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Efficacy and Safety of Incobotulinumtoxin-A for Trapezius Muscle Reduction: Quantitative Evaluation With Imaging Studies

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Background: Bilateral trapezius muscle hypertrophy can cause both aesthetic concerns and physical discomfort. This study aimed to objectively assess the clinical efficacy and safety of incobotulinumtoxin-A (INCO) injections in patients with bilateral trapezius muscle hypertrophy.

Methods: This single-center retrospective study included 22 patients with bilateral trapezius muscle hypertrophy who received INCO injections and were followed up at 1, 3, and 6 months after treatment. Evaluation methods included clinical photography, imaging analysis with ultrasound and 3-dimensional computed tomography, and the Global Aesthetic Improvement Scale.

Results: Photographic evaluations revealed significant reductions in surface area at 1 month (28.82% ± 3.93%), 3 months (26.83% ± 3.60%), and 6 months (28.74% ± 3.30%), compared with baseline (all $P < 0.001$). Ultrasonography showed significant reductions in thickness at 1 month (5.20 ± 1.01 mm) and 3 months (4.64 ± 0.80 mm), which were sustained until 6 months (5.23 ± 0.89 mm), compared with baseline ($P < 0.001$). A notable volume reduction in the upper trapezius muscle was detected in the 3-dimensional computed tomography scan of a single patient. The Global Aesthetic Improvement Scale scores indicated high satisfaction, with no significant adverse events.

Conclusions: INCO injections effectively reduced trapezius muscle size, with sustained results up to 6 months posttreatment. This study supports the use of INCO as a safe and effective option for managing trapezius hypertrophy. *(Plast Reconstr Surg Glob Open 2025;13:e6782; doi: 10.1097/GOX.0000000000006782; Published online 20 May 2025.)*

INTRODUCTION

Bilateral trapezius muscle hypertrophy is a condition characterized by the abnormal enlargement of the trapezius muscles, leading to both aesthetic concerns and functional impairments. Affected individuals often experience physical discomfort, pain, tension-type headaches, and limited range of motion, alongside aesthetic concerns about their appearance.[1] Increased muscle tension due to trapezius muscle hypertrophy induces the activation of trigger points in the upper trapezius muscle, leading to pain that may spread ipsilaterally from the neck to the temporal region.[2] These issues can significantly impact the quality of life, making effective treatment options highly desirable.

Botulinum toxin type A (BoNT/A) has emerged as a promising nonsurgical alternative for the management of muscle hypertrophy. Its ability to induce temporary muscle paralysis and subsequent atrophy has been well documented in various clinical settings.[3–6] The Food and Drug Administration has approved 12 therapeutic and aesthetic

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indications for botulinum toxin injection,[7] ranging from blepharospasm in 1989 to platysma bands in 2024. As off-label uses of botulinum toxin have shown efficacy,[8] there is still a significant need to expand its indications further. Previous research has demonstrated that botulinum toxin can effectively reduce muscle size, with the upper trapezius muscle serving as a primary target.[9] Several studies have demonstrated that botulinum toxin injections can improve aesthetic contours and alleviate associated discomfort.[10–12] Among the different formulations available, incobotulinumtoxin-A (INCO, Xeomin; Merz Pharmaceuticals GmbH, Frankfurt, Germany) stands out due to its high purity and reduced risk of immunogenicity.[13–15] Despite its potential, there is a notable lack of focused research on the application of INCO, specifically for the treatment of trapezius muscle hypertrophy.

Although there have been some efforts to provide objective measurement,[16,17] the number of studies using quantitative methods to measure volumetric reduction of the trapezius remains limited. Addressing this unmet need, our study aims to evaluate the clinical effectiveness and safety of INCO injection in patients with bilateral trapezius muscle hypertrophy. This retrospective study includes patients who received INCO for bilateral trapezius muscle hypertrophy with follow-up visits at 1, 3, and 6 months posttreatment for photographic and quantitative imaging evaluations of trapezius muscle volume reduction.

Takeaways

Question: Can incobotulinumtoxin-A (INCO) injections effectively and safely reduce bilateral trapezius muscle hypertrophy, as objectively assessed through imaging studies?

