Journal of
Vascular Diseases

Article

Is the Sublingual Artery a Reliable Alternative for Intraoral Anastomoses in Head and Neck Free-Flap Reconstruction? Anatomical Basis and Preliminary Results

Vasco Starke [1,2], Jürgen Wallner [1,*], Robert Stigler [3], Sidney Mannschatz [2], Jakob Müller [2] and Erich Brenner [2]

1 Department of Oral and Maxillofacial Surgery, Medical University of Graz, Auenbruggerplatz 5, 8036 Graz, Austria
2 Department of Anatomy, Histology, and Embryology, Institute of Clinical and Functional Anatomy, Medical University of Innsbruck, Müllerstr. 59, 6020 Innsbruck, Austria
3 Department of Oral and Maxillofacial Surgery, Medical University of Innsbruck, Anichstr. 35, 6020 Innsbruck, Austria
* Correspondence: j.wallner@medunigraz.at; Tel.: +43-(0)-31638530193

Abstract: Background/Objectives: Head and neck free-flap reconstructions are often required to treat tumors or extensive post-traumatic jaw defects. The facial artery is the standard receiving vessel for intraoral microvascular anastomoses. However, its use is associated with several disadvantages, such as lesions of buccal nerve branches of the facial nerve or the parotid duct, as well as variability in course and diameter. The aim of this study is to investigate whether branches of the sublingual artery can be considered as an alternative intraoral supply vessel to the facial artery to avoid these drawbacks. Methods: Twelve formalin-fixed cadaveric heads with 24 sides (n = 24) were dissected. The origin, course, branching pattern, and distribution of the sublingual artery were examined. In addition, the diameters of the branches of the sublingual artery were assessed to identify potential supply vessels for anastomoses. Results: In ten of the twenty-four cases (41.7%), the sublingual artery originated from the lingual artery, and in nine cases (37.5%), the lingual artery originated from the facial artery. The main trunk of the sublingual artery was present in the floor of the mouth in all cases (100%), with a diameter of $\geq$0.9 mm in vitro (1 mm in vivo). In 15 of the 24 half heads (62.5%), branches of the sublingual artery with $\geq$0.9 mm were identified in this space, with the main branch being considerably stronger. Conclusions: The large diameter of the sublingual artery in the floor of the mandible suggests that this vessel or its branches could be considered as alternative pedicles for intraoral anastomoses in mandibular microvascular free-flap grafts.

Keywords: sublingual artery; pedicle; microvascular free flap reconstruction; intraoral anastomosis; head and neck cancer; tumor surgery

Citation: Starke, V.; Wallner, J.; Stigler, R.; Mannschatz, S.; Müller, J.; Brenner, E. Is the Sublingual Artery a Reliable Alternative for Intraoral Anastomoses in Head and Neck Free-Flap Reconstruction? Anatomical Basis and Preliminary Results. *J. Vasc. Dis.* **2024**, *3*, 397–406. https://doi.org/10.3390/jvd3040031

Academic Editors: Miltiadis Krokidis, Pazhanichamy Kalailingam and Suresh Veeraperumal

Received: 23 August 2024
Revised: 29 September 2024
Accepted: 25 October 2024
Published: 31 October 2024

