

STUDY OF GLABELLAR WRINKLE PATTERNS IN THE PAKISTANI POPULATION

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Abstract

Background: Glabellar wrinkles, formed by the dynamic action of facial muscles such as the corrugator supercilii and procerus, vary widely among individuals and populations. Classification of these wrinkle patterns is essential for personalized aesthetic treatment, especially with the use of botulinum toxin. However, data on glabellar wrinkle patterns in the Pakistani population are limited.

Objective: To identify and classify the prevalent glabellar wrinkle patterns in Pakistani adults to guide population-specific aesthetic interventions.

Methods: This observational case series was conducted at the Department of Dermatology, Shaikh Zayed Hospital, Lahore, over a six-month period from January 2025 to June 2025. A total of 100 patients aged 30–60 years were enrolled using convenience sampling. Participants were evaluated clinically and photographed while performing glabellar muscle contraction. Wrinkle patterns were categorized into five types—‘11’, ‘U’, ‘X’, ‘Pi’, and ‘I’—based on morphological classification described in previous literature.

Results: The mean age of participants was 42.26 ± 6.56 years, with 65 females and 35 males. The most common wrinkle pattern was the ‘11’ type (75%), followed by ‘X’ (10%), ‘Pi’ (8%), ‘U’ (4%), and ‘I’ (3%). No significant gender-based differences were observed. Some hybrid patterns were noted but not categorized separately.

Conclusion: The ‘11’ glabellar wrinkle pattern is the most prevalent among Pakistani adults, while the ‘I’ and ‘U’ patterns are relatively rare. These findings emphasize the importance of regional classification in achieving optimal outcomes with botulinum toxin injections and support the need for culturally and anatomically tailored aesthetic approaches.

INTRODUCTION

The glabella, the anatomical region between the eyebrows and above the nasal bridge, is a focal point of facial expression and emotional communication. It plays a central role in conveying negative emotions such as anger, frustration, confusion, or fatigue through dynamic muscle contractions.[1] The muscles involved in this region—the corrugator supercilii, procerus, and the medial portions of the orbicularis oculi and frontalis—form the glabellar complex. Their coordinated or opposing

contractions generate wrinkle lines that are perpendicular to the vector of muscular force, producing vertical, transverse, and oblique lines over the glabella [2, 3].

These wrinkle lines, commonly referred to as glabellar rhytides, are among the earliest and most prominent markers of facial aging. They often appear even in younger adults as a result of repetitive muscle use, photodamage, and a gradual decline in dermal collagen and elastin. Over time, they become

deeper and more permanent, contributing significantly to a perceived aged or stern appearance. These wrinkle patterns are not only aesthetically concerning but also carry social implications, often being interpreted as signs of stress, anger, or aging [1]. As a result, the glabellar region is frequently targeted in both cosmetic and therapeutic interventions.

Numerous modalities have been explored for the treatment of glabellar wrinkles, including chemical peels, ablative and non-ablative laser therapies, dermal fillers, surgical brow lifts, and most notably, neuromodulator injections. Among these, chemodenervation using botulinum toxin has emerged as the gold standard. Since its first documented use in aesthetic medicine by Carruthers and Carruthers in 1990 [5], botulinum toxin has gained widespread acceptance due to its minimally invasive nature, high patient satisfaction, and safety profile [4,6]. The treatment works by temporarily weakening hyperactive muscles, thereby smoothing dynamic wrinkles and preventing their deepening over time.

While the anatomical landmarks for glabellar injections are generally consistent, the functional anatomy—namely, how different patients recruit their muscles—is highly variable. Multiple studies have emphasized that factors such as gender (with men having thicker skin and stronger musculature), ethnicity, chronological aging, sun exposure, and occupational habits all influence facial wrinkling patterns [6,8–11]. Consequently, the "one-size-fits-all" approach in aesthetic treatment planning is being replaced by individualized assessment strategies.

