) was employed for treatment. The antenna endplate was positioned beneath each patient's nape to set a monopolar circuit. A disposable microneedle with proximal insulation (S-type needle, AGNES Medical Co.) (Figure 1) was fixed into the hand piece and then applied to ablate the



Video. Watch now at https://academic.oup.com/asj/article-lookup/doi/10.1093/asj/sjz288.

lesions. The proximally insulated microneedle was then inserted into each lesion, and an RF current was applied through it 2 to 3 times per papule. A video demonstrating a portion of the procedure is available online as Supplemental Material at www.aestheticsurgeryjournal.com. The parameters (initially set at 4 W and 100 milliseconds) were modulated on the basis of clinical details. Cold packs and mupirocin ointment were applied after treatment. There was no further dressing or postoperative care after the procedure day.

Assessment

Patient demographics, prior treatments, and patient satisfaction levels were recorded through medical charts, questionnaires, and clinical photographs. Two kinds of objective efficacy assessment were performed through clinical photographs. First, an expert panel of 2 independent reviewers, blinded to the number of treatments, rated global improvement based on pretreatment and posttreatment photographs employing the same 5-point scale utilized in the patient questionnaire.[9,10,17,18] Second, the panel assessed the severity of syringoma lesions on each photograph employing Periorbital Syringoma Severity Index (PSSI) (Table 1; Figure 2). The total score of PSSI was obtained from the summation of each score of 4 categories: number, size, involvement, and density.

Expected adverse events including erythema, edema, bleeding, infection, postinflammatory hyperpigmentation, and scars were identified by reviewing medical records, questionnaires, and clinical photographs.

Table 1. Periorbital Syringoma Severity Index[a]

Category	Score	Description
Number	0	No syringoma lesion
	1	Number of lesions is between 1 and 10
	2	Number of lesions is more than 10
Size	0	Most papules are smaller than a grid divided by the fine crease near the lesion
	1	Most papules are larger than the grid obscuring adjacent fine crease
Involvement	0	Syringomas involve lower eyelids exclusively
	1	Syringomas involve beyond the lower eyelids (ie, upper eyelid, nose, cheek)
Density	0	Discrete lesions
	1	Adjacent lesions; borders of adjacent lesions are merged, but each papule is distinguishable
	2	Confluent lesions; borders of adjacent lesions are overlapped making each papule indistinguishable

[a]The total score of PSSI was obtained from summation of each scores of 4 categories; number, size, involvement, and density.

Statistical Analysis

All statistical analyses were performed employing SPSS software version 25 (Statistical Package for the Social Sciences; SPSS, Inc., Chicago, IL). The difference in PSSI score before and after treatment was compared with the Wilcoxon signed-rank test. Statistical significance was defined as $P < 0.05$. To determine the level of agreement between the raters, weighted kappa was calculated.[19] According to the interpretation scale of Landis and Koch,[20] weighted kappa coefficients of greater than 0.61 indicated that the PSSI score was reliable whereas less than 0.61 showed that it was unreliable.

RESULTS

Demographics

A total of 55 subjects (3 men and 52 women) underwent more than 3 treatments for syringoma utilizing SMNR. The majority of the patients (94.6%) were female. The age ranged from 18 to 69 years old (mean, 38.4 years). The initial

Table 2. Patient Demographics

	No. (%)
Gender	
Female	52 (94.6)
Male	3 (5.5)
Age group (y)	
10-19	2 (3.6)
20-29	8 (14.5)
30-39	20 (36.4)
40-49	20 (36.4)
50-59	4 (7.3)
60-69	1 (1.8)
Race	
Asian	55 (100.0)
Fitzpatrick skin phototype	
III	3 (5.5)
IV	52 (94.6)
Initial onset (age in years)	
10-19	14 (25.5)
20-29	25 (45.5)
30-39	8 (14.6)
40-49	8 (14.5)
Lesion involvement	
Lower eyelids	55 (100.0)
Beyond the lower eyelids[a]	49 (89.1)
Prior treatments	
CO_2 laser	27 (49.1)
Others	9 (16.4)
None	19 (34.6)
Presence of familial history	29 (52.7)
Total	55 (100.0)

[a]Upper eyelids, nose, cheek, forehead, etc.

development of syringoma for most of the patients (70.9%) was in the second and third decades of their life. Before treatment with SMNR, 36 patients (65.5%) had undergone prior interventions (CO_2 laser, erbium laser, TCA, and others). The average total follow-up period was 230.7 days (range, 94-687 days). The average interval between treatments was approximately 3 months (115.6 days). All of the patients had syringoma lesions on their lower eyelids, whereas 49 cases (89.1%) involved other regions. These demographics are presented in Table 2.

