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Platysma: Human and Comparative Anatomy, Histology, and Clinical Aspects

Platisma: Anatomía Humana y Comparada, Histología y Aspectos Clínicos

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SUMMARY: The quest for aesthetic procedures is experiencing a steady increase in popularity, concomitant with the expanding array of available treatment options. Of notable interest is the burgeoning trend in the use of minimally invasive techniques. Among the various aspects of facial anatomy, the platysma stands as a pivotal element that significantly influences the aesthetic appearance of the neck region. It has garnered particular attention as a strategic focal point in various treatments geared towards enhancing the neck's visual appeal. Additionally, the versatility of the platysma extends beyond the realm of cosmetic improvements. Its functional significance is recognized in reconstructive surgical procedures, where it may be harnessed for specific maneuvers. Furthermore, the muscle serves as a critical access point for minimally invasive endoscopic surgeries in the neck region. While these developments hold great promise, it is crucial to underscore that safety should always take precedence in any medical or surgical approach. This applies equally to the neck region, which presents a complex and intricate anatomical landscape. An in-depth understanding and meticulous investigation of the platysma in all its diverse aspects are paramount to ensuring the success and safety of any procedure conducted in this region. This comprehensive review aspires to provide a contemporary understanding of the platysma, offering an in-depth analysis that encompasses its intricate anatomy, histological characteristics, and multifaceted clinical implications. By delving into these diverse dimensions, it aims to equip healthcare professionals and researchers with a robust foundation for informed decision-making and practice.

KEY WORDS: Platysma; Anatomy; Histology.

INTRODUCTION

The platysma muscle, which is part of the facial expression muscle group, has been the focus of numerous studies due to its importance in aesthetic and surgical procedures. Knowledge of platysma muscle anatomy is essential for conducting these interventions. This muscle is located in the facial and neck region and has a thin thickness. Notably, the platysma muscles in humans and dogs have anatomical and histological similarities (Dyce *et al*., 2004; Netter, 2019).

The anatomical variations of the platysma muscle have attracted increasing interest in both anatomical and clinical research. This muscle, which originates from the fascia covering the upper portions of the pectoralis major and deltoid, exhibits substantial variability in its arrangement and insertion points. These variations can occur regardless of factors such as age, body type, or skin color, highlighting the individual and unique nature of the platysma (Minelli *et al*., 2023). Microscopically, the platysma muscle varies little compared to other species. It consists of striated skeletal muscle characterized by multinucleated fibers with peripheral and elliptical nuclei situated proximally to the plasma membrane (Saladin, 2018).

In addition to its role in moving the skin and underlying tissues, the platysma muscle plays an essential role in facial expression, extending from the clavicle to the mandible and chest. Its relevance transcends muscular

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function, influencing the aesthetics of the head and neck region and contributing significantly to the aging process (De Maio *et al*., 2017). In the context of aging, the platysma muscle plays a prominent role. Over time, contractions of the platysma muscle can lead to the development of expression lines and furrows on the neck and lower third of the face. This interaction between muscle activity and the skin presents challenges to modern clinical approaches in developing strategies for mitigating the visible signs of aging. Consequently, there is a growing interest in minimally invasive procedures, such as the application of botulinum toxin (De Maio, 2021). In addition to its role in aesthetics, the platysma muscle plays a relevant role in other surgical procedures, including facial reconstruction using flaps and access procedures in endocrine surgeries (Sturm *et al*., 2022).

The aim of this study was to conduct an anatomical and histological investigation of the platysma muscle to clarify its complexity and clinical relevance.

Anatomical investigation

Anatomical description. The platysma muscle has its proximal insertion in the skin below the clavicle and in the upper part of the thorax. It extends to the mandible and the facial muscles around the mouth, where its distal insertion is located. The proximal insertion serves as the muscle's point of origin and remains fixed, whereas the distal insertion functions as the mobile point. The platysma is a thin muscle with fibers arranged in a flat manner, extending from the lateral part towards the medial region of the body (Netter, 2019; Pelle-Ceravolo, 2021) (Figs. 1 to 3).

