CASE REPORT

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The combination of Q-switched neodymium:yttrium–aluminum–garnet (Nd:YAG) laser with photoacoustic pulse technology in combination with polynucleotides (PN) salmon DNA for skin rejuvenation: A case series

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ABSTRACT

Background: Skin aging leads to dyspigmentation, wrinkles, and lentigines. Photorejuvenation, especially Q-switched Nd:YAG laser therapy, is commonly used to address these concerns. We present a case series evaluating the effectiveness of combining Q-switched Nd:YAG laser with Polynucleotides (PN) Salmon DNA for facial photorejuvenation.
Case series: Five healthy adults underwent four sessions of full-face laser toning with a QS 1064 nm Nd:YAG laser followed by Polynucleotide (PN) Salmon DNA 2% injections every two weeks. We recorded subjective assessments and pain levels during treatment and captured photographic images for analysis. The treatment significantly improved skin brightness and pigmentation, with some subjects achieving mild or no pigmentation. Skin elasticity improvements varied among subjects. Some experienced significant enhancement, while others showed minor changes or none at all. Skin redness responses varied. Objective measurements revealed pore size, skin elasticity, moisture, skin tone, wrinkles, and skin age improvements.
Conclusion: Combining Q-switched Nd:YAG laser with PN Salmon DNA shows promise for enhancing skin health and appearance.

Keywords: facial rejuvenation, photorejuvenation, polynucleotides (PN) salmon DNA, Q-switched Nd:YAG laser, skin aging.
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INTRODUCTION

Skin aging is an ongoing process that occurs over time on the skin.[1] Aged skin undergoes structural and functional changes characterized by dyspigmentation, the development of wrinkles, and lentigines.[2] Various intrinsic and extrinsic risk factors can often precipitate changes in the skin, such as nutritional status, smoking, and ultraviolet (UV) radiation.[3] Persistent exposure to the sun's UV rays may accelerate skin aging by inducing DNA damage and mutation. Photodamage refers to changes in the skin that occur after persistent exposure to UV rays.[2,3]

Photorejuvenation uses light energy sources such as lasers to improve the appearance of the skin damaged due to skin aging caused by various risk factors.[4] These lasers' ability to repair skin damage or improve wound healing depends on their wavelength and pulse width.[5] Q-switched neodymium:yttrium-aluminium-garnet (Nd: YAG) laser has been used widely for photorejuvenation and often combined with other treatment modalities such as intense pulsed light (IPL) or hyaluronic acid, which has proven to be effective in various condition including melasma and hyperpigmentation.[6,7] The laser exerts its function on tissue by improving the formation of collagen fibrils, which play a crucial role in skin remodeling.[5]

Polydeoxyribonucleotide (PDRN) is a DNA-derived drug from Oncorhynchus mykiss (Salmon trout) or Oncorhynchus keta (Chum Salmon) sperm. It has been vastly used to enhance wound healing through its ability to stimulate cell migration and maturation, angiogenesis, and to reduce inflammation in impaired wound healing models in experimental and clinical studies.[8] Recently, the topical application of polynucleotide (PN) as a filler injection has become a popular method for skin rejuvenation. It improves skin elasticity and tissue regeneration with minimum or no adverse effects.[9]

Limited data currently exist regarding the use of combination therapy for facial photorejuvenation. We report a series of cases to assess the safety and effectiveness of combining the Q-switched Nd-YAG laser with polynucleotides (PN) derived from Salmon DNA (Nucleofill® Strong, Promoitalia, Italy) for facial photorejuvenation.

CASE DESCRIPTION

The data were obtained from patients who visited a private Dermatology Clinic from May 4, 2023, to June 12, 2023, with complaints of facial depigmentation. Five adults, four females, and one male,

Table 1. Subject's perception of skin brightness

Subject number	Initial	Final	
1	3	4	Improvement
2	3	5	Improvement
3	2	4	Improvement
4	3	4	Improvement
5	2	4	Improvement

Value 1= very dull, 2= dull, 3= moderate, 4= bright, 5= very bright

Table 2. Subject's perception of skin pigmentation

Subject number	Initial	Final	
1	3	4	Improvement
2	4	5	Improvement
3	4	4	No improvement
4	3	3	No improvement
5	3	4	Improvement

Value 1= very severe, 2= severe, 3= moderate, 4= mild, 5= none

Table 3. Subject's perception of skin elasticity

Subject number	Initial	Final	
1	2	5	Improvement
2	4	4	No improvement
3	3	4	Improvement
4	3	4	Improvement
5	3	3	No improvement

