

Development of "Core Syllabus" for Facial Anatomy Teaching to Aesthetic Physicians: A Delphi Consensus

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Background: A detailed understanding of facial anatomy, specifically the vascular framework, is crucial for delivering safe nonsurgical aesthetic procedures. To date, there is no core document based on consensus for the teaching of facial anatomy to aesthetic physicians exists. The aim of this study was to ascertain the most critical anatomical structures for avoiding disastrous complications during nonsurgical aesthetic procedures.

Methods: After a detailed literature review, Delphi questionnaire was developed listing 154 anatomical structures of the face and neck for consensus review. Thirty-five international experts in surgical and nonsurgical facial aesthetics were invited to complete an online survey designed to rank the relevance of each anatomical element on a Likert scale from 1 (not at all important) to 4 (very important) or 5 (no opinion). Consensus for items included in the core syllabus was predefined as achieving a Cronbach's $\alpha \ge 0.90$ and an agreement score of $\ge 80\%$.

Results: Thirty-four international experts (97.14%) completed the iterative online Delphi survey. The consensus among the specialists polled was achieved after 1 round of the survey (Cronbach's $\alpha = 0.94$). The expert panel reached an agreement score of $\geq 80\%$ on 137 of the 154 anatomical structures listed.

Conclusion: The outcome of this Delphi study represents an essential first step in systematizing an evidence-based facial anatomy "Core Syllabus" for the teaching of aesthetic physicians and practitioners. This "Core Syllabus" will act as a blueprint for the educators while crafting a program. (*Plast Reconstr Surg Glob Open 2018;6:e1687; doi: 10.1097/GOX.0000000000001687; Published online 6 March 2018.*)

INTRODUCTION

The Merriam-Webster dictionary notes that the word anatomy was first used in the 14th century and was defined as "the art of unraveling the parts of an organism to ascertain their position, relations, structure, and function."¹ The study of gross anatomy traditionally epitomizes a crucial stage in the training of prospective physicians. "The Anatomy Lesson," one of the first portraits by the young Rembrandt in the year 1632, displays assiduous scholars hovering over a corpse under the direction of a praelector

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Copyright © 2018 The Authors. Published by Wolters Kluwer Health, Inc. on behalf of The American Society of Plastic Surgeons. This is an open-access article distributed under the terms of the Creative Commons Attribution-Non Commercial-No Derivatives License 4.0 (CCBY-NC-ND), where it is permissible to download and share the work provided it is properly cited. The work cannot be changed in any way or used commercially without permission from the journal. DOI: 10.1097/GOX.00000000001687 or mentor (Dr. Nicolaes Tulp). This famous masterpiece bears witness to the significance of physicians obtaining a sound basis in the anatomical sciences.²

A thorough understanding of anatomy is a primary requisite for physicians to assess, diagnose, select appropriate treatment, and complete clinical procedures safely and more efficiently. For centuries, detailed appreciation of human anatomy has remained a cornerstone of the successful practice of medicine.³ More recently, the method of anatomy teaching in medical schools has undergone significant changes. This is no better exemplified than in the United Kingdom after the publication of the General Medical Council's Tomorrow's Doctors. The transformation has brought a range of pedagogic styles including problem-based, patient-centric, self-directed, and system-based teaching, delivered through small group classes or clinical sessions.⁴ Recent technological advances such as virtual reality, computer-aided learning, and multimedia resources integrated into the classic

Disclosure: The authors have no financial interest to declare in relation to the content of this article. The Article Processing Charge was paid for by Anglia Ruskin University, Chelmsford, United Kingdom. learning method of prosections have changed the entire perspective of anatomical teaching.

In the literature, many authors have expressed substantial concern about the decline of proper anatomy education and its consequences in undergraduate training.^{5,6} Applying anatomical expertise requires sequential learning, in which core knowledge developed during preclinical years is contextualized during the clinical years. Inevitably, there is a limited recall of the knowledge, which was gained by learning the 3-dimensional functional anatomy, even in a spiral curriculum where familiarity with anatomical structures is repeated several times during the course.7 This apparent inability to contextualize remote anatomical learnings has led to the questioning of the proficiency of newly graduated physicians. Recent surveys have shown that clinicians in both the United Kingdom and North America perceive modern anatomical education to be inadequate.^{8,9} A review article published in 2012 added credence by citing 32 cases of blindness as a result of inadvertent cosmetic filler or autologous fat vascular occlusion.¹⁰ In a more recent review article, 98 cases of blindness due to cosmetic injection therapy were identified, originating from different facial areas.¹¹

This fundamental lack of anatomical knowledge leads to significant concerns about the competency levels of many aesthetic practitioners and particularly the level of safety in clinical practice.^{5,8,12} Acknowledging that anatomical familiarity is paramount to safe and efficient clinical practice, the question remains as to "what ought to be taught."

There is an urgent need to integrate all the available anatomical nomenclature into a mandatory list of critical structural knowledge that is common to all nonsurgical facial aesthetics procedures. Furthermore, there is a lack of a single database to which course directors can refer to ensure that all the attendees have gained the critical knowledge necessary for safe clinical practice; nonpractical superficial memorization through textbooks is not sufficient.

