UNIVERSIDADE ESTADUAL DE CAMPINAS
FACULDADE DE ODONTOLOGIA DE PIRACICABA

KAIO DOS SANTOS

STUDY OF THE ANATOMICAL VARIATIONS OF THE ZYGOMATICUS MINOR AND ZYGOMATICUS MAJOR MUSCLES: ANATOMICAL AND CLINICAL IMPORTANCE

ESTUDO DAS VARIAÇÕES ANATÔMICAS DOS MÚSCULOS ZIGOMÁTICO MENOR E MAIOR: IMPORTÂNCIA ANÁTOMO-CLÍNICA

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Dissertação apresentada à Faculdade de Odontologia de Piracicaba da Universidade Estadual de Campinas como parte dos requisitos exigidos para a obtenção do título de Mestre em Biologia Buco Dental, na Área de Anatomia.

Dissertation presented to the Piracicaba Dental School of the University of Campinas in partial fulfillment of the requirements for the degree of Master in Oral Biology, in the Area of Anatomy.

Orientadora: Profa. Dra. Ana Cláudia Rossi

ESTE EXEMPLAR CORRESPONDE À VERSÃO FINAL DA DISSERTAÇÃO DEFENDIDA PELO ALUNO KAIO DOS SANTOS E ORIENTADO PELA PROF[A]. DR[A]. ANA CLÁUDIA ROSSI.

Piracicaba
2025

FICHA CATALOGRÁFICA

Ficha catalográfica
Universidade Estadual de Campinas (UNICAMP)
Biblioteca da Faculdade de Odontologia de Piracicaba
Marilene Girello - CRB 8-6159

Sa59e

Santos, Kaio dos, 1997-
Estudo das variações anatômicas dos músculos zigomático menor e maior : importância anátomo-clínica / Kaio dos Santos. – Piracicaba, SP : [s.n.], 2025.

Orientador: Ana Cláudia Rossi.
Dissertação (mestrado) – Universidade Estadual de Campinas (UNICAMP), Faculdade de Odontologia de Piracicaba (FOP).

1. Expressão facial. 2. Músculos. 3. Anatomia. 4. Zigoma. I. Rossi, Ana Cláudia, 1988-. II. Universidade Estadual de Campinas (UNICAMP). Faculdade de Odontologia de Piracicaba (FOP). III. Título.

Informações complementares

Título em outro idioma: Study of the anatomical variations of the zygomaticus minor and zygomaticus major muscles : anatomical and clinical importance
Palavras-chave em inglês:
Facial expression
Muscles
Anatomy
Zygoma
Área de concentração: Anatomia
Titulação: Mestre em Biologia Buco-Dental
Banca examinadora:
Ana Cláudia Rossi [Orientador]
Felippe Bevilacqua Prado
Juliana Haddad
Data de defesa: 12-02-2025
Programa de Pós-Graduação: Biologia Buco-Dental

Identificação e informações acadêmicas do(a) aluno(a)
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Faculdade de Odontologia de Piracicaba

A Comissão Julgadora dos trabalhos de Defesa de Dissertação de Mestrado, em sessão pública realizada em 12 de fevereiro de 2025, considerou o candidato KAIO DOS SANTOS aprovado.

PROFª. DRª. ANA CLÁUDIA ROSSI

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A Ata da defesa, assinada pelos membros da Comissão Examinadora, consta no SIGA/Sistema de Fluxo de Dissertação/Tese e na Secretaria do Programa da Unidade.

DEDICATÓRIA

Dedico este trabalho a minha mãe que largou os estudos para que eu pudesse iniciar os meus e, até hoje, não mede esforços para que eu possa ir atrás dos meus sonhos e conquistar os meus objetivos.

AGRADECIMENTOS

O presente trabalho foi realizado com apoio da Coordenação de Aperfeiçoamento de Pessoal de Nível Superior – Brasil (CAPES) – Código de Financiamento 001.

Agradeço primeiramente a Deus pela conquista desse sonho, que se iniciou juntamente com a minha graduação.

Agradeço a minha mãe que, independente das dificuldades que passamos, continua me incentivando e me dando o suporte necessário para alcançar meus sonhos. Agradeço ao meu irmão, João Pedro, pelo apoio principalmente com o conhecimento de sistemas que foi fundamental para concluir minha dissertação.

Agradeço à Júlia Mori pelo incentivo e apoio, especialmente nos momentos difíceis, que foram essenciais para que a realização deste sonho se tornasse possível. Agradeço também por ser minha motivação para ser um profissional melhor, desde o final da minha graduação.

Agradeço à Professora Dra. Ana Cláudia Rossi pela orientação, dedicação e apoio que me acompanham desde o início da faculdade. Sua postura profissional e humana é uma inspiração para todos que têm o privilégio de serem seus alunos.

Agradeço aos professores Dr. Alexandre Rodrigues Freire e Dr. Felippe Bevilacqua Prado pelos valiosos aprendizados e orientações ao longo desta jornada.

À Universidade Estadual de Campinas, na pessoa do seu Reitor Prof. Dr. Antonio José de Almeida Meirelles.

À Faculdade de Odontologia de Piracicaba, na pessoa do seu Diretor Prof. Dr. Flávio Henrique Baggio Aguiar.

À Coordenadoria do Programa de Pós-Graduação em Biologia Buco-dental, na pessoa da Senhora Coordenadora Profa. Dra. Ana Cláudia Rossi.