1. Introduction

Head and neck reconstructions are often required to treat tumors or extensive post-traumatic jaw defects. Microvascular free-flap grafting is a suitable reconstructive treatment option to ensure the tension-free wound coverage of large defects in order to fulfill the aesthetic and functional requirements. Therefore, appropriate pedicle vessels are crucial for the success of graft vascularization. Conventional extraoral microvascular anastomoses, typically supplied by ventral branches of the external carotid artery, necessitate an invasive exposure of the neck. Alternatively, intraoral microvascular anastomoses can be applied in treatments where it is not necessary to surgically expose the neck (benign tumors, post-traumatic defects, etc.) [1–4]. In these cases, where the neck is not exposed, the procedure is less invasive and avoids morbidities such as impairments of the external appearance due to scarring and/or damage to the marginal mandibular branch of the facial nerve [5,6]. In addition, less invasive intraoral anastomoses enable the use of short pedicle flaps without interpositional grafts. The literature indicates similar success rates when intraoral and extraoral techniques are compared [1,5,6]. However, as the facial artery is the standard receiving vessel for the intraoral procedure, standard intraoral anastomoses are technically challenging and have several disadvantages, limiting the procedure. The buccal branches of the facial nerve or the parotid duct can be injured by the approach, and the course and diameter of the facial vessels are often unpredictable and variable [6]. To overcome these limitations, the use of the lingual artery and especially the sublingual artery could be an alternative source of intraoral anastomosis that is not associated with such disadvantages. Anatomically, the lingual artery generally arises from the external carotid artery in the carotid triangle; a trunk may occur with the facial artery (linguofacial trunk, 18%), the superior thyroid artery (thyrolingual trunk, 2%), or even both (<1%) [7]. Under the hypoglossal nerve, the lingual artery's course is from the middle pharyngeal constrictor muscle medial to the hyoglossus muscle, where the hyoid branch and the dorsal lingual branches originate (supply to the root of the tongue and the palatine tonsil). In the sublingual region at the oral border of the hyoglossus muscle, the lingual artery releases the sublingual artery (supply to the sublingual gland and the muscles and mucosa of the floor of the mouth). The lingual artery ends as a 'deep lingual artery' running to the tip of the tongue (supply to the tongue muscles) [8]. In recent decades, the course of the lingual artery and its branches has been examined in various studies. Authors have made several classifications [9–12] and descriptions [9,13] that differ from those in standard anatomical textbooks. However, so far there is no complete consensus in the literature regarding the origin and appearance of the sublingual artery and the vascular supply of the floor of the mouth. Nakajima et al. observed that the sublingual artery sets off from the lingual artery in only about half of the specimens (in 49%, the facial artery was the origin) [9]. Shangkuan et al. divided the course of the lingual artery into four segments and precisely depicted the appearance and diameter of these segments, but without applying this method to the sublingual artery and its arterial supply to the floor of the mouth [10]. In this study, a comprehensive anatomical investigation of the course, appearance, diameter, and branching pattern of the lingual and sublingual artery and its branches was performed to evaluate its reliability as a potential alternative pedicle for intraoral anastomoses in head and neck free-flap reconstruction.

2. Materials and Methods

Twelve formalin-embalmed human cadaver heads (nine females; three males) with 24 sides (n = 24; 12 right and 12 left) were acquired for this study [14]. The bodies were donated by people who had given their informed consent for their use for scientific and educational purposes prior to death. The bodies, donated to the Department of Clinical and Functional Anatomy at the Medical University of Innsbruck, were a representative sample of the Austrian general population at the age of death [15]. The specimens had a mean age at death of 83.2 years (range: 62–93 years) and a mean height of 164 cm (range: 151–175 cm). None of the cadavers showed any evidence of trauma, previous surgery, or gross pathology in the head and neck region.

The following anatomical dissection protocol was applied: The skin, platysma, subcutaneous tissue, and two superficial layers of the cervical fascia were removed to expose the external carotid artery in the anterior cervical region. The lingual artery was identified and followed distally. The digastric muscle, stylohyoid muscle, connective tissue, and fat tissue were resected to obtain a closer overview. The mylohyoid muscle was split longitudinally and the hyoglossus muscle was split transversally to the muscle fibers. Both muscles were subsequently unfolded. All branches of the lingual artery and accompanying veins were carefully traced up to the horizontal section in the tongue. The sublingual artery was precisely revealed in the floor of the mouth, with its main trunk and all branches up to its insertion point in the mandible.

The course, branching pattern, and distribution of the lingual and the sublingual artery were examined using the segment classification of Shangkuan et al. and surveyed with a tape measure (XD P113.432, XD Collection, Xi'an, China) [10]. Documentation was made photographically using a high-resolution camera (iPhone XR®, Apple Inc., Cupertino, CA, USA). All branches of the arterial vessels mentioned above were assessed to determine their inner luminal diameter with a 0.9 mm stylet (Vasocan®, 22 G/0.9 × 25 mm, B. Braun, Melsungen, Germany). Figure 1 illustrates the technical procedure (Figure 1).

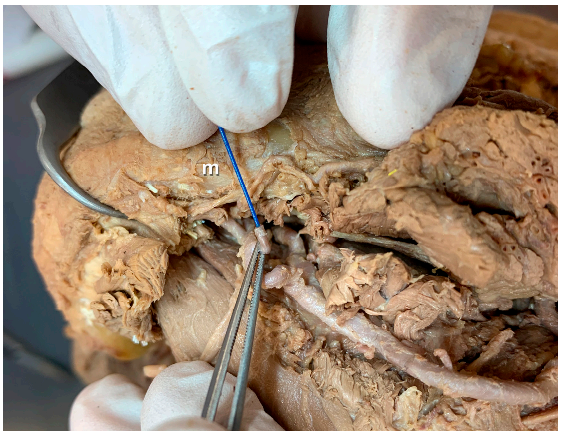

Figure 1. Technical method to assess the branch diameter with a 0.9 mm stylet. m: mandible; view from caudal.

A luminal diameter of 1 mm was defined as the lowest limit since in vivo microvascular anastomoses can be performed surgically using this caliber. However, as this is an in vitro study, the shrinkage of the specimens' arteries due to contraction caused by the loss of pressure and embalming (chemical formalin fixation) must be considered. According to Danesh-Meyer et al., this shrinkage amounts to about 8% [16]. Therefore, a stylet with the previously described size was chosen.