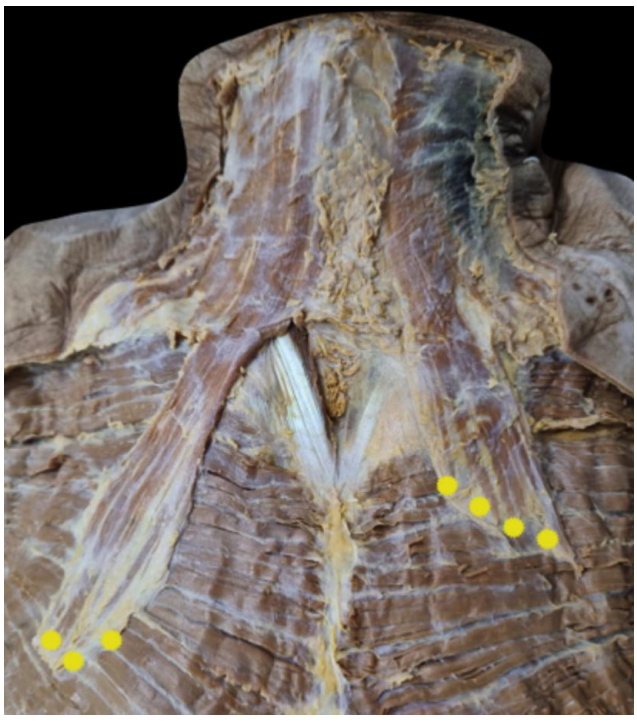

Fig. 1. The yellow dots indicate the atypical origin of the platysma muscle on the right and left sides, located in the upper thorax region.

Fig. 2. The yellow arrows indicate the direction of the platysma muscle fibers.

Fig. 3. The yellow dots indicate the insertion points of the platysma muscle in the submandibular region and the muscles around the mouth.

The platysma is the sole facial expression muscle located in the neck. It is a cutaneous muscle with the function of tightening the skin in the neck region. With aging, this superficial muscle can change the facial contour, leading individuals to experience discomfort regarding their appearance (Sandulescu *et al*., 2020; Davidovic *et al*., 2021).

The facial nerve is responsible for innervating the muscle and is one of twelve pairs of cranial nerves. It originates in the bulbopontine sulcus and then divides to innervate the facial muscles. Injuries at any point along the nerve course can cause peripheral facial paralysis, in which the paralysis occurs on the same side affected by the injury, resulting in impairments for the individual (Machado & Haertel, 2013; Hwang *et al*., 2015). The blood supply to the platysma muscle is provided through the submental and suprascapular arteries (Hurwitz *et al*., 1983; Aboudib Jr. & Castro, 1984).

In dogs, the facial muscles have the same origin, deriving from the second pharyngeal arch, and are innervated by branches of the facial nerve. As in humans, the platysma muscle in dogs is more superficial. Another similarity between human and canine platysma muscles is their elongated structure compared to other facial expression muscles. In dogs, the platysma fibers are arranged longitudinally, covering a portion of the face and neck. The act on the caudal retraction of the labial commissure and contribute to skin movements in the head region (Dyce *et al*., 2004; López-Plana *et al*., 2018). (Figs. 1-3).

Anatomical variation. According to Standring (2016) anatomical description, the platysma muscle originates from the fascia that covers the upper portions of the pectoralis major and deltoid muscles. Platysmal fibers traverse the clavicle, ascending medially along the side of the neck. The anterior fibers intertwine in the midline with the contralateral muscle fibers, lying below and behind the mental symphysis. Some fibers insert into the lower margin of the mandible, whereas others adhere to the skin and subcutaneous tissue of the mandible.

Goss (1998) identified the X-shaped arrangement of the anterior fibers in the midline of the muscle. They observed that, under certain circumstances, the platysma may exhibit variations, including absence, reduction, or extension below the clavicle, as also depicted in Figure 1, where an atypical presentation of its origin was identified. Vistnes & Souther (1979) conducted a detailed study of the medial fibers of the platysma muscle. de Castro (1980) conducted a more comprehensive analysis, investigating multiple variations in the distribution of medial fibers.

Regarding the arrangement of the posterior fibers of the platysma muscle, the results corroborate the findings of de Castro (1980), with the fibers consistently positioned posterior to the angle of the mandible. Variation in fiber inclination was also observed, with more horizontal orientation in short-stature individuals. These posterior fibers cross the mandible, with some inserting into the bone below the oblique line, whereas others attach to the skin and subcutaneous tissue of the lower part of the face, often merging with adjacent muscles around the angle and lower portion of the mandible (Goss, 1998).