RESUMO

Os músculos da expressão facial funcionam principalmente para transmitir emoções, mas também desempenham função como esfíncteres, dilatadores e movimentadores de estruturas faciais. Os músculos zigomático menor e maior são essenciais para expressar emoções, especialmente sorrir, e exibem significativa variabilidade anatômica. O objetivo do estudo foi descrever a anatomia e a incidência das variações dos músculos zigomático menor e zigomático maior. Um estudo anatômico do terço médio da face foi conduzido para identificar a anatomia dos músculos da expressão facial, usando 70 espécimes cadavéricos. Após este estudo, o examinador identificou os músculos zigomático menor e zigomático maior (quando presentes). A morfologia foi avaliada observacionalmente, identificando as possíveis variações anatômicas, que foram descritas e classificadas de acordo com o número de ventres musculares, orientação das fibras e os locais de origem e inserção no terço médio da face. Dos 70 cadáveres avaliados, 64 eram hemifaces e 6 eram cabeças inteiras. Cada lado das cabeças foi avaliado individualmente, resultando em um total de 76 hemifaces avaliadas. Dentre as hemifaces, 53 (69,7%) apresentaram os músculos zigomático menor e maior simultaneamente, seguindo o padrão descrito, com origem no corpo do osso zigomático e na superfície lateral deste mesmo osso, e inserção na pele do lábio superior e no ângulo da boca. Dentre os músculos zigomático maior, 58 (76,3%) não apresentaram variações, enquanto 18 (23,7%) apresentaram algum tipo de variação na origem, ventre muscular ou inserção. Dentre os músculos zigomático menor, 59 hemifaces (77,6%) apresentaram o músculo no padrão descrito, 7 (9,2%) estavam ausentes e as 10 (13,2%) restantes apresentaram algum tipo de variação. Concluindo, os músculos zigomáticos maiores e zigomáticos menores apresentam variações na origem, ventre muscular e inserção.

Palavras-chave: Expressão facial, Músculos, Anatomia, Zigoma.

ABSTRACT

The muscles of facial expression function primarily to convey facial emotions, but also play roles as sphincters, dilators, and movers of facial structures. The zygomaticus minor and major muscles are essential for expressing emotions, especially smiling, and exhibit significant anatomical variability. The aim of the study was to describe the anatomy and the incidence of the variations of the zygomaticus minor and zygomaticus major muscles. An anatomical study of the middle third of the face was conducted to identify the anatomy of the facial expression muscles, using 70 cadaveric specimens. After this study, the examiner identified the zygomaticus minor and zygomaticus major muscles (when present). The morphology was evaluated observationally, identifying the possible anatomical variations, which were described and classified according to the number of muscle bellies, fiber orientation, and the origin and insertion sites in the middle third of the face. Of the 70 cadavers evaluated, 64 were hemifaces and 6 were whole heads. Each side of the heads was evaluated individually, resulting in a total of 76 hemifaces evaluated. Among the hemifaces, 53 (69.7%) had both the zygomaticus minor and major muscles simultaneously, following the described pattern, with their origin from the body of the zygomatic bone and the lateral surface of this same bone, and insertion into the skin of the upper lip and the angle of the mouth. Among the zygomaticus major muscles, 58 (76.3%) showed no variations, while 18 (23.7%) exhibited some type of variation in origin, muscle belly, or insertion. Among the zygomaticus minor muscles, 59 hemifaces (77.6%) had the muscle in the described pattern, 7 (9.2%) were absent, and the remaining 10 (13.2%) showed some type of variation. In conclusion, the zygomaticus major and zygomaticus minor muscles have variations in origin, muscle belly, and insertion.

Keywords: Facial expression, Muscles, Anatomy, Zygoma.

SUMÁRIO

1. INTRODUÇÃO

A principal função dos músculos da expressão facial é proporcionar as expressões da face, mas esses músculos também atuam como esfíncteres e dilatadores dos orifícios faciais, bem como elevadores e depressores de estruturas faciais (Hutto e Vattoth, 2015). Esses músculos são tipicamente muito finos. Eles têm sua origem no osso, mas se inserem diretamente na pele da face (Ghassemi et al., 2003).

O músculo zigomático menor é um músculo superficial da expressão facial que tem sua origem no osso zigomático, próximo à sutura zigomaticomaxilar. Percorre a bochecha obliquamente, passando pelas fibras musculares do orbicular da boca, e se insere no tecido subcutâneo do lábio superior (Hutto e Vattoth, 2015; Zabojova et al., 2018; Kaplan, 2019). Está envolvido na expressão de muitas emoções faciais diferentes e é um músculo crucial para o sorriso (Choi et al., 2014; Kaplan, 2019). Desloca levemente o lábio superior para fora e para cima, expondo os dentes superiores, bem como lateralmente (Youn et al., 2012; Kaplan, 2019). Também é determinado que o músculo zigomático menor trabalha em conjunto com os músculos levantador do lábio superior e levantador do lábio superior e da asa do nariz (Youn et al., 2012).

O músculo zigomático maior localiza-se anteriormente ao ducto parotídeo na região em que este penetra nas fibras do músculo bucinador (Hutto e Vattoth, 2015). Sua origem está localizada no osso zigomático, lateralmente à origem do músculo zigomático menor, corre inferomedialmente na bochecha e se insere no músculo orbicular da boca (Hutto e Vattoth, 2015; Kaplan, 2019; Phan e Onggo, 2019). Ele puxa o ângulo da boca súperolateralmente e desempenha um papel importante na expressão facial, especialmente no sorriso (Hu et al., 2008; Kaplan, 2019; Phan e Onggo, 2019).

A anatomia dos músculos da expressão facial frequentemente apresenta significativa variabilidade morfológica no que diz respeito à sua presença, dimensões, forma, padrões de inserção e orientação, e essas variações anatômicas podem ser observadas tanto entre os lados da face de um mesmo indivíduo quanto entre os indivíduos (Zabojova et al., 2018; Kaplan, 2019; Phan e Onggo, 2019). Eles podem se sobrepor e cruzar vários planos (Kaplan, 2019).

O músculo zigomático menor, assim como o músculo zigomático maior, é responsável pela expressão do sorriso. Ele pode estar presente ou ausente, e, caso presente, pode apresentar variações anatômicas, como a quantidade de ventres musculares, como, por exemplo, a existência de um ventre bífido (Zabojova et al., 2018).

Sicher e Dubrul (1977) relataram que o músculo zigomático possui feixe bem desenvolvido e com cor vermelho escuro, mesmo em indivíduos com músculos faciais fracos e pálidos. Descreve sua origem no processo temporal do osso zigomático e dirige suas fibras achatadas para anterior e para baixo a fim de encontrar a comissura labial, juntamente com as fibras do músculo levantador do ângulo da boca.

Enquanto Testut (1967) separou o músculo zigomático em maior e menor, contudo, relatou que o músculo zigomático menor é um dos mais variáveis sendo muitas vezes confundido em seu trajeto ou em todo seu feixe com os músculos zigomático maior ou levantador do ângulo da boca. Este mesmo autor ainda relata a variação do músculo zigomático menor tendo origem inteiramente no músculo orbicular do olho, em seu segmento palpebral. Por fim, Testut expôs a variação da duplicidade deste músculo. Além das variações dos feixes musculares, há variação sobre a disposição, como Peer et al. (2022) relataram a presença de feixes musculares orientados horizontalmente e de feixes levemente orientados de forma oblíqua.