The mean, range, and standard deviation (SD) of the measurement parameters were determined. Descriptive statistics were calculated using Excel (Microsoft Office, Microsoft Corp., Redmond, Washington, DC, USA).

3. Results

3.1. Anatomical Findings

The lingual artery was found and exposed in all specimens (100%). In 17 of the 24 hemiheads (70.8%), the lingual artery originated from the external carotid artery. A linguofacial trunk was found in six (25%) and a thyrolingual trunk in one (4.2%) of the cases. In the original segment (classification of Shangkuan et al. [10]), an average of 1.4 branches (range: 0–3 branches) arose from the lingual artery. These branches most frequently coursed downwards to supply the hyoid bone. A total of 57.6% of these branches had an inner diameter under 0.9 mm, while 42.4% had an inner diameter of at least 0.9 mm. Within the hyoglossus segment, 3.2 branches (range: 1–6 branches) originated, on average, from the lingual artery. Up to four dorsal lingual branches most frequently led upwards to supply the root of the tongue and the palatine tonsil. A total of 38.5% of these branches had a luminal diameter under 0.9 mm, while 61.5% had at a luminal diameter of at least 0.9 mm. Also, up to four branches coursed downwards, either to the hyoid bone or to the surrounding muscles. A total of 54.5% of these branches had a luminal diameter of less than 0.9 mm, while 45.5% had a luminal diameter of at least 0.9 mm. On five sides, the sublingual artery arose in this segment, most frequently leading downwards. All of the sublingual arteries had a main trunk with a luminal diameter of at least 0.9 mm. In the ascending segment, an average of 3.5 branches (range: 1–7 branches) arose from the lingual artery. These branches most frequently coursed upwards to supply the tongue muscles. A total of 79.5% of these branches had an inner diameter of less than 0.9 mm, while 20.5% had an inner diameter of at least 0.9 mm. The sublingual artery arose in this segment on ten sides, always leading downwards. A total of 80% of these sublingual arteries had a luminal diameter of at least 0.9 mm, while 20% had a smaller diameter. Length measurements of the lingual artery are shown in Table 1.

Table 1. Length measurements of the lingual artery.

	Straight Length	Stretched Length
Original segment	21.9 ± 6.6 (7–30)	39 ± 13.3 (20–70)
Segment within the hyoglossal muscle	20.4 ± 5.0 (11–30)	25.2 ± 7.8 (11–42)
Ascending segment of the deep lingual artery	18.9 ± 5.2 (13–34)	23.1 ± 5.5 (13–39)

The distances in mm are reported as mean ± standard deviation and (range), measured for 12 hemiheads (n = 24). n: number.

The sublingual artery was found and exposed in all specimens (100%). In ten of the twenty-four cases (41.7%), the sublingual artery originated from the lingual artery (Figures 2 and 3).

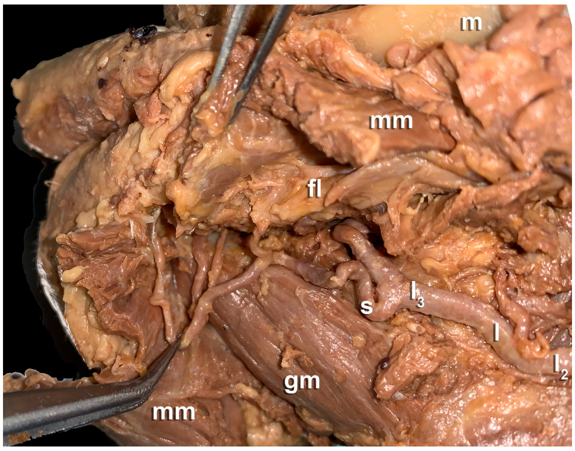

Figure 2. The sublingual artery branching off the lingual artery—overview. fl: facial layer; gm: geniohyoid muscle; l: lingual artery; l_2: hyoglossus segment; l_3: ascending segment; m: mandible (angle); mm: mylohyoid muscle; s: sublingual artery.

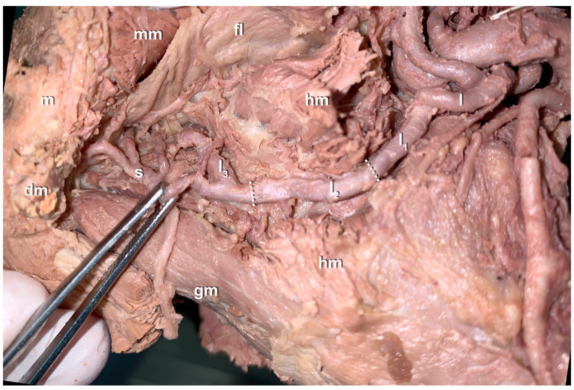

Figure 3. The sublingual artery branching off the lingual artery—detailed illustration. dm: digastric muscle; fl: facial layer; gm: geniohyoid muscle; hm: hyoglossus muscle; l: lingual artery; l_1: original segment; l_2: hyoglossus segment; l_3: ascending segment; m: mandible; mm: mylohyoid muscle; s: sublingual artery.