The platysmal fibers on both sides cross in the midline in a variable manner, as originally described by de Castro (1980) and later confirmed by Vistnes & Souther (1979). According to Connell & Gaon (1983), the platysma most commonly originates in the upper thoracic region, anterior to the clavicle, followed by the subcutaneous tissue of the subclavicular and acromial regions (de Castro, 2000), as well as the pectoral region (Vistnes & Souther, 1979).

Studies conducted by Hurwitz *et al*. (1983) and Kocer *et al*. (2005) suggest that the platysma muscle is more voluminous in men and tends to be relatively thin and atrophied in women. The direction of the platysma muscle fibers has been described as ascending, originating from the clavicle and extending towards the face, according to Vistnes & Souther (1979) and Kocer *et al*. (2005).

It is worth noting that the platysma thickness can vary, ranging from a thin layer that is difficult to delineate to a thicker, and more easily identifiable layer. Surprisingly, these variations appear unrelated to age, body type, or skin color but rather to individual characteristics. The platysma can be short in the facial region or extend to the zygomatic region or the ear (Aboudib Jr. & de Castro, 1984).

Jost & Levet (1984) described the parotid fascia or periosteum of the mandible as the site of platysma insertion, whereas Kocer *et al*. (2005) and Connell & Gaon (1983) reported that the insertion predominantly occurs in the skin of the cheek, followed by the cutaneous muscles around the mouth (de Castro, 2000) and the mandibulocutaneous ligament or zygoma (Gassner *et al*., 2008).

The mandibular insertion of the platysma constitutes the largest portion of the mandibular ligament (Minelli *et al*., 2023). Moreover, the platysma muscle can be subcategorized based on its topographic positioning on the face and neck or according to its insertion into various facial components, as originally proposed by Lightoller (1925) and later by Feldman (2014).

The platysma is a thin, flat muscle that extends along the anterior part of the neck. It originates in the infraclavicular subcutaneous tissue above the deltoid, trapezius, and pectoral muscles, as well as in the clavicular region. In its course toward the lower part of the face, the platysma transposes the sternocleidomastoid muscle and the submandibular gland. In the cervicomental angle, which extends from the hyoid to the mastoid, the direction of the platysmal fibers changes from a vertical orientation in the neck to a more horizontal alignment in the submandibular region and lower face, a characteristic directly associated with bipedalism (de Castro & Rodrigues, 2021; Minelli *et al*., 2023)

Histological analysis. Under the microscope, the platysma muscle consists of striated skeletal muscle fibers. These cells are multinucleated, with elliptical nuclei located peripherally and adjacent to the plasma membrane. The fibers are arranged in bundles and are surrounded by a thin layer of connective tissue called the sarcolemma. In longitudinal sections, transverse striations (bands) are observed in the cytoplasm (Fig. 4A) (Saladin, 2018).

Myofibrils are present within the muscle fibers. Myofibrils are specialized structures containing contractile proteins, such as actin and myosin. The A-band (anisotropic) contains actin and myosin filaments and is darker and denser. At the center of the A-band lies the H-line, where only myosin filaments are present. The I-band (isotropic) contains only actin filaments, and it displays a darker line at its center called the Z-line, which demarcates the boundary between adjacent sarcomeres. Muscle contraction occurs as actin filaments slide over myosin filaments, resulting in the shortening of the sarcomere and, consequently, the muscle fiber as a whole (Ross & Pawlina, 2012).

Due to its thinness, superficial location, and close association with the movement of the skin and subcutaneous tissues, the platysma muscle often exhibits sweat and sebaceous glands in histological processing (Evans & Miller, 2016). In dogs, however, only sebaceous glands are observed, as their distribution differs from that observed in humans and is found only in the cushion, nasal, and labial regions (Gross *et al*., 1992).

In general, sebaceous glands are exocrine and are located in the dermis. Each gland comprises a secretory unit, which includes the duct and sebaceous cells. These cells are rounded, have a central nucleus, and contain a substantial amount of lipids (Ross & Pawlina, 2012) (Fig. 4B).