Efficacy

Routine questionnaires answered on the second visit revealed near-total improvement (>75%) in 2 of the 55 patients (3.6%), marked clinical improvement (51-75%) in 26 (47.3%), moderate clinical improvement (26-50%) in 15 (27.3%), minimal improvement (0-25%) in 7 (12.7%), and worsened in 5 (9.1%). Approximately one-half of the patients (50.9%) experienced clearance of more than one-half of the lesions (Figure 3A).

A total of 110 periorbital regions of 55 patients was analyzed. The result of investigator-rated global improvement on the second visit showed near-total clearance (>75%) in 1 of the 110 periorbital regions (0.9%), marked clearance (51-75%) in 10 (9.1%), moderate clearance (26-50%) in 36 (32.7%), minimal clearance (0-25%) in 61 (55.5%), and worsened lesions in 2 (1.8%). On the third visit, more than 75% clearance was observed in 6 periorbital regions (1.8%), 51% to 75% clearance in 32 (29.1%), 26% to 50% clearance in 42 (38.2%), 0 to 25% clearance in 28 (25.5%), and worsened lesions in 2 (1.8%) (Figure 3B).

The PSSI score was significantly decreased after the first (mean, 3.2) and second (mean, 1.7) treatments ($P < 0.05$) compared with baseline (mean, 4.0). The proportion of patients with lower PSSI scores increased with time, whereas that of patients with higher PSSI scores decreased (Figure 4). All of the weighted kappa coefficients for the inter-rater reliability were above 0.61 (baseline, 0.89; 2nd visit, 0.81; and 3rd visit, 0.62). Representative cases are presented in Figures 5-7.

Safety

We did not find any evidence of serious adverse events, such as posttreatment scarring or dyspigmentation, on reviewing the medical records and clinical photographs. Most of the patients tolerated the therapy well. Temporary edema erythema and crusting were identified in 31 cases (56.3%), 26 cases (47.2%), and 15 cases (27.3%). The mean duration of each event was 2.4, 3.9, and 1.8 days, respectively. There was 1 case (1.8%) of postinflammatory hyperpigmentation that remained for 2 months. No cases of infection or scarring were identified through the analysis.

DISCUSSION

The goal of syringoma treatment is to improve cosmetic appearance, because these lesions are considered benign, nonprogressive, and typically asymptomatic.[4] Both