The sublingual artery originated from the facial artery in nine cases (37.5%) (Figure 4).

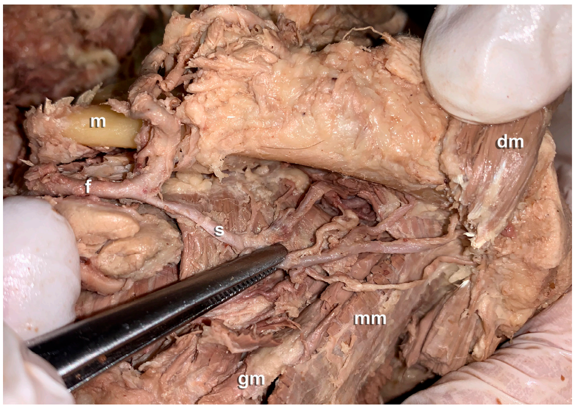

Figure 4. The sublingual artery branching off the facial artery. The sublingual artery represents the submental artery, which supplies the floor of the mouth and, with its terminal branch, the mandible with arterial blood by releasing large-caliber branches into the deep sublingual space. In these cases, the lingual artery did not have any sublingual branches; the supply to the floor of the mouth was taken over by the facial artery. dm: digastric muscle; f: facial artery; gm: geniohyoid muscle; m: mandible (angle); mm: mylohyoid muscle; s: sublingual artery.

On four sides (16.7%), the sublingual artery was present twice. One sublingual artery originated from the facial artery and the other one originated from the lingual artery. In one case (4.2%), anastomosis was found between the facial artery and the lingual artery, in addition to a sublingual artery arising from the lingual artery. From the point of origin to the insertion in the mandible, the straight length averaged 36.1 mm (range: 12–59 mm; SD: $\pm$9.3 mm) and the stretched length averaged 47.1 mm (range: 15–70 mm; SD: $\pm$13.2 mm).

The main trunk of the sublingual artery was present in the floor of the mouth in all cases (100%), with a diameter of $\geq$0.9 mm.

On average, the sublingual artery had four branches (range: 1–11 branches). Most frequently, these branches coursed upwards to supply the laterally located sublingual gland and the muscles and mucosa of the floor of the mouth. In 15 of the 24 hemiheads (62.5%), at least one branch was found to have a luminal diameter $\geq$ 0.9 mm, and the main branch in each of these samples was considerably stronger. In four of these fifteen sites, two branches and in one of the fifteen sites, four branches were found to have a luminal diameter of at least 0.9 mm. Figure 2 shows this vividly (Figure 2). In nine of the twenty-four cases (37.5%), no branch with an inner diameter of at least 0.9 mm lumen was identified. In four of these nine sites, the branches of the sublingual artery were only marginally present.

A layer of fascia was found between the mylohyoid and the hyoglossus muscle in each specimen (Figures 2 and 3). Branches of the mandibular nerve ran through this layer.

3.2. Clinical Application

The main trunk of the sublingual artery seems to be suitable for intraoral anastomoses, especially in cases where large-caliber branches are present. To approach these vessels from enoral, a sagittal incision through the anterior oral mucosa is required. Care must be taken to ensure that the incision and subsequent dissection are not performed in the lateral area of the floor of the mouth in order to preserve the lingual nerve, the Warton duct, and the sublingual glandular tissue, as the main trunk of the sublingual artery courses in a mediocaudal location to these structures and parallel to the mandibular corpus in the area of the premolars. The genioglossus muscle serves as a guide structure for identifying the sublingual artery. In a clinical setting, Doppler ultrasound can also be used as a non-invasive test to detect blood flow in order to locate the sublingual artery even more accurately in the soft tissue of the genioglossus muscle. The vessel must be mobilized from the depths cranially to the mylohyoid muscle and cranioventrally to the hyoglossus muscle. Regardless of whether the sublingual artery originates from the facial artery or the lingual artery, according to the results of our samples, its main trunk is always located in the sublingual space (floor of the mouth).

Figure 5 illustrates the access procedure (Figure 5).