Value 1= very loose, 2= loose, 3= moderate, 4= slightly elastic, 5= very elastic

Table 4. Subject's perception of skin redness

Subject number	Initial	Final	
1	3	5	Improvement
2	5	5	No improvement
3	4	4	No improvement
4	4	5	Improvement
5	3	4	Improvement

Value 1= very red, 2= red, 3= moderate, 4= slight redness, 5= not red at all

Table 5. Objective measurement with photographic images using the facial skin analysis system (Janus-IIIR®)

	Initial	Final	Result
Pores	33.2	31.4	-5.4%
Elasticity	32.6	33.2	1.8%
Moisture	35.8	38.6	7.8%
Skin tone	33.6	35.8	6.5%
Wrinkle	32	31.6	-1.3%
Skin age	34	33	-2.9%

are healthy, with no breastfeeding and pregnant females. The age of patients ranged from 20 to 45 years old and were treated by full-face laser toning with QS 1064 nm Nd:YAG with PTP technology 5.4 J, 10 Hz, 6mm 2 phases and followed by Polynucleotide (PN) Salmon DNA 2% injection every two weeks for four times. The frequency and the number of QS 1064 nm Nd:YAG laser toning sessions and any previous history of melasma or other pigmentary disorders were recorded. Photographic images were taken for all patients using the Facial Skin Analysis system (Janus-III®, PIE, Korea) at their initial presentation and after 4th treatment. These included three standard close-up views (right lateral, left lateral, and central). Facial pigmentation was assessed with the cross-polarized and LED light images. The clinical outcome also noted each patient's progress (subjectivity patient toward the change in skin quality and pain during the treatment).

The perception of subjects regarding the brightness of their skin before and after treatment was presented in Table 1. The subjects rated their skin's brightness on a scale of 1 to 5, with 1 being "very dull" and 5 being "very bright." It appears that the treatment aimed to improve skin brightness. The result indicates that the treatment positively affected the subjects' perception of their skin brightness. In all cases, there was an improvement in the ratings of skin brightness after the treatment. Subjects who initially rated their skin as dull or moderately bright reported brighter skin after the treatment, with some even achieving a "very bright" rating. This suggests that the treatment successfully enhanced the perceived brightness of the subjects' skin.

The data in Table 2 represents subjects' perceptions of skin pigmentation before and after treatment. The subjects rated the level of pigmentation on their entire face using a scale ranging from 1 to 5, with 1 indicating "very severe," 2 indicating "severe," 3 indicating "moderate," 4 indicating "mild," and 5 indicating "none." The objective of the treatment appears to be the improvement of skin pigmentation.

The data suggests varying levels of improvement in subjects' perceptions of skin pigmentation after the treatment. Subjects 1 and 5 improved their perception of skin pigmentation from moderate to mild, indicating that the treatment positively reduced pigmentation. Subject 2 experienced a significant improvement, shifting from severe pigmentation to no pigmentation, suggesting that the treatment was highly effective in reducing pigmentation. Subjects 3 and 4 did not report any change in their perception of pigmentation, indicating that the treatment did not have an observable impact on their pigmentation levels.

Table 3 presents subjects' perceptions regarding skin elasticity before and after treatment. Subjects assessed the level of skin elasticity on their entire face using a scale ranging from 1 to 5, with 1 indicating "very loose," 2 indicating "loose," 3 indicating "moderate," 4 indicating

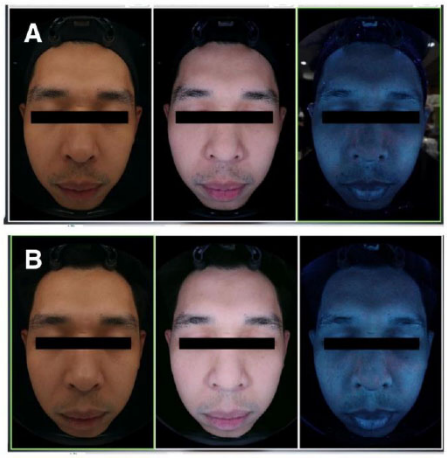

Figure 1. Photographic images acquired by the facial skin analysis system (Janus-IIIR®). A: Before (May 4, 2023); B: After (June 12, 2023).

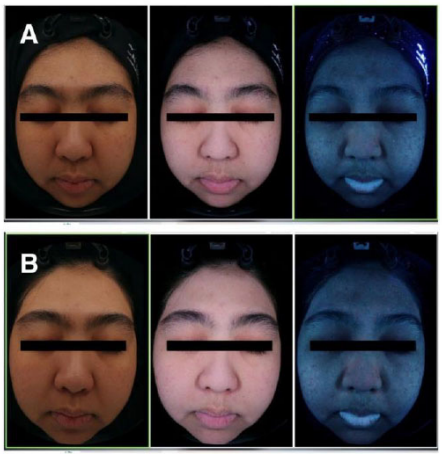

Figure 2. Photographic images acquired by the facial skin analysis system (Janus-IIIR®). A: Before (May 4, 2023); B: After (June 12, 2023).