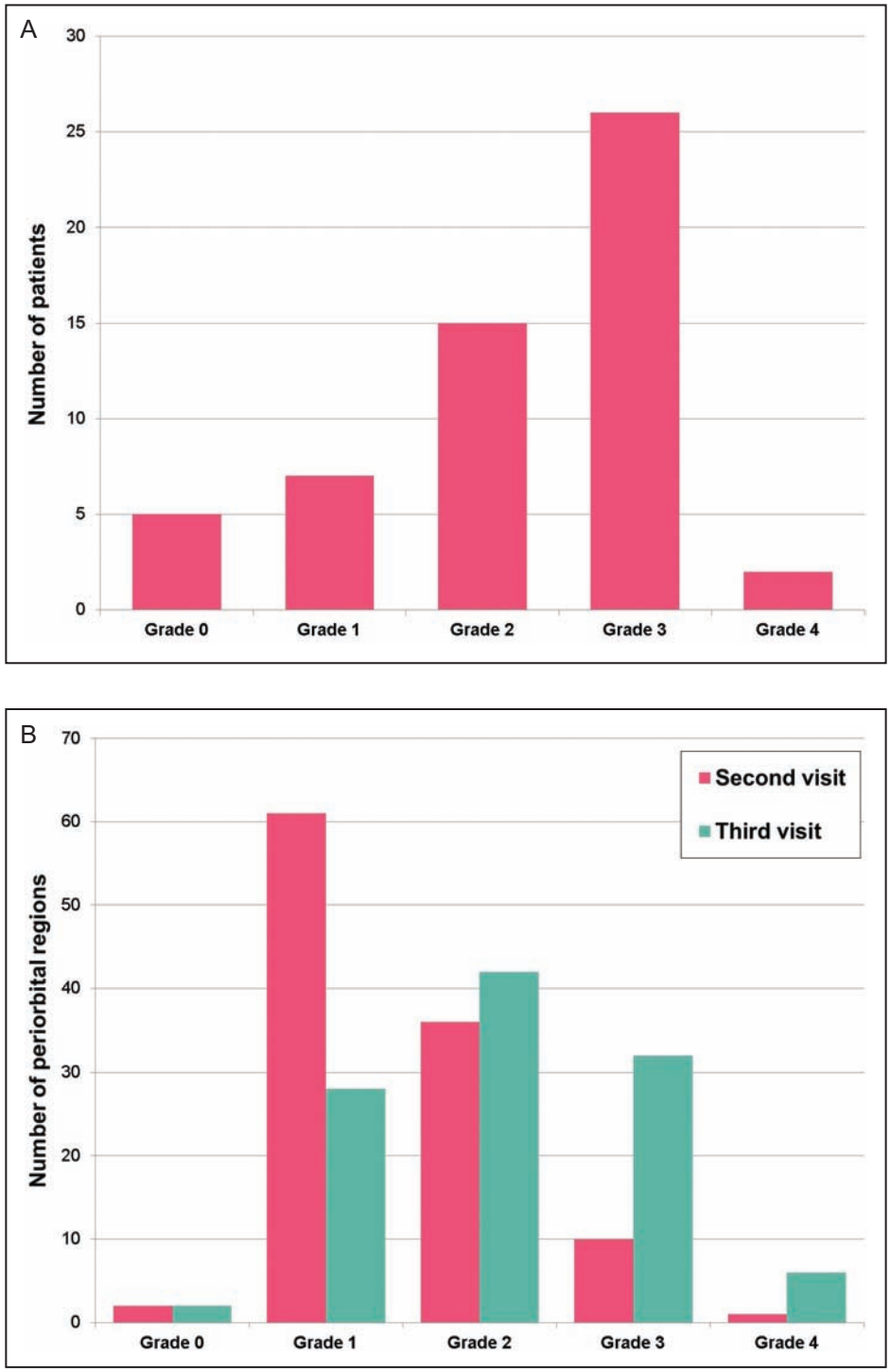


Figure 3. Results of global improvement. (A) Patient-rated global improvement based on routine questionnaire on the second visit. (B) Investigator-rated global improvement based on clinical photographs of the second and the third visits.

medical and surgical interventions have been described in the literature with variable success. For example, topical retinoid[21] and topical atropine[22] have been shown to be a medical modality with moderate efficacy. However, the generalizability is limited due to the small numbers of cases. Some destructive interventions such as surgical excision,[13] dermabrasion,[14] direct electrocautery,[23] and CO_2 laser vaporization[6,7,11,12] also have been reported.

Among them, CO_2 laser has been considered one of the better options and is widely employed due to

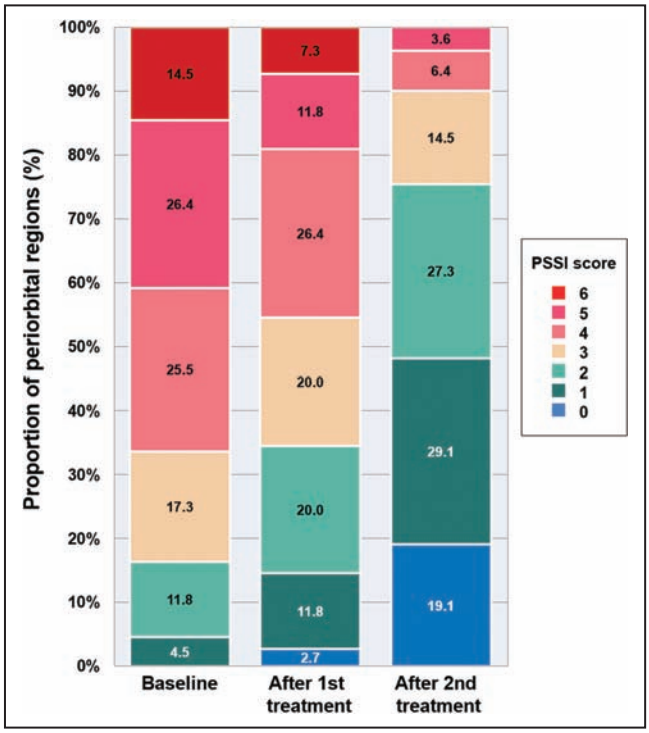


Figure 4. Results of periorbital syringoma severity index score.