O conhecimento dos músculos da expressão facial, a localização e a função de cada um, bem como suas variações anatômicas, são fundamentais para o planejamento cirúrgico e para resultados satisfatórios de procedimentos faciais estéticos, como aplicação de toxina botulínica e técnicas em cirurgia plástica (Kaplan, 2019; Phan e Onggo, 2019; Sarilita et al., 2021). Reconstruções forenses craniofaciais também utilizam a compreensão dos músculos da face, e no caso dos músculos zigomáticos menor e maior esse conhecimento auxilia na delimitação das superfícies frontal e lateral da bochecha (Sarilita et al., 2021). Além disso, descrições detalhadas sobre as diversas variações são de interesse para a aplicação na cirurgia plástica e em reconstruções forenses craniofaciais.

O conhecimento das variações anatômicas dos músculos zigomático menor e zigomático maior é necessário para profissionais que realizam tratamentos conservadores e cirúrgicos no terço médio da face, bem como no ensino da Anatomia.

2. ARTIGO: ANATOMY AND THE INCIDENCE OF THE VARIATIONS OF THE ZYGOMATICUS MINOR AND ZYGOMATICUS MAJOR MUSCLES IN A BRAZILIAN SAMPLE

Artigo submetido ao periódico: *EUROPEAN JOURNAL OF ANATOMY* (ANEXO 1).

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ABSTRACT

The muscles of facial expression function primarily to convey facial emotions, but also play roles as sphincters, dilators, and movers of facial structures. The zygomaticus minor and major muscles are essential for expressing emotions, especially smiling, and exhibit significant anatomical variability. The aim of the study was to describe the anatomy and the incidence of the variations of the zygomaticus minor and zygomaticus major muscles. An anatomical study of the middle third of the face was conducted to identify the anatomy of the facial expression muscles, using 70 cadaveric specimens. After this study, the examiner identified the zygomaticus minor and zygomaticus major muscles (when present). The morphology was evaluated observationally, identifying the possible anatomical variations, which were described and classified according to the number of muscle bellies, fiber orientation, and the origin and insertion sites in the middle third of the face. Of the 70 cadavers evaluated, 64 were hemifaces and 6 were whole heads. Each side of the heads was evaluated individually, resulting in a total of 76 hemifaces evaluated. Among the hemifaces, 53 (69.7%) had both the zygomaticus minor and major muscles simultaneously, following the described pattern, with their origin from the body of the zygomatic bone and the lateral surface of this same bone, and insertion into the skin of the upper lip and the angle of the mouth. Among the zygomaticus major muscles, 58 (76.3%) showed no variations, while 18 (23.7%) exhibited some type of variation in origin, muscle belly, or insertion. Among the zygomaticus minor muscles, 59 hemifaces (77.6%) had the muscle in the described pattern, 7 (9.2%) were absent, and the remaining 10 (13.2%) showed some type of variation. In conclusion, the zygomaticus major and zygomaticus minor muscles have variations in origin, muscle belly, and insertion.

Keywords: Muscles of facial expression, zygomaticus major muscle, zygomaticus minor muscle.

INTRODUCTION

The primary function of the muscles of facial expression is to provide facial expressions, but these muscles also act as sphincters and dilators of the facial orifices, as well as elevators and depressors of facial structures (Hutto and Vattoth, 2015). These muscles are typically very thin. They originate from the bone but insert directly into the skin of the face (Ghassemi et al., 2003).

The zygomaticus minor muscle is a superficial muscle of facial expression that originates from the zygomatic bone, close to the zygomaticomaxillary suture. It runs obliquely across the cheek, passing through the muscle fibers of the orbicularis oris, and inserts into the subcutaneous tissue of the upper lip (Hutto and Vattoth, 2015; Zabojova et al., 2018; Kaplan, 2019). It is involved in the expression of many different facial emotions and is a crucial muscle for smiling (Choi et al., 2014; Kaplan, 2019). It slightly displaces the upper lip outwards and upwards, exposing the upper teeth, as well as laterally (Youn et al., 2012; Kaplan, 2019). The

zygomaticus minor muscle has also been shown to work in conjunction with the levator labii superioris and levator labii superioris alae nasi muscles (Youn et al., 2012).

The zygomaticus major muscle lies anterior to the parotid duct where it enters the fibers of the buccinator muscle (Hutto and Vattoth, 2015). Its origin is located on the zygomatic bone, lateral to the origin of the zygomaticus minor muscle, runs inferomedially on the cheek and inserts into the orbicularis oris muscle (Hutto and Vattoth, 2015; Kaplan, 2019; Phan and Onggo, 2019). It pulls the angle of the mouth superiorly laterally and plays an important role in facial expression, especially in smiling (Hu et al., 2008; Kaplan, 2019; Phan and Onggo, 2019). The anatomy of the muscles of facial expression often presents significant morphological variability with respect to their presence, dimensions, shape, insertion patterns and orientation, and these anatomical variations can be observed both between the sides of the face of the same individual and between individuals (Zabojova et al., 2018; Kaplan, 2019; Phan and Onggo, 2019). They can overlap and cross several planes (Kaplan, 2019).

The zygomaticus minor muscle, like the zygomaticus major muscle, is responsible for the expression of the smile. It may be present or absent, and, if present, it may present anatomical variations, such as the number of muscle bellies, such as the existence of a bifid belly (Zabojova et al., 2018).

Sicher and Dubrul (1977) reported that the zygomaticus muscle has a well-developed bundle and a dark red color, even in individuals with weak and pale facial muscles. It describes its origin in the temporal process of the zygomatic bone and directs its flattened fibers anteriorly and downwards to meet the labial commissure, together with the fibers of the levator anguli oris muscle.