Although the sebaceous glands and muscles are not directly related in terms of anatomy or function, both can be affected by hormonal and metabolic processes that may impact the health of the skin and muscles (Gross *et al*., 1992; Evans & Miller, 2016).

Clinical application. Clinical approaches to the platysma muscle can be categorized based on aesthetic or non-aesthetic requirements and involve both surgical and non-surgical methods. The platysma muscle plays a crucial role in the aesthetics of the head and neck region, especially in the context of aging (Cho *et al*., 2023). A comprehensive understanding of this muscle reveals its significance in clinical approaches, which are becoming increasingly relevant due to the rise in aesthetic procedures. This is evident both in the practice of orofacial harmonization in dentistry and in the fields of plastic surgery and dermatology in medicine (Braz *et al*., 2015; de Maio *et al*., 2017).

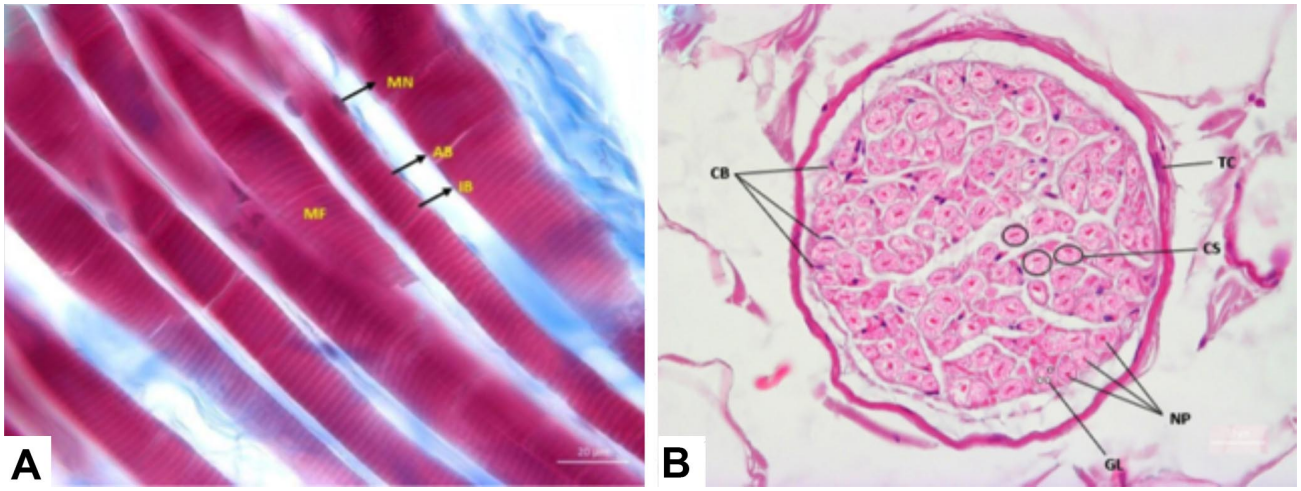

Fig. 4. Photomicrograph of the dog's platysma muscle. In A, the fibers are seen in a longitudinal section of striated skeletal muscle stained with Masson's Trichrome. In B, a sebaceous gland stained with H/E. Muscle myofibers (MF); Myocyte nuclei (NM); A-band (BA); I-band (BI). In B: Basal cells (CB); Connective tissue (TC); Sebaceous cells (SC); Pyknotic nuclei (NP); Lipid droplets (GL).

The biomechanics of the platysma become notable during its contraction, which results in the cutaneous tissue in the lower third of the face being pulled downwards, pulling the lower lip downwards and backwards. Over time, this continuous action can lead to the appearance of dynamic and static expression lines, particularly in the neck and lower third of the face. This manifests as the development of labiomental grooves and rhytids (Le Louarn, 2016). Moreover, the aging process can result in horizontal laxity, contributing to diastasis of the muscle bundles. Combined with the loss of skin elasticity and the accumulation of submental fat, this phenomenon considerably accentuates the aging process in this area (Braz *et al*., 2015; Hwang *et al*., 2017).