its narrow zone of photothermolysis compared with direct electrodessication. Wheeland[12] first described the use of the continuous wave CO_2 laser for the treatment of syringomas in 1986. Apfelberg[6] followed in 1987 with the report of utilizing superpulsed CO_2 lasers. Wang[11] utilized resurfacing CO_2 laser with flashscanner to treat syringomas. After that, fractionated laser beam pattern[9] and pinhole drilling method[18] were suggested as remedies to reduce the downtime of the CO_2 laser. However, CO_2 laser cannot completely avoid the risk of damage to the skin surface because the laser beam must penetrate the epidermis to reach the dermal tumor. Meanwhile, Hong reported in 2010 that syringoma can be effectively treated without surface damage utilizing intralesional electrocoagulation with a monopolar RF device and single insulated microneedle (SMNR).[16] However, the sample size was limited (2 cases) to determine its efficacy or safety.

Our data indicate competent efficacy of SMNR in treatment of periorbital syringomas. After a single treatment session, 50.9% of patients experienced marked (>50%) resolution of syringoma lesions. This result is quite different from the data of the independent investigators, which showed that the more than one-half resolution was observed in 10% of the periorbital regions after 1 treatment session and in 34.5% after 2 sessions. This discrepancy reflects the degree of improvement patients actually feel might be more than their clinician expected. At the time of evaluation, the independent raters would have spent enough time evaluating the photographs, recognizing even the smallest lesions. Taking these circumstances into consideration, the efficacy data of the present study are quite comparable with that of 2 previously reported clinical trials that evaluated the efficacy of CO_2 laser treatment in treating periorbital syringomas. One study that employed fractional ablative CO_2 laser[9] reported that 51.4% of cases reached marked (>50%) resolution, and the other study that utilized CO_2 laser via the pinhole method[18] reported that 58.6% of cases achieved the same degree of outcome.

The most important advantage of SMNR compared with conventional CO_2 laser therapy is its favorable safety profile. In this study, persistent adverse events, such as posttreatment dyspigmentation or scarring, did not occur in a single case. Moreover, SMNR seems to be free from a prolonged downtime issue compared with CO_2 laser therapy. It only left temporary edema, erythema, and crusting, lasting less than 4 days (mean of 2.4, 3.9, and 1.8). Previous clinical research with CO_2 laser showed that fractional ablative method[9] resulted in posttreatment erythema for a mean of 16.67 days, crusting for a mean of 5.87 days, and posttreatment hyperpigmentation in 14.3% of patients. CO_2 laser via the pinhole method[18] left prolonged erythema in 6.9% of patients and hyperpigmentation in 3.4%.

There is minimal chance of external drainage during the intralesional electrocoagulation procedure. However, unlike cystic tumors such as sebaceous cysts, there is neither sac around the syringoma nor accumulated materials that must be drained for complete removal. Solely to coagulate the over-proliferated eccrine ducts without external drainage will enough to induce regression of the lesions after self-absorption of coagulated debris. Of course, there may still be remnants after the first treatment. However, additional treatment sessions are not burdensome because the procedure rarely leaves traces.

Several characteristics of RF procedures give them an edge over laser procedures. Intralesional electrocoagulation induces the thermal coagulative zone inside the tangled ductal structure via its microneedle, which penetrates the epidermis and reaches the target depth in the dermis. The difference in electrical impedance between the epidermis (high) and the dermis (low) allows the RF energy to flow in the targeted dermal tissue. Also, the amount of RF energy converted to heat energy depends on the electric conductivity of the adjacent tissue and not the chromophores nearby, such as melanin pigments.[24,25]

Some features of the novel microneedle employed in this study enhanced the selectivity of the RF treatment even more. A 200-μm proximally insulated part on the 1200-μm needle protrudes from the blunt body, forming a