Findings: This single-center retrospective study of 22 patients demonstrated that INCO injections significantly reduced trapezius muscle size, as measured by clinical photography (28.74% ± 3.30%) and ultrasonography (5.23 ± 0.89 mm), with effects lasting up to 6 months posttreatment and high patient satisfaction reported via Global Aesthetic Improvement Scale scores, without significant adverse events.

Meaning: INCO injections offer a safe and effective treatment option for bilateral trapezius muscle hypertrophy, providing sustained reduction in muscle size for up to 6 months, as objectively confirmed by imaging studies.

MATERIALS AND METHODS

Study Design

This retrospective study analyzed patients with bilateral trapezius muscle hypertrophy who received INCO injections at Apkoo-Jung Oracle Dermatology Center from March 1, 2023, to August 30, 2023. The study included patients between 20 and 50 years of age who returned for follow-up visits at 1, 3, and 6 months posttreatment for photographic and imaging evaluations. Each follow-up visit was included if patients visited within 2 weeks before or after the intended follow-up period. The closest available date was chosen for each follow-up visit. Patients who did not attend any follow-up visits were excluded from the analysis. Botulinum toxin injection was administered to patients with a convex shape of the upper trapezius muscle and muscle stiffness upon palpation, according to their needs. Additionally, patients with a history of previous botulinum toxin injections or other procedures on the trapezius muscle within 1 year, those with neuromuscular disorders, and those with contraindications to botulinum toxin were excluded. This study was approved by the institutional review board of the Korea National Institute for Bioethics Policy (No. P01-202405-01-014).

Procedure

One hundred units of INCO were diluted in 5 mL of saline. The trapezius muscle on each side was injected intramuscularly with 50 units, using a 31G needle. The dosage of 50 units per side was selected based on previous studies.[9–12] The injection site was delineated with a horizontal line on the acromion level and a vertical line at the lowest point of the lateral neckline. The injections were administered at 12 points per side, with a spacing of 1–2 cm between each point along the superior border of the upper trapezius muscle, followed by additional injections 1–2 cm below, parallel to the muscle border (Fig. 1). Care was taken to ensure that injection points were at least 2 cm away from the acromion to avoid shoulder muscle weakness. Four units of INCO were injected at each point, with an additional 2 units being injected at the thickest point.

Outcome Parameters

The study's outcome parameters included clinical photographs, radiological imaging results, and the Global Aesthetic Improvement Scale (GAIS). Clinical photographs and ultrasound were conducted at each visit (baseline and 1, 3, and 6 mo) for all cases, whereas a 3-dimensional (3D) computed tomography (CT) scan was performed in 1 case at baseline and at 3 and 6 months after treatment. After obtaining informed consent and carefully considering radiation exposure, CT scanning was performed as an exploratory investigation to obtain detailed volumetric data. The GAIS evaluation was conducted at each visit following treatment (1, 3, and 6 mo) in comparison with baseline photographs.

Clinical Photographs

At each visit, front and back photographs were taken to include both the acromion of the shoulders and the upper trapezius muscles. Surface area analysis of the upper trapezius muscle was performed using the ImageJ (National Institutes of Health, Bethesda, MD program. (**See figure, Supplemental Digital Content 1**, which displays representative photographs and the relative surface area of the left upper trapezius muscle before and after INCO injection. Compared with the baseline [32.51%] [A], the relative surface area of the upper trapezius muscle was decreased at 1 month [29.80%] [B], 3 months [26.73%] [C], and 6 months [27.50%] [D], **http://links.lww.com/PRSGO/E43**.) The relative surface area of the upper trapezius was