Testut (1967) separates the zygomaticus muscle into major and minor, however, he reports that the zygomaticus minor muscle is one of the most variable, often being confused in its path or in its entire bundle with the zygomaticus major or levator anguli oris muscles. This same author also reports the variation of the zygomaticus minor muscle originating entirely from the orbicularis oculi muscle, in its palpebral segment. Finally, Testut exposes the variation in the duplication of this muscle. In addition to the variations in the muscle bundles, there is variation in the arrangement, as Peer et al. (2022) reported the presence of muscle bundles oriented horizontally and bundles slightly oriented obliquely. Knowledge of the muscles of facial expression, their location and function, as well as their anatomical variations, are essential for surgical planning and for satisfactory results of aesthetic facial procedures, such as the application of botulinum toxin and plastic surgery techniques (Kaplan, 2019; Phan and Onggo, 2019; Sarilita et al., 2021). Forensic craniofacial reconstructions also use an understanding of

the muscles of the face, and in the case of the zygomaticus minor and major muscles, this knowledge helps to delimit the frontal and lateral surfaces of the cheek (Sarilita et al., 2021). In addition, detailed descriptions of the various variations are of interest for application in plastic surgery and in forensic craniofacial reconstructions.

The knowledge of the anatomical variations of the zygomaticus minor and zygomaticus major muscles is necessary for professionals who perform conservative and surgical treatments in the middle third of the face, as well as in teaching anatomy.

The aim of the study was to describe the anatomy and the incidence of the variations of the zygomaticus minor and zygomaticus major muscles.

MATERIAL AND METHODS

The present research was approved by the Research Ethics Committee of the Piracicaba Dental School – FOP/UNICAMP under protocol CAAE: 73366223.6.0000.5418 (ANEXO 2).

Research Design and Sample

This is a descriptive observational study. Seventy human heads were selected from the Anatomy Laboratory of the Piracicaba Dental School (FOP-UNICAMP), which are part of the Biobank "Bones, Teeth, and Human Cadavers" of FOP-UNICAMP. The heads are from adult cadavers, Brazilian individuals, aged between 18 and 80 years and both sexes (40 male and 30 female). Of the 70 cadavers evaluated, 5 specimens were preserved in formalin and 65 specimens were preserved with glycerin.

The study used cadaveric faces from adult individuals that preserved the anatomical structures in the middle third of the face, particularly the facial expression muscles. Cadaveric faces were excluded if they did not preserve the middle third of the face, or if they presented any pathology involving a foreign body in the middle third of the face that interfered with the anatomy of the facial expression muscles.

Analysis of Morphology of the Zygomaticus Major and Minor Muscles

An anatomical study of the middle third of the face was conducted to identify the anatomy of the facial expression muscles, using 70 cadaveric specimens. After this study, the examiner identified the zygomaticus minor and zygomaticus major muscles (when present).

The morphology was evaluated observationally, identifying the possible anatomical variations, which were described and classified according to the number of muscle bellies, fiber orientation, and the origin and insertion sites in the middle third of the face (Figure 1).

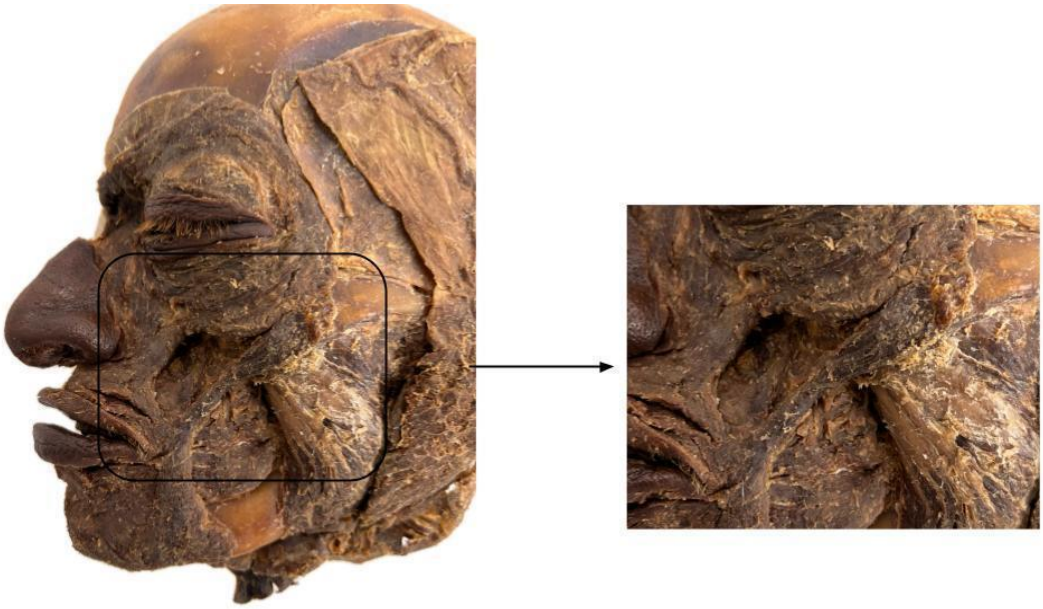

Figure 1. Lateral view of a face (cadaveric specimen). The delimited area represents the region of interesting evaluated for the description and classification of the zygomaticus major and minor muscles.

Data Analysis

Descriptive statistics (in %) were performed to determine the incidence of anatomical variations of the studied muscles.

RESULTS

Of the 70 cadavers evaluated, 64 were hemifaces and 6 were whole heads. Each side of the heads was evaluated individually, resulting in a total of 76 hemifaces evaluated.

Among the hemifaces, 53 (69.7%) had both the zygomaticus minor and major muscles simultaneously, following the described pattern, with their origin from the body of the zygomatic bone and the lateral surface of this same bone, and insertion into the skin of the upper lip and the angle of the mouth.

Among the zygomaticus major muscles, 58 (76.3%) showed no variations, while 18 (23.7%) exhibited some type of variation in origin, muscle belly, or insertion. Among the

zygomaticus minor muscles, 59 hemifaces (77.6%) had the muscle in the described pattern, 7 (9.2%) were absent, and the remaining 10 (13.2%) showed some type of variation.

Regarding variations in the zygomaticus major muscle, 9 occurred in the origin, 8 in the muscle belly, and 14 in the insertion. For the zygomaticus minor muscle, 5 variations were found in the origin, 3 in the belly, and 5 in the insertion.

Variations in muscles' origin

Em relação à origem, o músculo zigomático maior apresentou 2 tipos de variações (Figura 2). A primeira variação foi uma origem mais anterior, observada em apenas 1 espécime. A segunda variação, presente em 4 hemifaces, envolveu uma origem mais lateral, ainda mais distante do músculo zigomático menor quando presente.