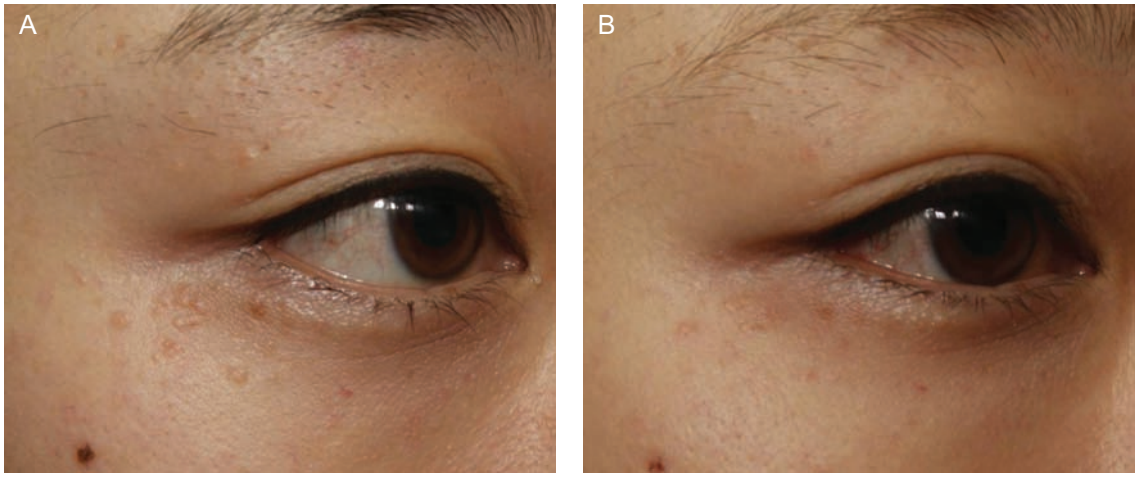


Figure 5. This 34-year-old female is a representative case. (A) Baseline and (B) 6 months after baseline. She received 2 sessions in total (treatments at 0 and 3 months).

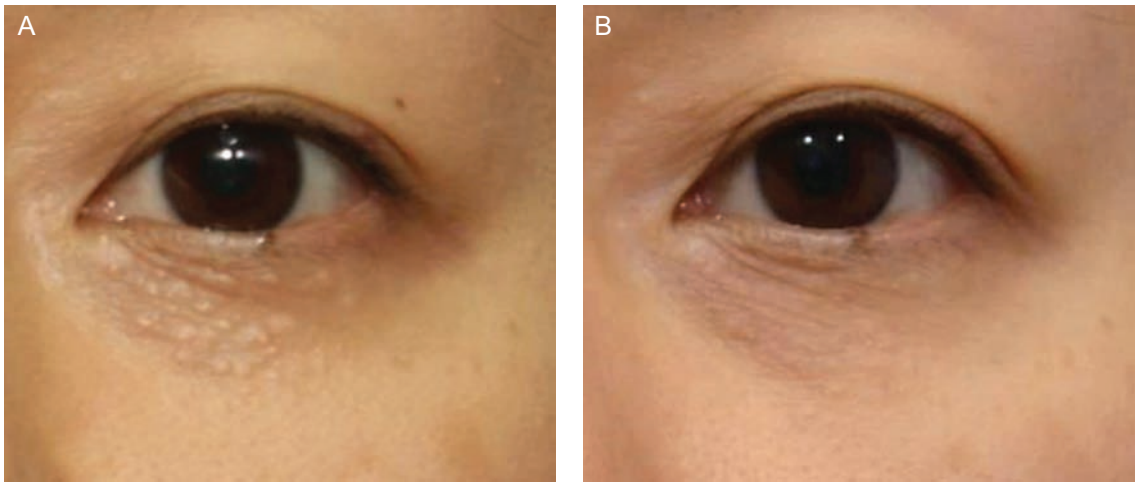


Figure 6. This 32-year-old female is a representative case. (A) Baseline and (B) 6 months after baseline. She received 2 sessions in total (treatments at 0 and 3 months).