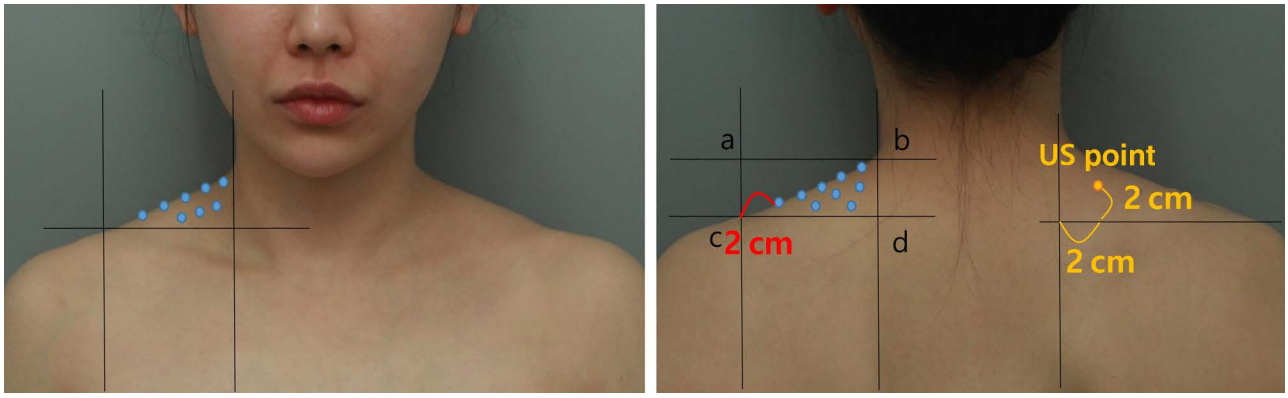

Fig. 1. Illustration of the reference area and injection points for INCO. The reference area is defined by horizontal and vertical reference lines: ab represents the horizontal line along the lowest point of the lateral neckline, cd is the horizontal line at the acromion level, ac is the vertical line on the acromion point (c), and bd is the vertical line on the lowest point of the lateral neckline (b). The blue dots indicate 12 injection points, which are at least 2 cm away from point c. The yellow dot shows the ultrasound (US) point, situated 2 cm lateral and 2 cm superior from the right angle (point d).

calculated as a percentage of the rectangular area of reference, defined by the following boundaries: a vertical line from the lowest point of the lateral neckline (bd), vertical and horizontal lines bisecting the acromion (ac, cd), and a horizontal line from the lowest point of the lateral neckline (ab) (Fig. 1).

Imaging Analysis

The thickness and volume of the upper trapezius muscle were measured by ultrasound and 3D CT scans, respectively. On ultrasonography, the maximum thickness among the captured images was measured at a fixed point situated 2 cm lateral and 2 cm superior from point d (Figures 1, 2A). In the patient who also underwent a 3D CT scan, the volume of the trapezius muscle was calculated by summing the cross-sectional areas. AVIEW Modeler (Corelinesoft, Seoul, Republic of Korea) version 1.1.46 was used to reconstruct 3D images and calculate volumes. The trapezius muscle was divided into upper, middle, and lower parts. The spinous process of the T1 spine was selected as a reference point between the upper and middle trapezius muscles, and the spinous process of the T4 spine was selected as a reference point between the middle and lower trapezius muscles (Fig. 2B).

Global Aesthetic Improvement Scale

The postprocedure subjective improvement was assessed by both physicians and patients using the GAIS, which ranges from 0 to 4 (0 = worse, 1 = no change, 2 = improved, 3 = much improved, 4 = very much improved).

Statistical Analysis

Categorical variables were summarized as frequencies and percentages, whereas continuous variables were summarized as mean, SD, median, minimum, and maximum. One-way repeated measures analysis of variance with the Dunnett multiple comparisons test was used to assess the changes in trapezius muscle thickness between baseline and at 1, 3, and 6 months postinjection. Pearson correlation analysis was used to examine the relationship between the delta percent reduction in muscle thickness and potential influencing factors (age and baseline muscle thickness). The statistical analyses were conducted using SPSS version 29.0 and Prism version 10.2.3, with a P value of less than 0.05 considered statistically significant.

RESULTS

A total of 22 patients were subjected to statistical analysis. All patients were women, with a mean age of 33.7 ± 4.85 (range 25–43) years.

Photographic Evaluation

The relative surface area of the upper trapezius muscle was calculated from photographic images taken serially before and after INCO injection. The results revealed a continuous and sustained reduction in the muscle surface area for up to 6 months (Table 1 and Figure 3A). When compared with the baseline (31.26% ± 3.83%), statistically significant reductions in mean relative surface area were observed at 1 month (28.82% ± 3.93%, $P < 0.0001$), 3 months (26.83% ± 3.60%, $P < 0.0001$), and 6 months (28.74% ± 3.30%, $P < 0.0001$) posttreatment.