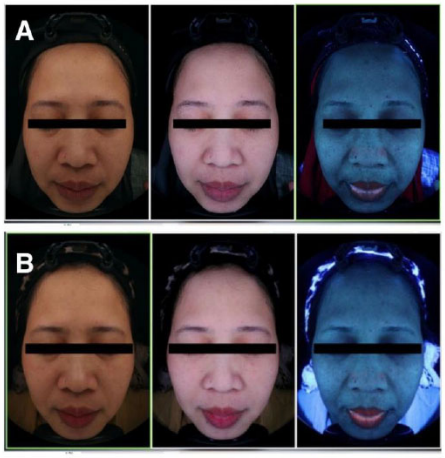

Figure 3. Photographic images acquired by the facial skin analysis system (Janus-IIIR®). A: Before (May 4, 2023); B: After (June 12, 2023).

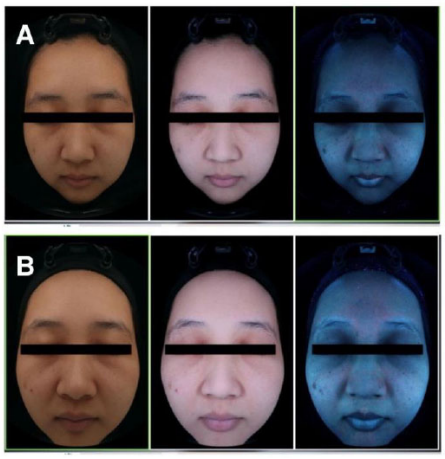

Figure 4. Photographic images acquired by the facial skin analysis system(Janus-IIIR®). A: Before (May 4, 2023); B: After (June 12, 2023).

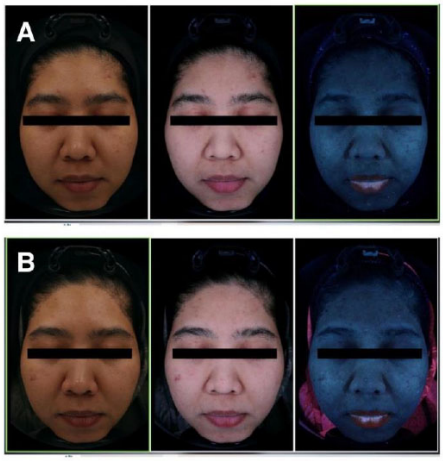

Figure 5. Photographic images acquired by the facial skin analysis system (Janus-IIIR®). A: Before (May 4, 2023); B: After (June 12, 2023).

"slightly elastic," and 5 indicating "very elastic." The goal of the treatment seems to be the improvement of skin elasticity.

The result reveals that the treatment had varying effects on different subjects' perceptions of skin elasticity. While Subject 1 experienced a substantial improvement, Subjects 3 and 4 showed some positive changes, albeit not as pronounced. On the other hand, Subjects 2 and 5 did not perceive any notable changes in skin elasticity. These findings highlight the variability in treatment outcomes among individuals and emphasize the importance of considering individual responses when assessing the effectiveness of such treatments. Further objective measurements and research may be needed to corroborate these subjective perceptions and provide a more comprehensive evaluation of the treatment's efficacy.

Table 4 presents subjects' perceptions regarding skin redness before and after a treatment. Subjects assessed the level of skin redness on their entire face using a scale ranging from 1 to 5, with 1 indicating "very red," 2 indicating "red," 3 indicating "moderate," 4 indicating "slightly red," and 5 indicating "not red at all." The treatment appears to target the reduction of skin redness.

The data reveals varying responses to the treatment among subjects. While some individuals experienced significant reductions in skin redness, others reported no changes. These findings underscore the importance of considering individual variability in treatment outcomes.

It's important to remember that these findings are based on subjective perceptions of the subjects. Objective measurements and further studies may be necessary to confirm the actual changes in skin elasticity. Additionally, the specific details of the treatment and any potential side effects or long-term effects should be considered in a comprehensive evaluation of the treatment's effectiveness.

We also measured this treatment's objective with photographic images of all patients using the Facial Skin Analysis system (Janus-III, PIE, Korea) (Figure 1-5). The results are presented in Table 5. The result compares various skin attributes, including pores, elasticity, moisture, skin tone, wrinkles, and skin age, between two different time points. The percentage change (% change) between these two time points is also provided for each attribute.