International efforts have been made to categorize glabellar wrinkle morphology into clinical patterns to guide personalized treatment. Kim et al. proposed five major types of glabellar wrinkle patterns in Koreans: '11', 'U', 'X', 'Pi', and 'I', based on the presence and directionality of perpendicular and transverse lines [13]. Similarly, Almeida et al. described functional and anatomical variations affecting glabellar contraction [7]. These classification systems offer a valuable framework for visual assessment but were primarily developed in East Asian and Western cohorts, whose facial musculature and skin properties may differ significantly from those in South Asian populations.

Furthermore, anatomical studies such as those by Benedetto and Lahti [12] have demonstrated individual variations in the structure, location, and depth of the corrugator muscle, even among patients of similar demographics. These findings underscore the need for population-specific data, especially in light of the growing demand for cosmetic procedures in South Asia. Despite this increasing trend, there is a notable lack of research focusing on the wrinkle patterns and injection strategies suited for Pakistani individuals.

This study aims to bridge that knowledge gap by evaluating glabellar wrinkle morphology in a Pakistani cohort. By classifying the prevalent wrinkle patterns and correlating them with anatomical implications, we hope to provide a framework for safer, more effective, and culturally tailored use of botulinum toxin in aesthetic dermatology. An improved understanding of glabellar wrinkle patterns in the local population will enable clinicians to optimize injection techniques, minimize complications, and maximize patient satisfaction.

MATERIALS AND METHODS

This descriptive, observational case series was conducted at the Department of Dermatology, Shaikh Zayed Hospital, Lahore, over a six-month period from January 2025 to June 2025. The study aimed to classify glabellar wrinkle patterns among Pakistani adults to support the development of individualized treatment protocols. A total of 100 patients, aged between 30 and 60 years, were enrolled using a non-probability convenience sampling technique from the outpatient dermatology clinic. Patients were eligible for inclusion if they demonstrated visible dynamic glabellar lines during facial expression and provided informed written consent. Exclusion criteria included a history of botulinum toxin or other cosmetic procedures to the upper face within the past 12 months, presence of neuromuscular disorders, cutaneous lesions or scarring in the glabellar region, and unwillingness to participate. All participants were examined in a standardized sitting position under consistent lighting conditions. They were asked to actively contract their glabellar muscles (e.g., frown) to reveal the natural pattern of dynamic lines. Two experienced dermatologists

independently assessed the wrinkle patterns, and any discrepancies were resolved by consensus. Standardized high-resolution frontal photographs were taken to document each participant's wrinkle pattern. These were later reviewed and categorized into five distinct types—'11', 'U', 'X', 'Pi', and 'I'—as per the classification described by Kim et al. [13], based on the directionality and distribution of glabellar and adjacent forehead lines.

All clinical evaluations were conducted in accordance with ethical standards. The study protocol was reviewed and approved by the Institutional Review Board of Shaikh Zayed Hospital. Informed consent was obtained from all participants, who were also assured of confidentiality and the right to withdraw from the study at any stage without compromising their medical care.

RESULTS

A total of 100 patients were enrolled in the study, comprising 65 females (65%) and 35 males (35%), resulting in a male-to-female ratio of 1:1.85. The mean age of the participants was 42.26 ± 6.56 years, with an age range between 30 and 60 years. Among them, the majority (78%) were in the 30–40-year age group, while the remaining 22% were between 51 and 60 years (Table 1 & 2).

Based on clinical evaluation and photographic documentation during voluntary glabellar contraction, five distinct wrinkle patterns were identified: '11', 'U', 'X', 'Pi', and 'I'. The most common pattern observed was the '11' type, found

in 75 patients (75%). This pattern is characterized by prominent vertical lines between the eyebrows, typically associated with overactivity of the corrugator supercilii muscles.