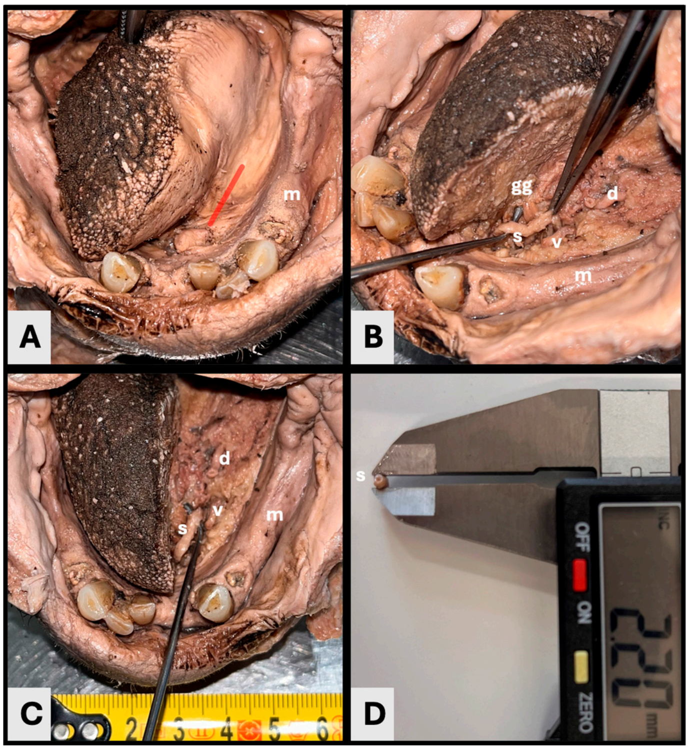

Figure 5. Access procedure: (**A**) shows the incision of the oral mucosa to access the anterior floor of the mouth (red line); particular care must be taken to ensure that the incision is not made further laterally to avoid injury to the lingual nerve, the Warton duct, and the sublingual glandular tissue; the incision should be approximately 2 cm in length and parallel to the mandibular corpus in the area of the premolars; the tongue (post-mortem black tongue discoloration) was retained. (**B**,**C**) show the mobilized main trunk of the sublingual artery in the sublingual space with the accompanying sublingual vein; the genioglossus muscle serves as a guide structure for the sublingual artery; the sublingual artery must be mobilized from the depths cranially to the mylohyoid muscle and cranioventrally to the hyoglossus muscle; in order to preserve the lingual nerve, the Warton duct and the sublingual gland, care must be taken not to reach the lateral aspect of the floor of the mouth during mobilization. The tongue was hemidissected to provide a better overview; hence, the dorsal root artery was also cut. (**D**) shows the sectioned lumen of the main trunk of the sublingual artery (caliper gauge: vessel diameter 2.2 mm). d: dorsal root artery (lingual artery); gg: genioglossus muscle; m: mandible; s: sublingual artery; v: accompanying sublingual vein.