Dentistry and medicine have been intensifying their research efforts to offer more effective and less invasive interventions, following the trend of seeking increasingly less invasive procedures (Sturm *et al*., 2022; Cho *et al*., 2023). One prominent approach involves using botulinum toxin, which shows promise in reducing excessive muscle activity. This treatment aims to mitigate the unwanted effects of persistent muscle movement, thus contributing to a more youthful and revitalized facial appearance, although it does not exclude the need for comprehensive treatments that address all aspects of aging in the region (De Maio & Rzany, 2009; Narins *et al*., 2012).

According to Cho *et al*. (2023), understanding the correct innervation is important for correct management in aesthetic treatments such as the application of botulinum toxin. This is because applying the toxin close to the motor-end plates is more effective. However, there are anastomoses between motor and sensory nerves in the middle third of the platysma muscle. Therefore, when determining the application points, one should extend to the anastomosis region, not just the submandibular region. According to De Maio *et al*. (2017), botulinum toxin can be applied to the platysma using two techniques. The first involves the application to the submandibular region at six points distributed horizontally, with 2-4U per point on each side. The second technique involves application to the region of the medial and lateral platysmal bands, distributed vertically, with four points on the lateral band and three points on the medial band, with 2U per point (Fig. 5).

There are surgical procedures available to rejuvenate the neck region. One such procedure involves vertical suturing of the medial bands of the platysma in the mentonian region to the thyroid cartilage, also known as platysmaplasty. This technique aims to provide enhanced support to the tissues in the submentonian region. Another approach is platysma myotomy, which involves a partial or total horizontal section of the platysma to reduce or prevent movement. The transection length varies depending on the location and configuration of the bands present (Marten & Elyassnia, 2018). However, as previously mentioned, the aging process in the neck region is complex. Therefore, for appropriate treatment, an effective targeted approach must be taken to address each specific need (Sturm *et al*., 2022).

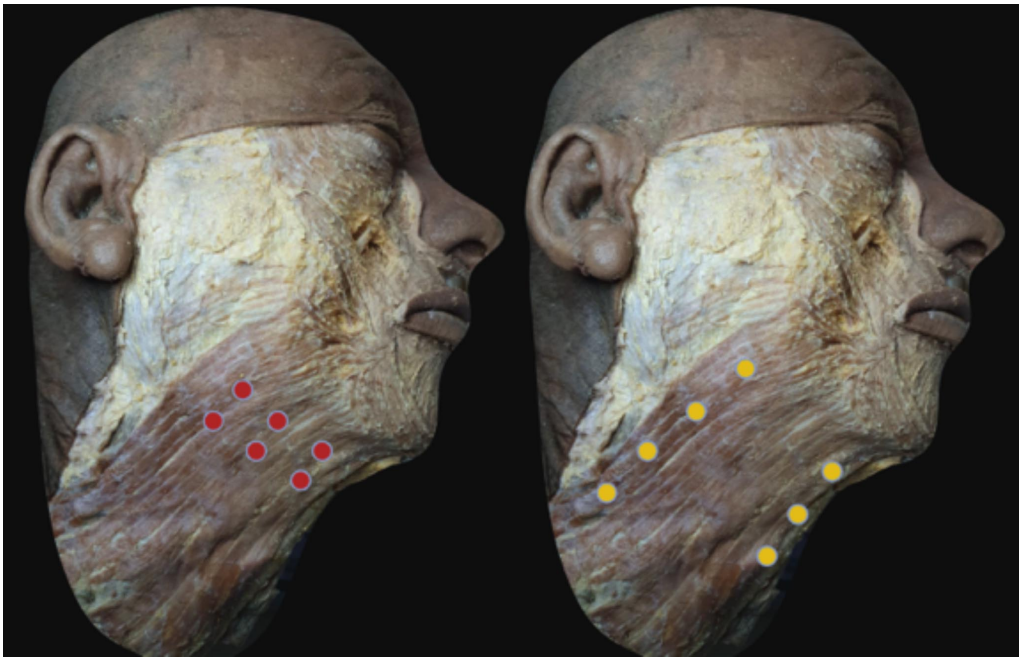

Fig. 5. Red dots indicate the submental application of botulinum toxin. The yellow dots indicate the application on the medial and lateral bands.