Before the treatment, the pores had a value of 33.2, which decreased to 31.4 after the treatment. The percentage change in pores is calculated as: ((31.4 - 33.2) / 33.2) * 100% = -5.4%. The negative percentage indicates a 5.4% decrease in pore size from May to June. This suggests an improvement in skin texture as the pores have become smaller.

Elasticity increased from 32.6 to 33.2. The percentage change in elasticity is calculated as ((33.2 - 32.6) / 32.6) * 100% = 1.8%. This positive percentage change suggests a 1.8% improvement in skin elasticity during this period.

Moisture levels increased from 35.8 to 38.6. The percentage change in moisture is calculated as: ((38.6 - 35.8) / 35.8) * 100% = 7.8%. This indicates a substantial 7.8% increase in skin moisture, a positive sign for skin health. Skin tone improved from 33.6 to 35.8. The percentage change in skin tone is calculated as ((35.8 - 33.6) / 33.6) * 100% = 6.5%. A 6.5% increase in skin tone suggests that the skin appears healthier and more even in color. Wrinkle values decreased from 32 to 31.6. The percentage change in wrinkles is calculated as: ((31.6 - 32) / 32) * 100% = -1.3%. The negative percentage indicates a 1.3% reduction in wrinkle appearance, implying a minor improvement in skin smoothness.

Skin age decreased from 34 to 33. The percentage change in skin age is calculated as: ((33 - 34) / 34) * 100% = -2.9%. A negative percentage change of 2.9% suggests that the skin appears younger, indicating an improvement in overall skin health.

DISCUSSION

The case series showed positive changes in most skin attributes over the period. Skin moisture, elasticity, skin tone, wrinkle appearance, and skin age have all improved. The pores showed a decrease in size, generally considered a positive change. These results suggest that the skincare regimen or treatments applied during this time have effectively enhanced overall skin health and appearance. The evaluation of patient subjective perceptions and objective measurements of various skin attributes before and after treatment has provided valuable insights into the effectiveness of the combination of Q-Switched Neodymium: yttrium–aluminum–garnet (Nd:YAG) laser with photoacoustic pulse technology and polynucleotides (PN) salmon DNA for skin rejuvenation treatment.

These findings are consistent with previous trials and systematic reviews. A mean reduction in indications of skin aging on a Global Aesthetic Improvement Scale of 30–40% was observed in a prior study using a non-ablative fractional high-power 1064-nm Q-switched Nd: YAG laser for face and neck rejuvenation. The patient's and the therapist's mean (range) satisfaction ratings, on a 0–10 point scale, were 8.7 (8–10), 8.0 (3–10) for the neck, and 9.0 (8–10), 9.2 (6–10) for the face[10]. The low-fluence Q-switched Nd:YAG laser (LFQSNY), commonly referred to as 'laser toning (LT)', has been accepted as a new gold standard of melasma treatment in Asia, where there is high demand for treatment.[11] These findings should be confirmed with long-term evaluation. The Previous trial showed a significant but modest reduction in mean melanin index, modified melasma area severity index (MASI), and photographic and patient assessment after treatment. All patients had a reappearance of pigmentation by the end of 12 weeks of follow-up.[12]

These case series showed no side effects from the treatment in all patients. Although LFQSNY is a relatively safe treatment for melasma using the abovementioned mechanisms, adverse events occasionally occur. Among them, MH (mottled hypopigmentation) or punctate leukoderma is the major concern since it lasts long without treatment. The incidence rate of MH is unknown. However, many published studies have reported no or less incidence of MH.[11] These findings are consistent with previous trials that showed no significant adverse events after treatment.[12,13]

Our case series study has limitations: no control group, the subjective outcome assessment, and short follow-up time. It is important to note that individual responses to the treatment vary, and further research, including larger sample sizes and longer-term assessments, may be necessary to provide a comprehensive evaluation of its efficacy. Additionally, considering both subjective and objective data is crucial in understanding the full impact of the treatment on skin attributes.

CONCLUSION

The combined analysis of subjective perceptions and objective measurements suggests that the treatment has effectively enhanced various skin health and appearance aspects.

CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

PATIENTS' CONSENT

All patients provided written informed consent before receiving any study-related procedures and to use their image or clinical history for publication.

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AUTHORS CONTRIBUTIONS

Authors SS and TH contributed to conceptualization. Authors SS and TH: methodology and formal analysis. Authors SS, TH, and SL contributed to the investigation and resources. Authors SS, TH, and SL contributed to the original manuscript draft. Authors SS, TH, and SL contributed to the visualization. Authors SS, TH, and SL contributed to validation, review, and manuscript editing. All authors read and approved the final manuscript.

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