Ultrasound Evaluation

The ultrasound evaluation of upper trapezius muscle thickness following INCO injection revealed significant changes over time (Table 1 and Figure 3B). At baseline, the mean muscle thickness was 5.99 ± 1.37 mm, with subsequent measurements taken at 1, 3, and 6 months postinjection. A significant reduction in muscle thickness was observed at 1 month postinjection (5.20 ± 1.01 mm, $P < 0.001$), with further reduction reaching a maximum at 3 months postinjection (4.64 ± 0.80 mm, $P < 0.0001$). By 6 months, there was partial recovery of muscle thickness; however, it remained decreased compared with the baseline measurement (5.23 ± 0.89 mm, $P < 0.001$), indicating a sustained effect of the botulinum toxin over time. The percentage of muscle volume reduction showed no significant relationship with age. However, the initial thickness of the trapezius muscle showed a moderate correlation

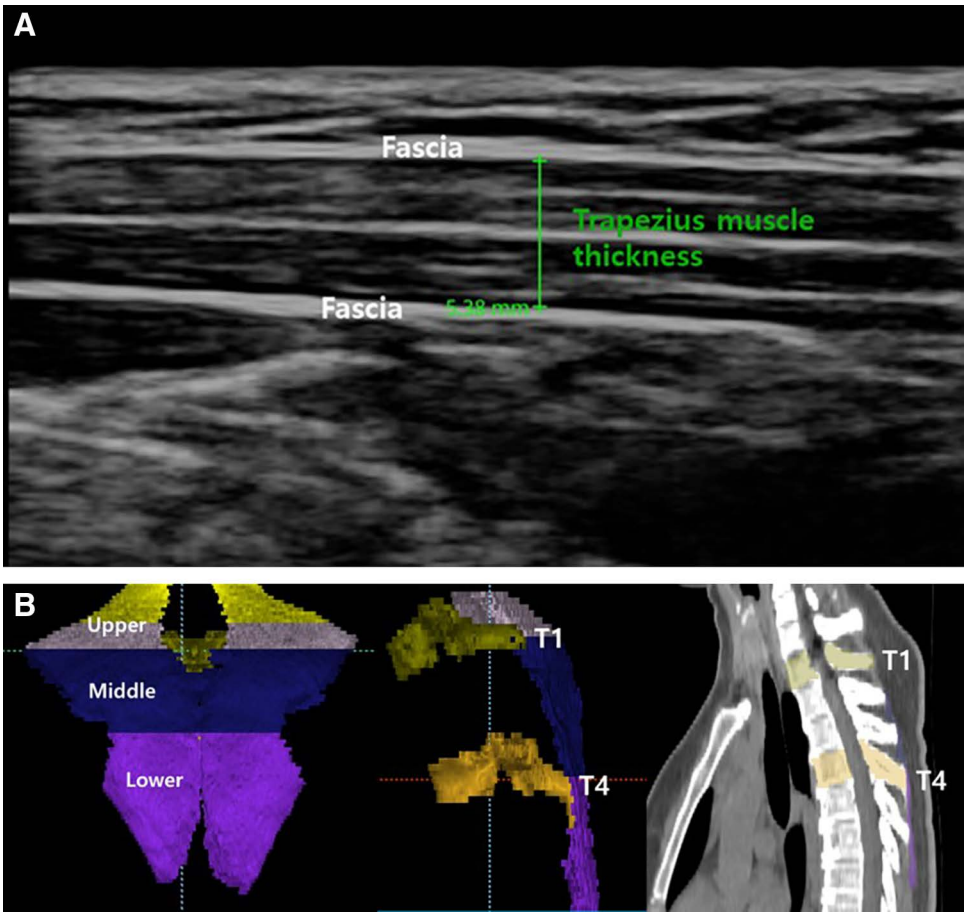

Fig. 2. Representative images of trapezius muscle measurements. A, Trapezius muscle thickness measured with ultrasonography. B, Trapezius muscle volume measured with 3D CT. The T1 and T4 vertebrae were selected as reference points to divide the upper, middle, and lower trapezius muscles.