4. Discussion

Surgical treatment in the head and neck area can result in extensive defects, compromising soft and hard tissue structures. Such interventions subsequently require sufficient reconstruction to enable patients' aesthetic and functional rehabilitation. Microvascular grafts such as the radial forehand flap or the osteocutaneous fibula graft can be used for this purpose. Both tension-free wound coverage and the sufficient anastomoses of the pedicle vessels to ensure flap survival are vital to the success of the treatment. These supply anastomoses are conventionally conducted via extraoral approaches using external carotid branches. However, this implies an invasive dissection of the neck, which leads to comorbidities and scarring. Several studies describe an alternative intraoral approach for cases in which neck dissection is not necessitated. The range of indications for the reconstruction of large wound defects includes benign neoplasms or jaw defects following traumatic injuries, as well as fibrous dysplasia and cleft palates [1–4,17,18]. This intraoral technique eliminates morbidities such as impairment of the external appearance or lesions of the facial nerve's marginal mandibular branch [5,6]. Furthermore, short pedicle flaps can be utilized without interpositional grafts [1,6]. Previous studies have shown similar success rates compared to extraoral techniques [1,5,6]. Kämmerer et al. reported total flap loss in 2 of 130 cases (1.5%) and Brandtner et al. in 1 of 70 cases (1.4%) [1,6]. In this study, with a high probability of occurrence, in the floor of the mouth, the main trunk and branches of the sublingual artery were identified as potential areas for intraoral anastomoses (diameter $\geq$ 0.9 mm in vitro and 1 mm in vivo). The decisive advantage of this recipient vessel over the facial artery is that, due to its different topographical course, injury to the parotid duct or the buccal nerve branches can be ruled out [6]. In addition, these sublingual vessels are easier to localize, as they do not run deep in the cheek like the facial artery and are not protected by fat tissue and muscles. Due to the topographical course beneath the oral mucosa, it could be predestined for reconstructive surgery in the mandibular region. Compared to the facial artery, this surgical access route is technically less difficult and not as restricted in terms of diameter size [6]. Most of the previous anatomical studies concerning the sublingual artery in detail were conducted on the Asian population [9–12,19]. In contrast, this study was carried out on a sample of the Central European population to provide results from a different ethnic group. More precisely, the specimens donated to the Division of Clinical and Functional Anatomy of the Medical University of Innsbruck constituted a representative sample of the Austrian population [15]. In this investigation, the definition of Shangkuan et al. was applied to classify the course of the lingual artery (the original segment, the segment within the hyoglossus, and the ascending segment) [10]. The fourth segment (the horizontal segments of the deep lingual artery) was not implemented because the intralingual section of the lingual artery was not part of the study's objectives. Shangkuan et al. provided a decent anatomical basis for tongue flaps, while we focused on the floor of the mouth to investigate a potential application for mandibular microvascular reconstruction [10]. Instead of ascertaining absolute measurements, we chose the technique using the stylet to determine the inner luminal diameters of the branches, as the surveyed specimens had no vascular pressure. According to Danesh-Meyer et al., the shrinkage of arteries from 8% to 10% arose mainly due to contraction caused by the loss of pressure rather than the embalming process with formalin [16]. This method, therefore, seemed to us to be the best way to acquire data closest to the condition of the arteries in vivo. Former publications showed different origins of the sublingual artery [9,12,20]. Loukas et al. found the sublingual artery to originate from the lingual artery in 73%, and from the submental artery in 23%, of their 100 examined cadaveric heads [20]. In the study of Masui et al., the sublingual artery originated from the lingual artery in 60%, from the facial artery near the origin of the submental artery in 12%, from the proximal portion of the submental artery in 5%, and from a distal portion of the submental artery in 19% of their 101 cases [12]. Nakajima at al. concluded that the probability of the sublingual artery arising from the facial or lingual artery is about the same after dissecting their 75 cadaveric heads [9]. This was confirmed in our samples, where the sublingual artery arose from the lingual artery in less than half of the cases. The different course of the sublingual artery may be of considerable anatomical significance, but clinically and functionally it is decisive, as the large-caliber main trunk and even peripheral large-caliber branches are present to supply the mucosa of the floor of the mouth. These branches do not necessarily originate from the sublingual artery. Supply patterns have been reported, suggesting that the submental artery (facial artery) may also extend into the sublingual space (by piercing the mylohyoid muscle) to release supply branches to the floor of the mouth when the sublingual artery is less prominently present [13,19]. Loukas et al. found mucosal branches with a mean diameter of 0.9 mm in the lateral incisor region in 72%, canine region in 62%, and first premolar region in 81% of the 100 cadaveric heads they examined [20]. Our already sufficiently described findings of the large-caliber branches of the sublingual artery, combined with the findings of Loukas at al. [20], are highly relevant from the clinical point of view, as they indicate that reliable pedicle branches of the sublingual artery occur at a remarkable percentage. The diameter cut-off was set at 0.9 mm in vitro (1 mm in vivo) in this investigation, because in our experience, microvascular anastomoses from this caliber on can be safely performed surgically, especially if the pedicle feeds more component flaps and/or larger flaps that require a high-volume perfusion. Calibers smaller than 1 mm were not calculated in this study. However, there are numerous studies in the literature that describe techniques for using smaller luminal diameters down to 0.3 mm [21–24]. When this is taken into account, our data must be interpreted differently, as the number of usable branches of the sublingual artery would then increase significantly.

The following limitations regarding this study should be mentioned. Measurements were performed manually and evaluated macroscopically with a tape measure, which may lead to slight unintentional deviations in the measurement process. However, this seems negligible, as the collected data only diverge in the low-micrometer range. As was already comprehensively described, we used the stylet to determine the calibers of the arteries and did not additionally survey the absolute measurements to avoid additional bias. In the cases where the main trunk of the sublingual artery had large-caliber branches, its diameter was considerably strong (several millimeters). Even though we have considered the shrinkage of the specimens' arteries (according to the literature [16]), there is most likely a slight difference between the in vitro study situation and an in vivo clinical setting. Future research should also focus on the venous recipient vessels, since the venous system was not addressed in this paper. The presence of reliable venous vessels with an adequate diameter is crucial for blood circulation and the survival of microvascular free-flap grafts. Their availability and that of the arterial supply is a basic prerequisite for clinical feasibility. Although a higher case number and a more balanced gender distribution would probably further validate the findings of this study, anatomical cadaver studies with similar case numbers can be found in the literature. This study provides the preliminary results of the sublingual artery.