Houve também 1 hemiface que apresentou dois músculos zigomático maior com duas origens, ventres musculares e inserções separadas.

Em relação ao músculo zigomático menor, foram encontrados 2 tipos de variação na origem, além da ausência do músculo em algumas hemifaces. A variação identificada foi a fusão das fibras na origem com o músculo zigomático maior, ocorrida em 2 casos. A última variação encontrada foi a fusão das fibras de origem do músculo zigomático menor e do músculo orbicular do olho, presente em 3 espécimes.

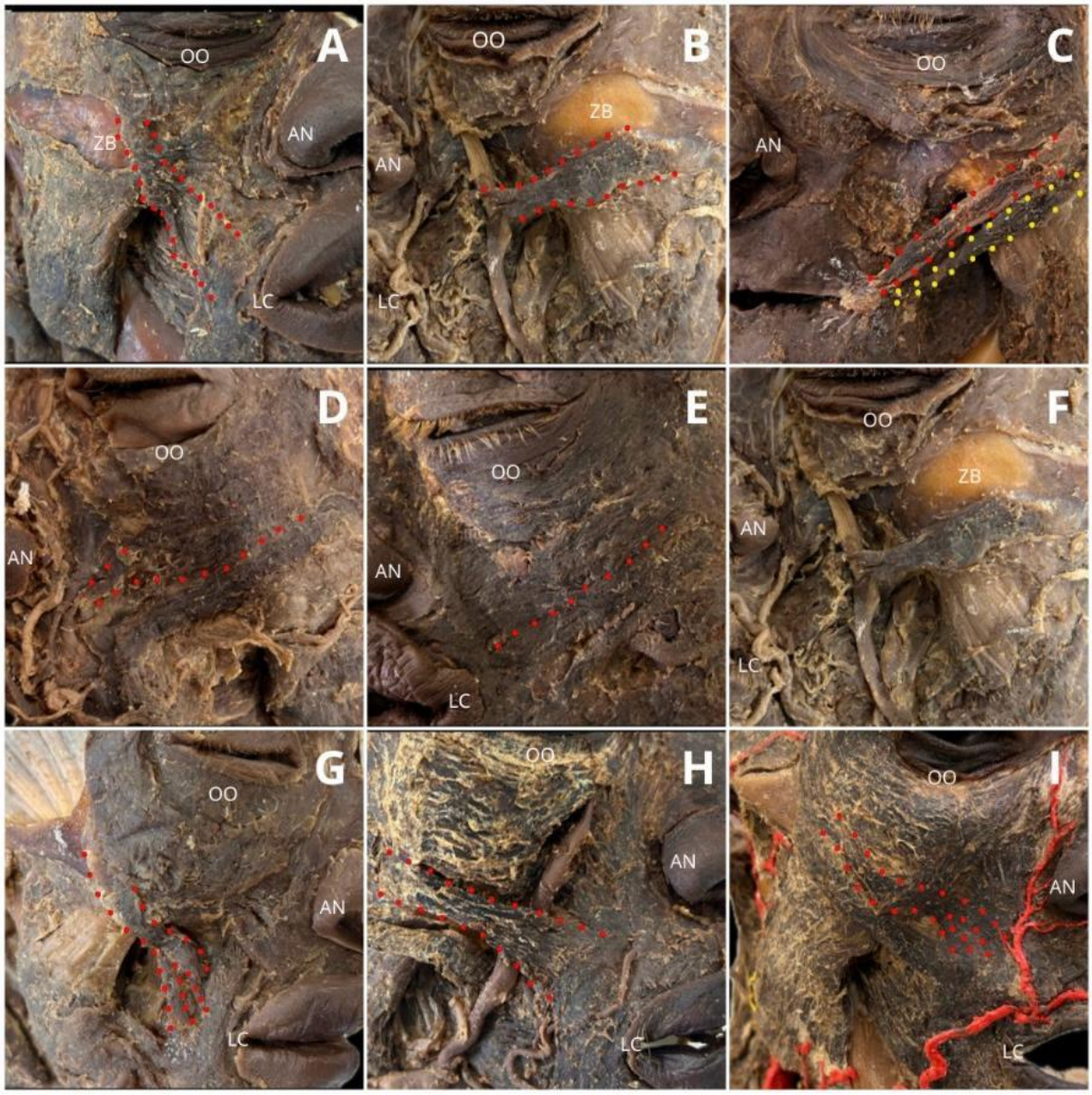

Figure 2. Lateral view of specimens of each type of muscle found. A. Variation in origin, with the zygomaticus major muscle having its origin more anteriorly. (n=1); B. Variation in origin, with the zygomaticus major muscle having a more lateralized origin. (n=4); C. Double zygomaticus major muscle. (n=1); D. Fusion of the fibers of the zygomaticus minor muscle with the orbicularis oculi muscle. (n=3); E. Fusion of the fibers of the zygomaticus major and minor muscles at the origin. (n=2); F. Absence of the zygomaticus minor muscle. (n=7); G. Zygomaticus major muscle with bifurcation of its belly along its path. (n=5); H. Zygomaticus major muscle with fan belly. (n=3); I. Zygomaticus minor muscle with bifurcation of the belly along its path. (n=2). OO: orbicularis oculi muscle; ZB: zygomatic bone; AN: ala of the nose; LC: labial commissure.

Variations in belly muscle

In the muscle belly, 3 variations were identified during the course of the zygomaticus major muscle. The first variation, a bifid muscle belly from the origin, was found in only 1 hemiface. The second variation, a bifurcation of the muscle belly during its course, was found in 4 hemifaces. The third variation, described as a fan-shaped muscle belly, was present in 3 hemifaces.

For the zygomaticus minor muscle, 1 variation was identified in the muscle belly, described as a bifurcation of the muscle belly along its course, which occurred in 3 hemifaces.