The second most prevalent type was the 'X' pattern, present in 10 patients (10%). This configuration combines both vertical and transverse wrinkles, often involving the procerus, depressor supercilii, and nasalis muscles. The 'Pi' pattern was observed in 8 patients (8%), representing a combination of vertical glabellar lines with transverse forehead lines, forming a shape reminiscent of the Greek letter Pi. The 'U' pattern was noted in 4 patients (4%), involving a mix of horizontal and oblique lines forming a curved configuration over the glabella, usually from synergistic contraction of the procerus and corrugator muscles. The least common configuration was the 'I' pattern, seen in only 3 patients (3%), characterized by a single vertical line or narrow central contraction, representing mild isolated corrugator activity (Table 3, Figure 1 and Figure 2). Figure 3 shows a pictorial representation of Glabellar wrinkle patterns.

No statistically significant gender predilection was observed for any specific pattern, although '11' lines were slightly more prominent in females, likely due to earlier onset of cosmetic concerns and treatment-seeking behavior. A few participants also exhibited hybrid or transitional forms of wrinkle patterns, but these were not categorized as distinct types due to their low frequency.

Table 1: Age Distribution of Participants

Age Group	Number of Patients	Percentage (%)
30-40	78	78.0%
51-60	22	22.0%

Table 2: Gender Distribution

Gender	Number of Patients	Percentage (%)
Male	35	35.0%
Female	65	65.0%

Table 3: Frequency of Glabellar Wrinkle Patterns

Pattern Type	Number of Patients	Percentage (%)
'11'	75	75.0%
'X'	10	10.0%
'Pi'	8	8.0%
'U'	4	4.0%
'I'	3	3.0%

Distribution of Glabellar Wrinkle Patterns

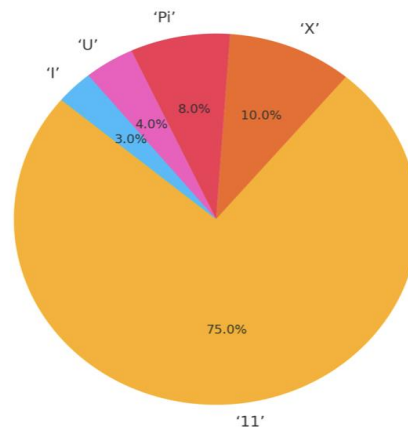


Figure 1: Distribution of Glabellar Wrinkle Patterns

Frequency of Glabellar Wrinkle Patterns

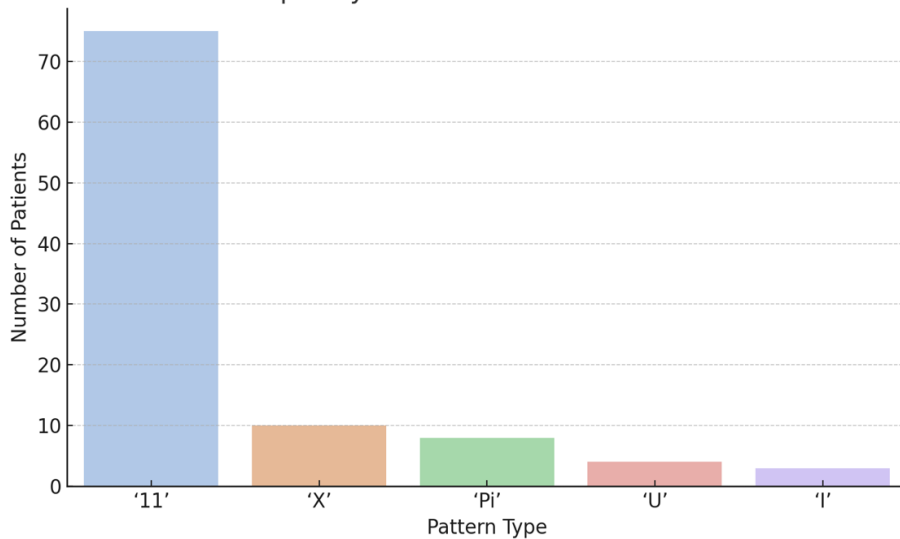


Figure 2: Frequency of Glabellar Wrinkle Patterns



Figure 3: Pictorial Representation of Glabellar Wrinkle Patterns

DISCUSSION

Facial wrinkles are among the earliest visible markers of aging and emotional expression, with glabellar lines receiving particular attention due to their prominent midline position and association with negative emotions. In this study, we analyzed glabellar wrinkle patterns among Pakistani adults and found that the '11' pattern—characterized by paired vertical lines between the eyebrows—was by far the most prevalent, occurring in 75% of patients. This finding is consistent with previous studies in other populations, such as the work of Kim et al., who reported a similar dominance of the '11' pattern in East Asians [13].