5. Conclusions

The sublingual artery is equally likely to originate from the facial artery or the lingual artery. The presence of a prominent main trunk of the sublingual artery (diameter $\geq$ 0.9 mm in vitro or 1 mm in vivo) in the floor of the mouth in all samples indicates that this vessel could be considered an alternative pedicle for anastomoses in microvascular free-flap grafts. Due to the location of the main trunk of the sublingual artery, underneath the mucosa in the mandibular premolar region, the vessel appears to be surgically accessible without major limitations. This study provides an anatomical basis for the sublingual artery constituting a potential alternative for intraoral anastomosis. The next step in the investigation will be a project in a clinical setting to verify the results of this study.

Author Contributions: Conceptualization, V.S., R.S., J.W. and E.B.; methodology, V.S., R.S., J.W., S.M., J.M. and E.B.; software, V.S. and E.B.; validation, V.S., R.S., J.W., S.M., J.M. and E.B.; formal analysis, V.S. and E.B.; investigation, V.S., R.S., J.W., S.M., J.M. and E.B.; resources, E.B.; data curation, V.S.; writing—original draft preparation, V.S., J.W., E.B., S.M. and J.M.; writing—review and editing, V.S., R.S., J.W., S.M., J.M. and E.B.; visualization, V.S., S.M., E.B. and J.W.; supervision, V.S., R.S., J.W., S.M., J.M. and E.B.; project administration, E.B.; funding acquisition, E.B. All authors have read and agreed to the published version of the manuscript.

Funding: This work was supported by the Austrian Science Fund (FWF) KLI 1044 "enFaced2".

Institutional Review Board Statement: Not applicable (this article does not contain any studies with living human participants or animals performed by the authors.).

Informed Consent Statement: Written informed consent was obtained by the Institute for Clinical and Functional Anatomy Innsbruck (Medical University of Innsbruck) before death from all body donors included in the study [25,26].

Data Availability Statement: The data that support the findings of this study are available from the corresponding author upon reasonable request.

Acknowledgments: The authors sincerely thank those who donated their bodies to science so that anatomical research could be performed. Findings derived from such research endeavors have the potential to augment humanity's collective understanding, subsequently enhancing the quality of patient care. Therefore, these donors and their families deserve our highest gratitude.

Conflicts of Interest: The authors declare no conflicts of interest.