Variations in muscles' insertion

The insertion was the site that showed the highest number of variations (Figure 3). Regarding the zygomaticus major muscle, seven variations were identified. The first variation appeared three times and was described as two insertions (Figure 4), the first at the labial commissure and the second at the lateral part of the upper lip. The second variation was also a double insertion, with the first at the labial commissure and the second at the insertion of the depressor anguli oris muscle, present in 3 muscles. The third variation, described as a fan-shaped insertion, was present in only two hemifaces. Variations 4, 5, and 6 appeared in only one hemiface each. Variation 4 was described as fibers at the insertion fused with the fibers of the zygomaticus minor muscle; variation 5 was insertion into the buccinator muscle; and variation 6 was insertion at the upper and lateral part of the upper lip. The seventh variation identified was the presence of three insertions, which appeared in two hemifaces.

Regarding the zygomaticus minor muscle, the first variation described appeared in two hemifaces, with the insertion located near the levator labii superioris muscle. The second variation was the presence of two insertions: the first along with the levator labii superioris muscle and the second with the fibers of the zygomaticus major muscle at the lateral part of the lip, which appeared in two hemifaces. One hemiface showed the insertion of the zygomaticus minor muscle both at the alar base of the nose and at the upper lip, described in just one muscle. The last variation described, besides the absence of the muscle, was also a double insertion, but both insertions were directed toward the upper part of the upper lip.

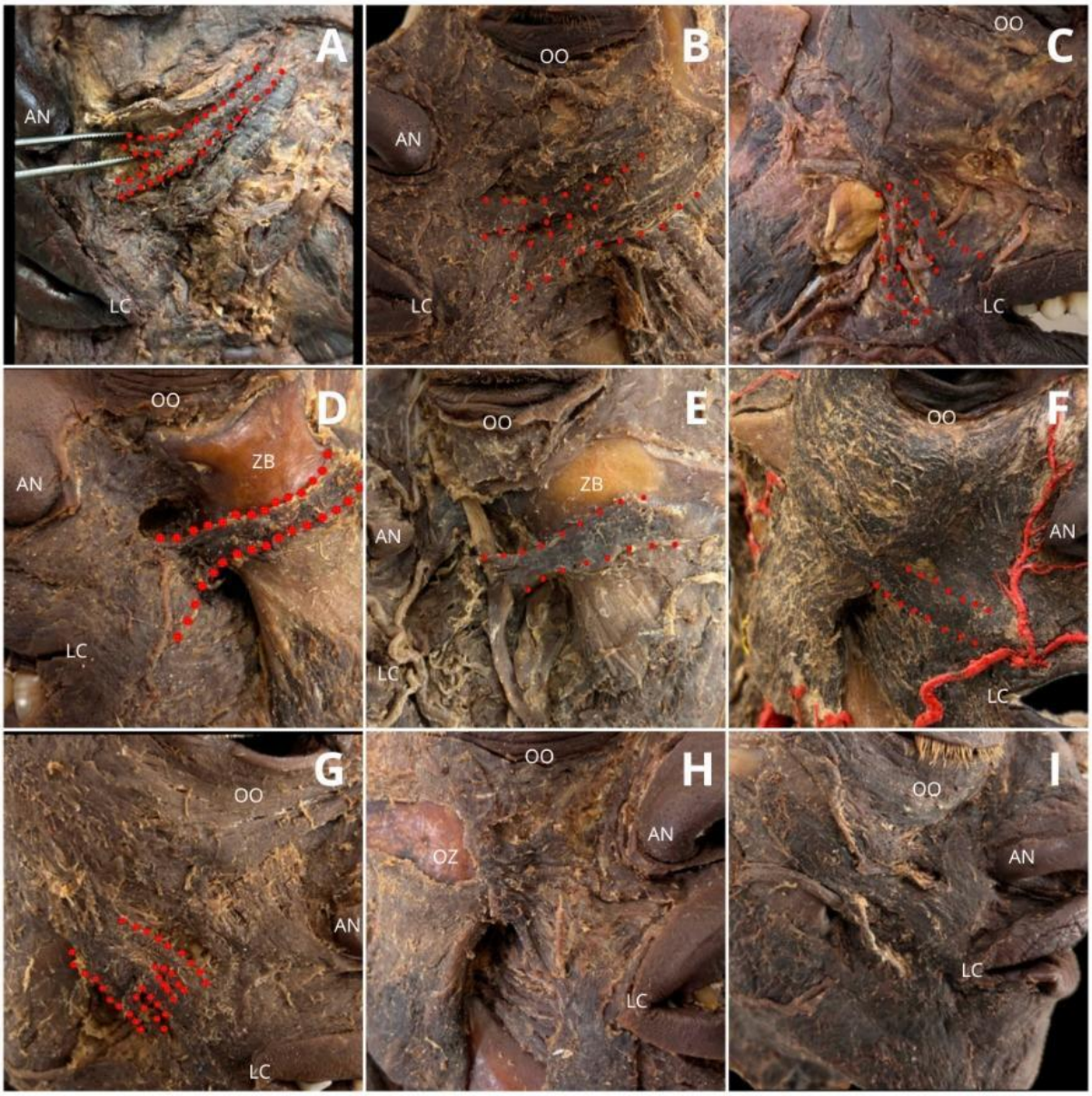

Figure 3. A. Zygomaticus minor muscle with fibers going to the wing of the nose. (n=1); B. Zygomaticus Major Muscle with two insertions, the first at the labial commissure and the second at the lateral part of the upper lip. (n=3); C. Zygomaticus Major muscle with two insertions, the first at the corner of the lip and the second at the insertion of the depressor anguli oris muscle. (n=3); D. Zygomaticus Major muscle with fan-shaped insertion. (n=3); E. Zygomaticus Major muscle inserting into the buccinator muscle. (n=1); F. Zygomaticus Major muscle inserting into the lateral part of the upper lip. (n=1); G. Zygomaticus Major Muscle with three insertions. (n=2); H. Zygomaticus Major Muscle with fibers at the insertion fused with the fibers of the Zygomaticus Minor Muscle. (n=1); I. Zygomaticus Minor muscle with fused insertion to the levator labii superioris muscle. (n=2). OO: orbicularis oculi muscle; ZB: zygomatic bone; AN: ala of the nose; LC: labial commissure.