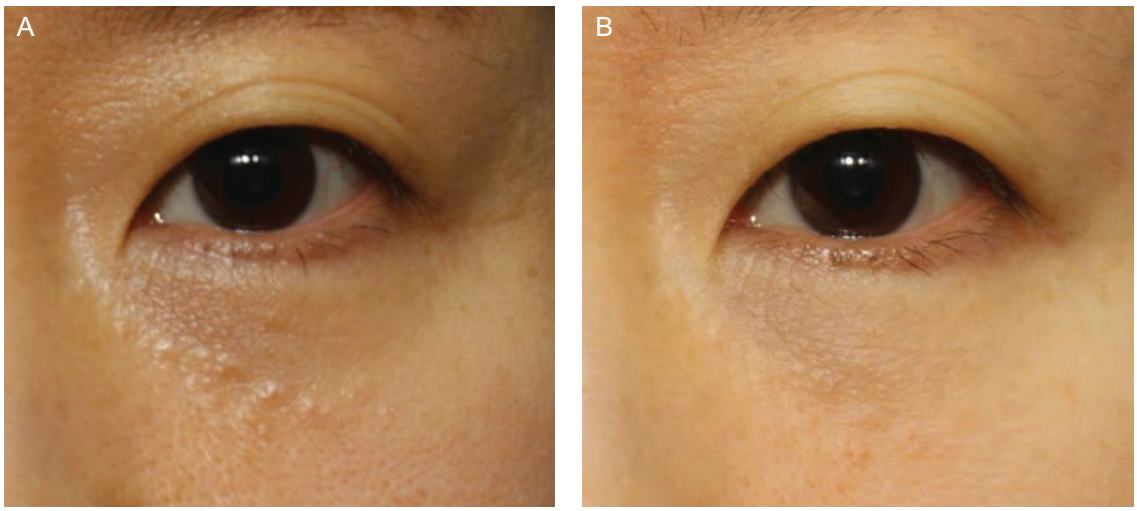


Figure 7. This 49-year-old female is a representative case. (A) Baseline and (B) 7 months after baseline. She received 2 sessions in total (treatments at 0 and 3 months).

T-shaped shoulder (Figure 1). The length of the insulated and exposed part of the S-type microneedle utilized in SMNR is designed to treat syringoma lesions exclusively. The exposed part covers the syringoma lesions while the insulated part gives off RF energy to bypass the epidermis.

The T-shaped shoulder of the microneedle, which functions as a stopper, provides uniform depth regardless of session or physician. It is especially useful when applied to papules with confluent patterns because immediate edema during the procedure can obscure the presumed depth of the adjacent papules. By contrast, conventional therapeutic modalities, such as CO_2 laser, often leave unnecessary scars or pigments if the operator lacks sufficient experience. It is difficult to estimate the depth of the flesh-colored dermal mass from the outside. For those reasons, SMNR is widely employed to selectively destruct various target lesions in the dermis, including acne vulgaris,[26,27] trichoepithelioma,[25] and lipoma.[28]

We developed a severity index (PSSI) to assess severity at a single moment rather than the difference between 2 moments. A review of the published literature showed that no studies have assessed the severity of syringoma lesions based on a single moment. The improvement scale based on the difference between before and after therapy has been commonly utilized for efficacy evaluation in the previous study.[9,10,17,18] The result of PSSI correlated well with both improvement scales. This novel evaluation method seems to be valid and is a reliable tool for assessing the severity of periorbital syringoma. We suggest that PSSI can be utilized in further clinical studies on the efficacy of syringoma treatment methods.

This study has some limitations. Most of the patients were female (94.6%). This may reflect the desire for the treatment because of its higher prevalence in females. Moreover, we did not examine the differences in the treatment responses depending on skin phototypes; the patients included Asians only (phototype IV in 94.6% and III in 5.5%). Considering that ethnic skin has a higher risk of dyspigmentation after dermatological treatment,[29] it is notable that posttreatment dyspigmentation occurred in only 1 case transitory after SMNR treatment. In addition, efficacy data after the third treatment session could not be included in the retrospective analysis because the routine clinical photographs were taken only before each treatment. Because there are possible remnants after each procedure, we usually treat patients at least 3 times with 3-month intervals. Further expected prospective study should include the data of the last follow-up visit. Lastly, it was a retrospective review from a single-center without a control group. Further prospective clinical studies including control treatment groups for other conventional active treatment may provide more precise information about the efficacy and safety of SMNR for the treatment of periorbital syringoma.

CONCLUSIONS

This retrospective analysis demonstrated favorable efficacy and safety of SMNR for the treatment of periorbital syringomas. Further prospective clinical trials or comparative clinical studies with balanced gender ratios and multiple ethnicities are needed.

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Drs Ahn and Jeong contributed equally as co-first authors.

Disclosures

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