Table 1. Changes in the Relative Upper Trapezius Surface Area and Trapezius Muscle Thickness at Baseline and 1, 3, and 6 Months After INCO Injection

		Posttreatment		
	Baseline	1 mo	3 mo	6 mo
Relative muscle surface area, %	31.26 ± 3.83	28.82 ± 3.93	26.83 ± 3.60	28.74 ± 3.30
Muscle thickness, mm	5.99 ± 1.37	5.20 ± 1.01	4.64 ± 0.80	5.23 ± 0.89

at 1 month ($R = 0.525$) and 3 months ($R = 0.667$), and a strong correlation at 6 months ($R = 0.710$). (**See figure, Supplemental Digital Content 2**, which displays Pearson correlation coefficients calculated to assess the relationship between the percentage change in muscle thickness at 1, 3, and 6 months [Δ% 1, Δ% 3, and Δ% 6 mo, respectively] following INCO injection and age, as well as the percentage in muscle thickness at these time points and baseline muscle thickness, **http://links.lww.com/PRSGO/E44**.)

3D Computed Tomography

One patient underwent a 3D CT scan before and after the INCO injection. The volumes of the upper, middle, and lower trapezius muscles were calculated (Fig. 4). A marked reduction in volume was observed in the upper trapezius muscle. In comparison to the baseline volume (61,289 mm^3), the upper trapezius muscle volume was reduced at 3 months after treatment (45,351 mm^3) with the reduction sustained in volume at 6 months (42,302 mm^3). In contrast, the middle trapezius muscle volume increased by an amount similar to the reduction observed in the upper trapezius.

Global Aesthetic Improvement Scale

The GAIS assessments, conducted by both physicians and patients, provided subjective evaluations of the trapezius muscle reduction over the same time points postinjection. In the physician GAIS scores, the majority of respondents indicated "improved" muscle reduction at 1 month postinjection (Fig. 5A). This positive trend continued at 3 months, with a notable proportion of respondents rating the reduction as "much improved." At 6 months, the majority of responses remained in the

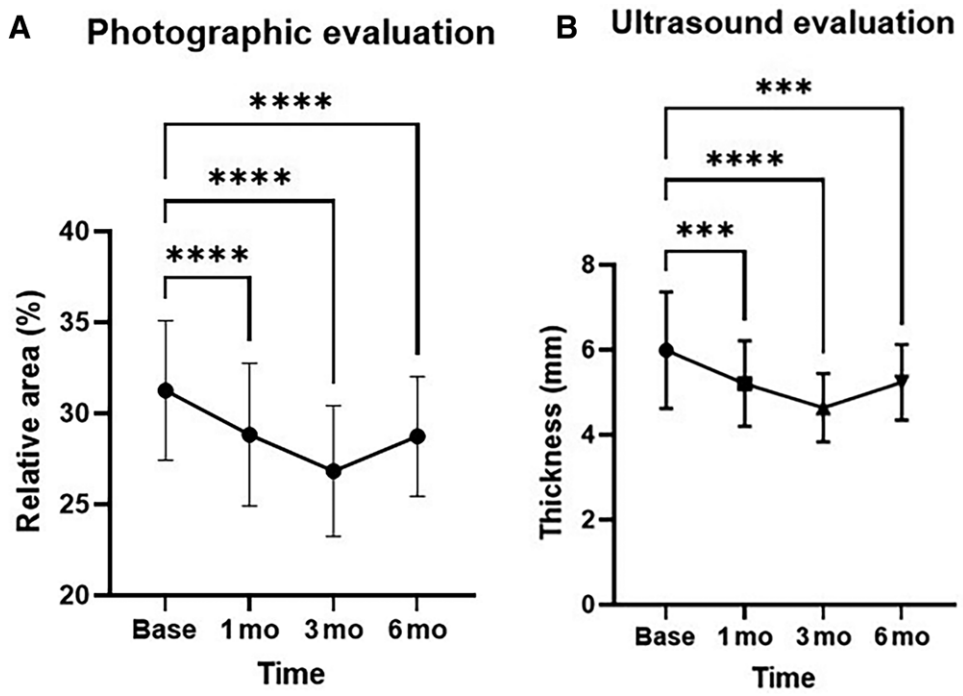

Fig. 3. Longitudinal changes in upper trapezius muscle size after injection treatment. A, The relative surface area (%) of the upper trapezius muscle was measured at baseline, and at 1, 3, and 6 months postinjection. B, Muscle thickness (in millimeters) was measured at baseline (base), and at 1, 3, and 6 months postinjection. Data are presented as mean ± SD. Statistically significant differences between time points are indicated by asterisks: ***$P < 0.001$, ****$P < 0.0001$, with significance compared with baseline measurements.