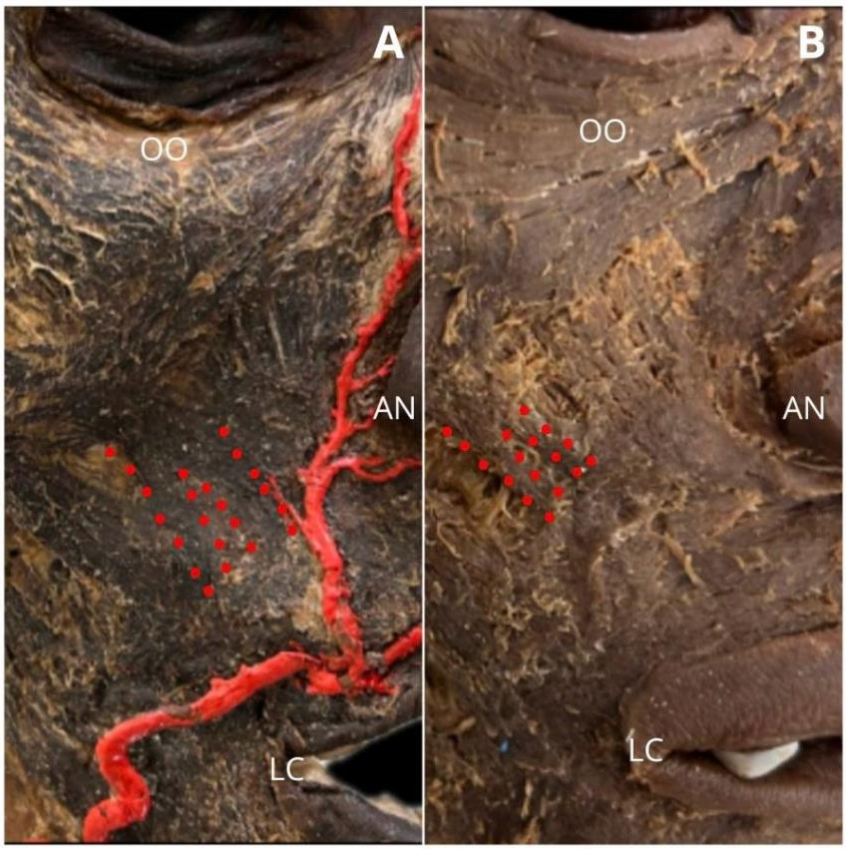

Figure 4. A. Zygomaticus Minor muscle with two insertions, the first with the levator labii superioris muscle and the second with the fibers of the zygomaticus major muscle. (n=2); B. Zygomaticus Minor muscle with two insertions going to the upper lip. (n=1). OO: orbicularis oculi muscle; AN: ala of the nose; LC: labial commissure.

DISCUSSION

The anatomical characteristics of the facial expression muscles are important due to the use of different flaps for the repair of facial tissue loss and facial rejuvenation surgeries (Rubin, 1974). Additionally, knowledge of anatomical variations is essential to avoid errors and provide the patient with appropriate clinical management during the specific procedures for each case (Ferreira et al., 2021). The area of the middle third of the face is a challenging region for plastic surgeons and may differ across various ethnicities (Farahvash et al., 2010).

In the population evaluated in the present study, variations in origin, muscle belly, and insertion were observed. Variations in the zygomaticus major muscles have been previously reported in the literature. Phan and Onggo (2019) and Pessa et al. (1998) suggest that the bifid zygomaticus major muscle clinically presents as a dimple in the cheek. The authors also noted

that this is considered a congenital defect (Phan and Onggo, 2019). It is important to note that the anatomical variations of the facial expression muscles can cause changes in an individual's facial expression. In the present study, with respect to the muscle belly of the zygomaticus major, three types of variations were found. Regarding the zygomaticus minor muscle, one variation in the belly was found, and the absence of this muscle was noted in 9.2% of the hemifaces.

Farahvash et al. (2010) conducted a study with the aim of determining the patterns of middle third facial muscles in Persian individuals, and the authors found that the incidence of the bifid zygomaticus major muscle was 19.2%. Pessa et al. (1998) investigated a series of 50 hemifacial dissections in cadavers and found that the incidence of the double zygomaticus major muscle was 34%. Hu et al. (2008) observed 70 hemiface dissections (59 cases of Koreans and 11 cases of French individuals) and reported that the bifid zygomaticus major muscle was observed in 40% of the cases. Phan and Onggo (2019) performed a meta-analysis to determine the prevalence of the bifid zygomaticus major muscle in different populations. The authors found that this anatomical variation was most prominent in the American subgroup (34%), followed by the Asian subgroup (27.4%) and the European subgroup (12.3%). The overall prevalence of the bifid zygomaticus major muscle was 22.7% (Phan and Onggo, 2019). However, no previous studies in the literature reviewed reported the prevalence of the bifid zygomaticus major muscle in the Brazilian population.

In the present study, variations in the muscle belly of the zygomaticus major were identified, with three variations observed. The first variation, a bifid belly from the origin, was found in only one hemiface (1.31%). The second variation, a bifurcation of the belly during its course, was found in 5.26% of the cases. The third variation was described as a fan-shaped muscle belly, present in 3.94% of the hemifaces. Again, hemiface 15 on the left showed the double zygomaticus major muscle.

The facial expression muscles are responsible for expressing people's emotions (Phan and Onggo, 2019). Both zygomatic muscles, the major and minor, are responsible for expressing emotions of joy through smiling and laughter (Choi et al., 2014; Kaplan, 2019; Phan and Onggo, 2019). According to Dimberg, Thunberg, and Grunedal (2002), during social interaction, emotional excitement and spontaneous facial mimicry are reflected by an increase in the activity of the zygomaticus major muscle when observing happy facial expressions.

CONCLUSION

In conclusion, the zygomaticus major and zygomaticus minor muscles have variations in origin, muscle belly, and insertion. The facial expression muscles directly influence individual appearance and contribute to emotional expression. Therefore, it is necessary to consider the anatomy of possible individual variations of the facial expression muscles, and their incidence is essential when performing surgical and/or aesthetic procedures on the face.

ACKNOWLEDGEMENTS

This study was financed in part by the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior – Brasil (CAPES) – Finance Code 001.

The authors sincerely thank those who donated their bodies to science so that anatomical research and teaching could be performed. Results from such research can potentially increase scientific knowledge and can improve patient care. Therefore, these donors and their families deserve our highest respect (Iwanaga et al., 2020).