In addition to aesthetics, the platysma muscle serves as a strategic graft in reconstructive surgical procedures for repairing facial or intraoral defects resulting from trauma, congenital anomalies, and malignant or benign lesions, among other causes. This is due to its embryological similarity to adjacent muscles and tissues, as well as its anatomical characteristics, including thinness and a plane with favorable innervation and vascularization (Wang *et al*., 2013). The platysma muscle flap can be employed to restore function in delicate regions, such as the lower and upper eyelids (Vaca *et al*., 2020) or the parotid region after tumor resection (Wang *et al*., 2013). This flap can be pedicled, as in the technique described by Wilson *et al*. (2012), in which the blood supply at the base of the flap is maintained, and the tissue is rotated to the desired region. This approach is widely used in cases of post-tumor resection in the parotid region. However, in larger regions, the graft of this muscle may be insufficient due to its thinness and delicacy, potentially harming the aesthetic contour. In these situations, grafting with the sternocleidomastoid muscle is more recommended (Jain & Rai, 2021).

For minimally invasive surgeries, the platysma is also important. Zhang *et al*. (2020) described an endocrine surgical technique using endoscopy in which the parathyroid region is accessed through a small hole with robotic surgical management. This procedure uses the subplatysmal region for surgical maneuvers, as this plane is a key anatomical piece, serving as a reference region in dissections. Furthermore, its characteristics contribute to reduced tissue trauma and increased postoperative comfort. Compared to the conventional method, in which surgery was performed with a 6 cm long incision in the anterior region of the neck (Chen *et al*., 2012) this technique aims to provide greater postoperative comfort and improved aesthetic outcomes.

CONCLUSION

Due to the complexity of the study of anatomy, it is natural to question the importance of its knowledge for professional performance in any area of health. Whether conducting interventions for aesthetic purposes or addressing diseases, professionals must possess anatomical knowledge of the targeted region, remain cognizant of potential complications, and consider anatomical variations that may necessitate adjustments in their intervention planning. The absence of essential anatomical knowledge can render the planning unreliable and potentially result in sequelae for the patient.

The platysma plays a fundamental role in the structure and function of the head and neck region, affecting both facial expression and aesthetics. Its innervation by the facial nerve makes it crucial for facial movements, and its relationship with the neck's skin can lead to the development of expression lines and furrows. Clinical approaches, such as the application of botulinum toxin, are gaining popularity as a means to mitigate the effects of aging. Furthermore, the platysma muscle is also important in reconstructive procedures. Detailed knowledge of this muscle continues to guide clinical practices for effective and personalized treatments.

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RESUMEN: La búsqueda de procedimientos estéticos ha experimentado un aumento constante en popularidad, junto con la creciente gama de opciones de tratamientos disponibles. De notable interés es la creciente tendencia en el uso de técnicas mínimamente invasivas. Entre los diversos aspectos de la anatomía facial, el platisma destaca como un elemento fundamental que influye significativamente en la apariencia estética de la región del cuello. Ha ocasionado especial atención como punto focal estratégico en varios tratamientos orientados a mejorar el atractivo visual del cuello. Además, la versatilidad del platisma se extiende más allá del ámbito de las mejoras cosméticas. Su importancia funcional se reconoce en procedimientos quirúrgicos reconstructivos, donde se puede aprovechar para maniobras específicas. Además, el músculo sirve como punto de acceso crítico para cirugías endoscópicas mínimamente invasivas en la región del cuello. Si bien estos avances son muy prometedores, es fundamental subrayar que la seguridad siempre debe tener prioridad ante cualquier abordaje médico o quirúrgico. Esto se aplica igualmente a la región del cuello, que presenta un aspecto anatómico complejo e intrincado. Una comprensión profunda y una investigación meticulosa del platisma en todos sus diversos aspectos son fundamentales para garantizar el éxito y la seguridad de cualquier procedimiento realizado en esta región. Esta revisión integral aspira a proporcionar una comprensión contemporánea del platisma, ofreciendo un análisis en profundidad que abarca su intrincada anatomía, características histológicas e implicaciones clínicas multifacéticas. Al profundizar en estas diversas dimensiones, su objetivo es dotar a los profesionales e investigadores de la salud de una base sólida para la toma de decisiones y la práctica informadas.

PALABRAS CLAVE: Platisma; Anatomía; Histología.

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