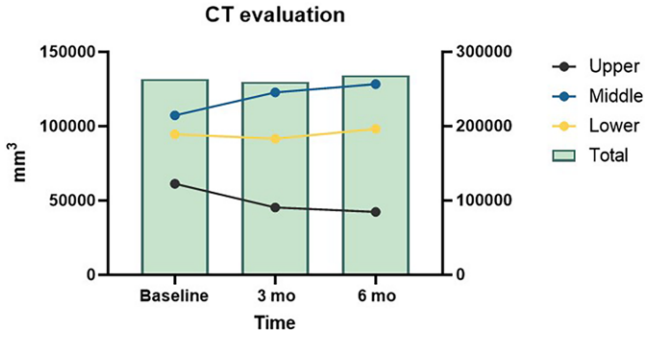

Fig. 4. Trapezius muscle volume calculated from 3D CT scan.

"improved" or "much improved" categories, indicating a favorable aesthetic outcome over time. Similarly, the patient GAIS scores reflected a consistent positive evaluation (Fig. 5B). Patients exhibited higher satisfaction levels compared with physicians at 3 and 6 months postinjection, with a greater proportion of patients rating their improvement as "much improved" or "very much improved."

Adverse events, including pain, bruising, swelling, infection, and asymmetry, were recorded immediately after treatment and at each follow-up visit. No adverse events were reported in any of the patients throughout the study period. The overall results demonstrated that both the surface area and thickness of the upper trapezius muscle were effectively decreased without any significant adverse events. The GAIS scoring demonstrated high satisfaction among both physicians and patients. Photographic, ultrasound, and subjective scoring results showed the efficacy of INCO injections in reducing trapezius muscle size, with significant and sustained improvements observed up to 6 months postinjection. Although we had only 1 patient who underwent a CT scan, the result showed a similar effect in the upper trapezius muscle.

DISCUSSION

The results of this study provide substantial evidence in support of the efficacy and safety of INCO injections in treating trapezius muscle hypertrophy, addressing both aesthetic and functional concerns. The significant reductions in muscle surface area and thickness observed through photographic and ultrasound evaluations, coupled with high GAIS scores from both physicians and patients, indicate the potential of botulinum toxin as a treatment modality for trapezius hypertrophy.

Photographic evaluations showed a clear downward trend in the relative surface area of the upper trapezius muscle, with significant reduction observed at 1 and 3 months, and sustained improvement up to 6 months postinjection. At 6 months postinjection, the upper trapezius muscle showed a slight recovery in size but remained significantly smaller compared with baseline, indicating that the treatment effect persisted without returning to the initial levels. Quantitative evaluations by ultrasonography corroborated these findings objectively, demonstrating a