References

1. Brandtner, C.; Bürger, H.; Hachleitner, J.; Gaggl, A. The intraoral anastomosing technique in reconstructive surgery of the face–A consecutive case series of 70 patients. *J. Cranio-Maxillofac. Surg.* **2015**, *43*, 1763–1768. [CrossRef] [PubMed]
2. Gaggl, A.; Bürger, H.; Virnik, S.; Chiari, F. An intraoral anastomosing technique for microvascular bone flaps in alveolar ridge reconstruction: First clinical results. *Int. J. Oral Maxillofac. Surg.* **2009**, *38*, 921–927. [CrossRef] [PubMed]
3. Nkenke, E.; Agaimy, A.; von Wilmowsky, C.; Eitner, S. Mandibular reconstruction using intraoral microvascular anastomosis following removal of an ameloblastoma. *J. Oral Maxillofac. Surg.* **2013**, *71*, 1983–1992. [CrossRef] [PubMed]
4. Sun, J.; Li, J.; Lv, M.M.; Wang, L.; Gupta, A.; Shen, Y. Expanded Transoral Microvascular Mandibular Reconstruction: A Scar-Free Approach. *J. Oral Maxillofac. Surg.* **2022**, *80*, 1115–1126. [CrossRef] [PubMed]
5. Zhang, H.-Y.; Shao, Z.; Jia, J.; Liu, B.; Bu, L.-L. Analysis of intraoral microvascular anastomosis in maxillofacial defects reconstruction. *J. Cranio-Maxillofac. Surg.* **2023**, *51*, 31–43. [CrossRef] [PubMed]
6. Kämmerer, P.W.; Tavakoli, M.; Gaggl, A.; Maranzano, M. Intraoral Microvascular Anastomosis in Immediate Free Flap Reconstruction for Midfacial Tumor Defects: A Retrospective Multicenter Study. *J. Clin. Med.* **2023**, *12*, 7064. [CrossRef]
7. Lippert, H.; Pabst, R. *Arterial Variations in Man: Classification and Frequency*; Springer: Berlin/Heidelberg, Germany, 1985.
8. von Lanz, T.; Wachsmuth, W. *Praktische Anatomie: Ein Lehr-und Hilfsbuch der Anatomischen Grundlagen Ärztlichen Handelns*; Springer: Berlin/Heidelberg, Germany, 2013.
9. Nakajima, K.; Tagaya, A.; Otonari-Yamamoto, M.; Seki, K.; Araki, K.; Sano, T.; Okano, T.; Nakamura, M. Composition of the blood supply in the sublingual and submandibular spaces and its relationship to the lateral lingual foramen of the mandible. *Oral Surgery Oral Med. Oral Pathol. Oral Radiol.* **2014**, *117*, e32–e38. [CrossRef]
10. Shangkuan, H.; Xinghai, W.; Zengxing, W.; Shizhen, Z.; Shiying, J.; Yishi, C. Anatomic bases of tongue flaps. *Surg. Radiol. Anat.* **1998**, *20*, 83–88. [CrossRef]
11. Seki, S.; Sumida, K.; Yamashita, K.; Baba, O.; Kitamura, S. Gross anatomical classification of the courses of the human lingual artery. *Surg. Radiol. Anat.* **2017**, *39*, 195–203. [CrossRef]
12. Masui, T.; Seki, S.; Sumida, K.; Yamashita, K.; Kitamura, S. Gross anatomical classification of the courses of the human sublingual artery. *Anat. Sci. Int.* **2016**, *91*, 97–105. [CrossRef]
13. Bavitz, J.B.; Harn, S.D.; Homze, E.J. Arterial supply to the floor of the mouth and lingual gingiva. *Oral Surgery Oral Med. Oral Pathol. Oral Radiol.* **1994**, *77*, 232–235. [CrossRef] [PubMed]
14. Platzer, W.; Putz, R.; Poisel, S. Ein neues Konservierungs-und Aufbewahrungssystem für anatomisches Material. *Cells Tissues Organs* **1978**, *102*, 60–67. [CrossRef]
15. Konschake, M.; Brenner, E. "Mors auxilium vitae"—Causes of death of body donors in an Austrian anatomical department. *Ann. Anat.-Anat. Anz.* **2014**, *196*, 387–393. [CrossRef] [PubMed]
16. Danesh-Meyer, H.V.; Savino, P.J.; Bilyk, J.R.; Eagle, R.C.; Sergott, R.C. Shrinkage: Fact or fiction? *Arch. Ophthalmol.* **2001**, *119*, 1217.
17. Sosin, M.; Sinada, G.G.; Rodriguez, E.D.; Dorafshar, A.H. Intraoral microvascular anastomosis of an iliac free flap for maxillary fibrous dysplasia. *J. Oral Maxillofac. Surg.* **2015**, *73*, 2068.e1–2068.e5. [CrossRef]
18. Landes, C.; Cornea, P.; Teiler, A.; Ballon, A.; Sader, R. Intraoral anastomosis of a prelaminated radial forearm flap in reconstruction of a large persistent cleft palate. *Microsurgery* **2014**, *34*, 229–232. [CrossRef]
19. Katsumi, Y.; Tanaka, R.; Hayashi, T.; Koga, T.; Takagi, R.; Ohshima, H. Variation in arterial supply to the floor of the mouth and assessment of relative hemorrhage risk in implant surgery. *Clin. Oral Implant. Res.* **2013**, *24*, 434–440. [CrossRef]
20. Loukas, M.; Kinsella, C.R., Jr.; Kapos, T.; Tubbs, R.S.; Ramachandra, S. Anatomical variation in arterial supply of the mandible with special regard to implant placement. *Int. J. Oral Maxillofac. Surg.* **2008**, *37*, 367–371. [CrossRef]
21. Harii, K. Microvascular surgery in plastic surgery: Free-tissue transfer. *Microsurgery* **1979**, *1*, 223–230. [CrossRef]
22. Chang, D.W. Lymphaticovenular bypass for lymphedema management in breast cancer patients: A prospective study. *Plast. Reconstr. Surg.* **2010**, *126*, 752–758. [CrossRef]
23. Kim, J.S.; Choi, T.H.; Kim, N.G.; Lee, K.S.; Han, K.H.; Son, D.G.; Kim, J.H.; Lee, S.-I.; Kang, D. The replantation of an amputated tongue by supermicrosurgery. *J. Plast. Reconstr. Aesthetic Surg.* **2007**, *60*, 1152–1155. [CrossRef] [PubMed]
24. Liu, H.-L. Microvascular anastomosis of submillimeter vessels—A training model in rats. *J. Hand Microsurg.* **2013**, *5*, 14–17. [CrossRef] [PubMed]

25. Riederer, B.M.; Bolt, S.; Brenner, E.; Bueno-López, J.L.; Circulescu, A.R.; Davies, D.; Caro, R.D.; Gerrits, P.; McHanwell, S.; Pais, D. The legal and ethical framework governing body donation in Europe–1st update on current practice. *Eur. J. Anat.* **2012**, *16*, 1–21.
26. McHanwell, S.; Brenner, E.; Chirculescu, A.R.; Drukker, J.; van Mameren, H.; Mazzotti, G.; Pais, D.; Paulsen, F.; Plaisant, O.; Caillaud, M.M. The legal and ethical framework governing Body Donation in Europe-A review of current practice and recommendations for good practice. *Eur. J. Anat.* **2020**, *12*, 1–24.