The mean age of patients in our study was 42.26 ± 6.56 years, aligning with the age range typically associated with the development of dynamic facial lines. Our findings also parallel those of Kamat et al., who observed a similar age distribution in Indian patients, further supporting the relevance of these patterns across South Asian populations [14].

The second most common pattern in our study was the 'X' type, seen in 10% of participants. This pattern is believed to result from a combined action of multiple muscles, including the procerus, nasalis,

and medial orbicularis oculi. The complexity of this pattern underscores the importance of thorough facial assessment prior to botulinum toxin injection, as a standard midline approach may not fully address the transverse or lateral lines present in 'X' or 'U' types [7,13]. Less frequent patterns such as 'Pi', 'U', and 'I' were observed in 8%, 4%, and 3% of patients, respectively. The rarity of the 'I' pattern supports its characterization as a subtle, under-recognized presentation, typically associated with isolated corrugator activity.

Importantly, our study reinforces the concept that wrinkle morphology is not uniform across populations. Factors such as facial muscle mass, bone structure, skin thickness, photodamage, and ethnicity all influence the development of rhytides [10,11,15]. For example, Asian populations—including Pakistanis—are known to exhibit smaller glabellar muscles and thicker dermis compared to Caucasians, often requiring lower doses of botulinum toxin for effective results [16]. This population-specific difference has significant clinical implications, especially when using classification systems developed in non-Asian cohorts.

In addition to interethnic variability, individual anatomical differences further complicate standardization. Benedetto and Lahti emphasized that even in anatomically “normal” individuals, there is substantial variability in the location, orientation, and depth of the corrugator supercilii muscle [12]. Such variability supports the rationale for pre-treatment facial animation assessment and personalized injection strategies. Recent imaging-based studies using high-resolution ultrasound and 3D facial analysis have also highlighted the importance of evaluating soft tissue dynamics to guide treatment planning [17,18].

Our findings support the clinical utility of visual classification systems like the one proposed by Kim et al. but suggest that regional adaptations may be warranted. For instance, while ‘Pi’ and ‘U’ patterns are well described in Korean patients, their rarity in our cohort suggests they may be less clinically relevant in Pakistani populations. Similarly, the relatively high proportion of the ‘X’ pattern in our study warrants further exploration into muscle interplay and alternative injection vectors.

Although our study did not perform dose mapping, future research may benefit from correlating wrinkle type with botulinum toxin dosage and clinical response, as recently suggested in practice-based consensus recommendations for Asian populations [19]. Incorporating objective metrics such as wrinkle severity rating scales or digital facial analysis may also improve reproducibility and interobserver reliability in future studies.

The strengths of this study include standardized clinical observation by experienced dermatologists, photographic documentation, and adherence to an established classification framework. However, limitations include the single-center design, lack of long-term follow-up, and exclusion of participants with prior aesthetic procedures, which may limit generalizability. Furthermore, muscle activity patterns were inferred from visual analysis and not confirmed via electromyography or imaging.

In summary, this study demonstrates that the ‘11’ glabellar wrinkle pattern is the predominant type among Pakistani adults, while ‘I’ and ‘U’ types are infrequent. These findings underscore the need for tailored clinical assessment and injection planning, especially in populations with different facial

anatomy than those typically represented in international guidelines. By advancing our understanding of wrinkle pattern distribution in the Pakistani population, this study contributes to the development of culturally and anatomically appropriate aesthetic treatment strategies.

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