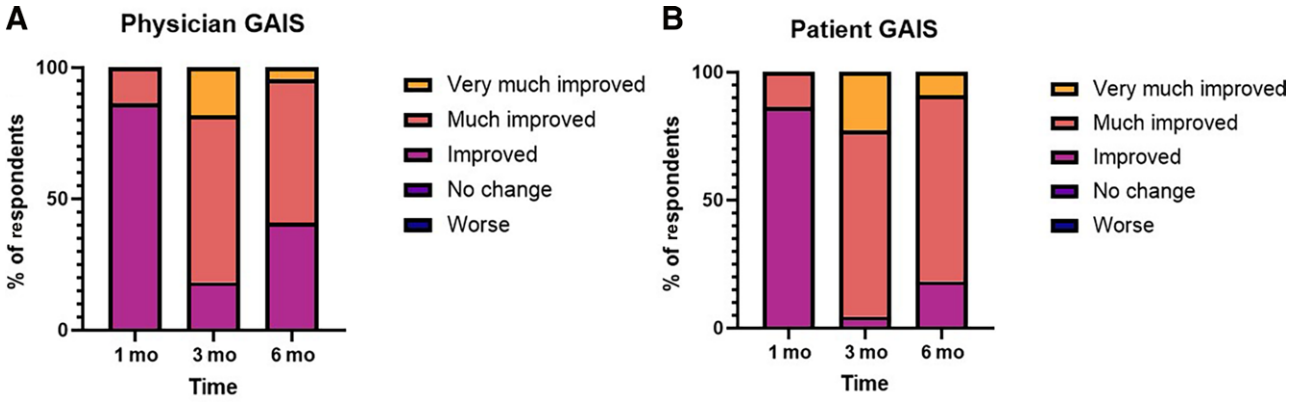

Fig. 5. Physician (A) and patient (B) GAIS assessment of trapezius muscle reduction over time following INCO injection. The GAIS scorings were recorded at 1, 3, and 6 months postinjection. The stacked bar graphs showed the percentage of respondents rating the muscle reduction as "worse," "no change," "improved," "much improved," and "very much improved."

significant reduction in muscle thickness at 1 month and reaching maximum reduction at 3 months, with a partial but sustained reduction still observed at 6 months. These results align with previous studies that have documented the muscle-relaxing effects of botulinum toxin through similar methods.[6,9,11]

The 3D CT scan results, although limited to 1 patient, provide additional insight into the volumetric changes within the trapezius muscle. The marked reduction in the upper trapezius volume and the increase in the middle trapezius volume highlight the differential impact of botulinum toxin across different segments of the muscle. The increase in the middle trapezius volume might be a compensatory response to the reduction of the upper trapezius. This increase in middle trapezius volume was not clinically apparent and did not affect the aesthetic appearance of the shoulder and neck. This suggests a potential for targeted muscle contouring, which could be of particular interest for a more attractive shoulder contour and longer neck. The observed muscle reduction likely results from a combination of flaccid paralysis and secondary effects, including decreased glycogen storage, reduced blood flow, and altered tissue water homeostasis, though their relative contributions remain to be elucidated.

The safety profile of INCO for trapezius muscle reduction was demonstrated with no serious adverse events reported. This aligns with existing literature highlighting the well-tolerated nature of botulinum toxin injections.

According to the previous literature survey about body indications with BoNT/A, nearly all the experts (96%) in Asia Pacific inject BoNT/A into nonfacial areas, including the trapezius and gastrocnemius muscles.[18] Unlike facial indications, body indications are generally considered more immunogenic (65%) due to the use of larger doses (eg, >100 U). Thus, 97.1% consider it important to use a highly purified preparation with the lowest immunogenicity for nonfacial indications.[15] INCO was chosen for trapezius contouring, a high-dose indication, due to its purity and absence of bacterial remnants such as complexing proteins, inactive neurotoxin, flagellin, and clostridial DNA that could act as adjuvants to increase the risk of neutralizing antibody formation.[19] Additionally, no cases of neutralizing antibody–related secondary nonresponse have been reported with exclusive INCO use.[15]

Our study also emphasizes the importance of objective, quantitative measurements in evaluating treatment outcomes. The integration of photographic, ultrasound, and CT imaging provides a comprehensive assessment of muscle reduction, which enhances the reliability and validity of our findings.

This study has several limitations. One of the limitations of the present study is the small sample size, which may affect the generalizability of the findings. Additionally, 3D CT analysis was only performed on a single patient, which limits the robustness of volumetric data. Future studies with larger, randomized controlled trials are needed to further validate these results and to explore the long-term effects of botulinum toxin injections on trapezius muscle hypertrophy. Also, this study administered a fixed dose regardless of baseline trapezius muscle volume. It would be helpful for future research to adjust the dose based on muscle volume to evaluate dose-dependent responses. Because our follow-up period was limited to 6 months, potential subsequent responses (eg, rebound or sustained effects) beyond this timeframe should be explored in future studies with longer durations.

In conclusion, INCO presents a promising nonsurgical option for the management of bilateral trapezius muscle hypertrophy. This treatment can effectively reduce muscle size, aesthetically improve shoulder contour, and alleviate discomfort, thereby enhancing the overall quality of life for affected individuals. Further research is warranted to optimize treatment protocols and dosing, and to confirm these findings in larger cohorts.

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DISCLOSURES

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