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3 CONCLUSÃO

Foi possível verificar que os músculos zigomáticos maiores e zigomáticos menores possuem variações na origem, ventre muscular e inserção. Os músculos da expressão facial influenciam diretamente a aparência individual e contribuem para a expressão emocional. Assim, é necessário considerar a anatomia das possíveis variações individuais dos músculos da expressão facial e a sua incidência é essencial quando se realizam procedimentos cirúrgicos e/ou estéticos na face.

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DADOS DO PROJETO DE PESQUISA

Título da Pesquisa: Estudo das variações anatômicas dos músculos zigomático menor e zigomático maior: importância anátomo-clínica

Pesquisador: Ana Cláudia Rossi

Área Temática:

Versão: 2

CAAE: 73366223.6.0000.5418

Instituição Proponente: Faculdade de Odontologia de Piracicaba - Unicamp

Patrocinador Principal: Financiamento Próprio

DADOS DO PARECER

Número do Parecer: 6.300.851

Apresentação do Projeto:

O parecer inicial é elaborado com base na transcrição editada do conteúdo do registro do protocolo na Plataforma Brasil e dos arquivos anexados à Plataforma Brasil. Os pareceres de retorno, emendas e notificações são elaborados a partir do último parecer e dos dados e arquivos da última versão apresentada.

A EQUIPE DE PESQUISA citada na capa do projeto de pesquisa inclui ANA CLÁUDIA ROSSI (Cirurgiã-Dentista, Professora da Área de Anatomia da FOP/UNICAMP, Pesquisadora responsável), KAIO DOS SANTOS (Cirurgião-Dentista, Mestrando no PPG em Biologia Buco-Dental da FOP/UNICAMP), LUCIANE NAOMI OGUMA WATANABE (Cirurgiã-Dentista, Doutoranda no PPG em Biologia Buco-Dental da FOP/UNICAMP), BEATRIZ CARMONA FERREIRA-PILEGGI (Cirurgiã-Dentista, Doutoranda no PPG em Biologia Buco-Dental da FOP/UNICAMP), ALEXANDRE RODRIGUES FREIRE (Cirurgião-Dentista, Professor da Área de Anatomia da FOP/UNICAMP), o que é confirmado na declaração dos pesquisadores e na PB.

Pendência 1 (atendida em 14/09/23). DELINEAMENTO DA PESQUISA: Trata-se de um estudo analítico observacional e transversal que será desenvolvido em 70 cabeças humanas de cadáveres

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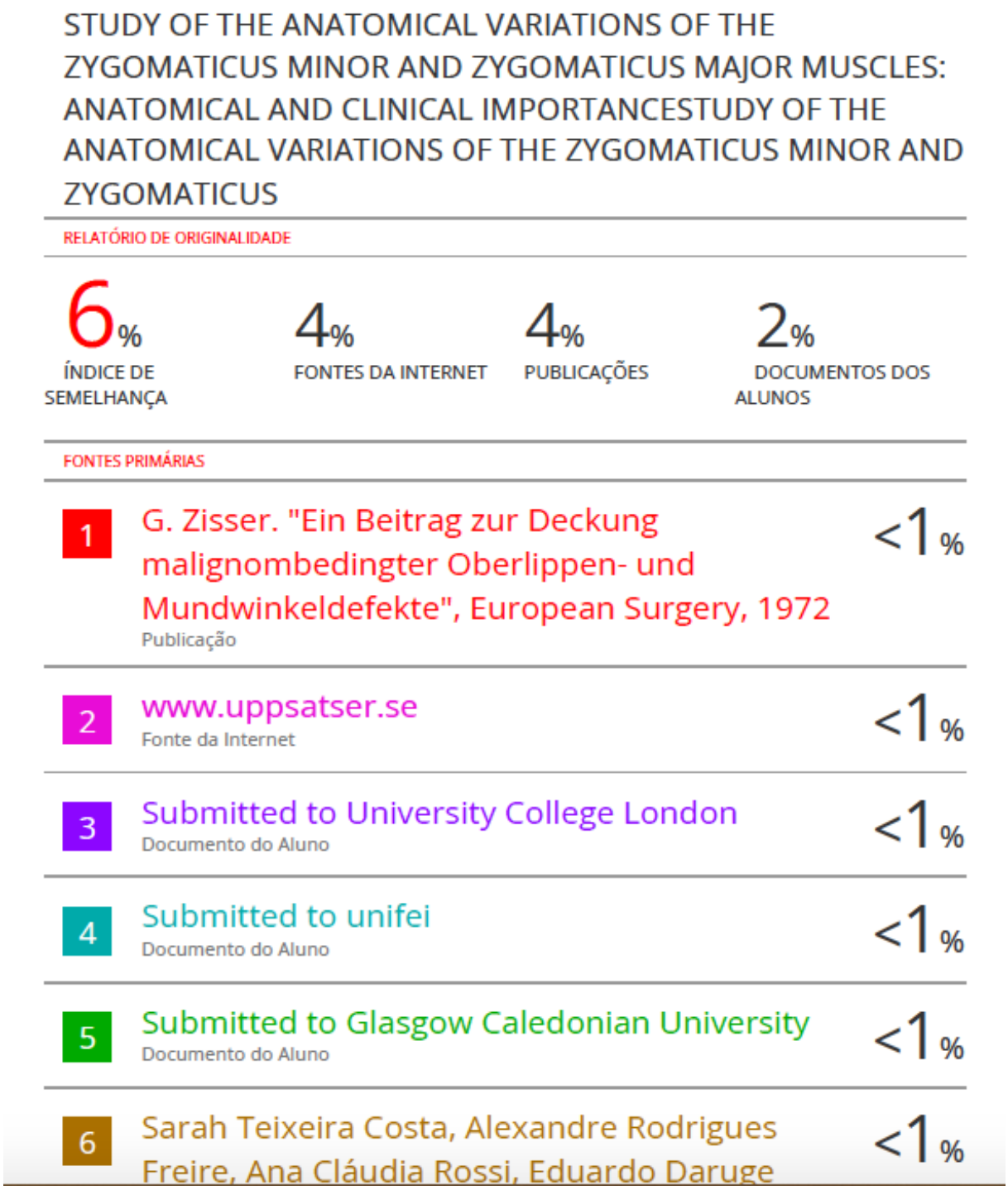
ANEXO 3: COMPROVANTE DO SOFTWARE ANTI-PLÁGIO



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