To determine appropriate content for facial anatomy teaching and learning, the authors conducted a modified Delphi study to build consensus among aesthetic plastic surgeons and dermatologists with global recognition as experts in both the practicing and teaching of nonsurgical facial aesthetics. Author's objective was to ascertain the most significant anatomical landmarks and structures necessary to avoid disastrous complications during nonsurgical aesthetic procedures. The goal of the present study was to create a facial anatomy core document for postgraduate and continuing medical education in facial aesthetics.

METHODS

Study Design

The study was approved by the Ethics Committee, Faculty of Medical Sciences, Anglia Ruskin University, Chelmsford, United Kingdom. A modified Delphi methodology was used to build the consensus among the expert panel of aesthetic dermatology and plastic surgery educators. The Delphi method is a proven technique commonly used in medical education research for curriculum and competency development.^{13–15} The process attempts "to assess the extent of agreement (consensus measurement) and to resolve disagreement (consensus development)" where there is either a lack of scientific evidence or contradictory evidence on a particular topic.¹⁶ The Delphi method has been established as an effective approach to systematically collecting experts' opinions to achieve consensus on subjects without bias.¹³ Based on the assumption that "group opinion is considered more valid and reliable than individual belief,"¹⁷ the Delphi method was adopted as the methodological approach to achieve consensus regarding the importance of specific anatomical components of facial assessment and treatment through injection therapy.

Expert Panel

The members of the consensus group were selected based on their experience as global thought leaders in the field of nonsurgical facial aesthetics. This subjective selection was supported by their contribution to education and research through the medical/surgical journal and textbook publications and podium appearances at major aesthetic meetings. Every polled participant required affiliation to an aesthetic plastic surgery or dermatology society within the Americas, Asia, Australia, or Europe (Table 1). Members of the expert panel were invited from 12 countries averaging more than 20 years of experience to represent views from a wide geographical area (Fig. 1).

Questionnaire Development

A comprehensive list of vital anatomical structures was developed that was deemed applicable for carrying out nonsurgical aesthetic procedures. This list was prepared from multiple sources including the authors' extensive experience with surgical anatomy and detailed cadaver dissec-

Table 1. Geographical Distribution of Expert Panel

Country	Specialty	Invitation Sent	Response Received
Argentina	Plastic surgery	1	1
Australia	Plastic surgery	2	2
	Dermatologist	1	1
Belgium	Dermatologist	1	1
Brazil	Plastic surgery	1	1
	Dermatologist	1	1
Colombia	Plastic surgery	1	1
	Facial plastic surgery	1	1
Canada	Plastic surgery	6	6
	Dermatologist	1	1
France	Plastic surgery	1	1
	Facial plastic surgery	1	1
Germany	Dermatologist	2	2
India	Plastic surgery	2	1
	Dermatology	1	1
Italy	Plastic surgery	2	2
Korea	Plastic surgery	1	1
	Anatomist	1	1
Malaysia	Plastic surgery	1	1
Singapore	Plastic surgery	1	1
South Africa	Dermatology	1	1
United Kingdom	Facial plastic surgery	1	1
The United States of America	Plastic surgery	6	5



Fig. 1. Specialty wise distribution of expert panel.

tions, and an in-depth review of published literature and reference textbooks on facial anatomy.10,18-21 The survey questionnaire comprised 154 anatomical structures of the face and neck including topographical landmarks, neurovascular structures, mimetic muscles of facial expression, functional muscles of mastication, superficial and deep fat compartments, true osteocutaneous and false ligaments, fascial planes, and defined anatomical spaces. The online questionnaire was developed using a web-based survey tool (www.surveymonkey.net), and contributors received an email invitation to participate. Panel members were asked to rate the relevance of each of the 154 facial anatomical structures for nonsurgical facial aesthetics on a 5-point Likerttype Scale (1 = Not at all Important; 2 = Slightly Important; 3 = Fairly Important; 4 = Very Important; 5 = No Opinion). The consensus participants were able to provide comments, suggestions, and expand on their reasons for selecting lowlevel importance ("not at all important"; Table 2).

Determination of Consensus

Delphi method does not have a set rule as to the number of rounds of questionnaires provided; however, 2 or 3 rounds are commonly in practice.²² Internal consistency or the homogeneity of the opinion among group members was defined as consensus. Cronbach's alpha analysis is 1 of the statistical indices commonly used to determine the reliability at the end of each round. In the statistical literature, an alpha of 0.70 or higher is required to be satisfactory for educational research purposes, whereas for direct clinical applications, it is suggested to obtain a minimum alpha of 0.90.²³ For consensus-seeking methodologies, an agreement score of $\geq 80\%$ is considered a significant achievement.²⁴ Therefore, for this study, an agreement score of $\geq 80\%$ and Cronbach's $\alpha \geq 0.90$ was set to represent consensus. Initial survey items that lacked consensus were modified based

on the comments from the responders and resubmitted in round 2 for secondary alpha analysis.

Data Collection

Delphi Round 1

The first round of Delphi process triggered with 146 anatomical structures of the face and neck aimed for each panel member to select the critical structures for nonsurgical facial aesthetic procedures. The experts were given the option of the free text box where they could propose additional items.

Delphi Round 2

Items from the first round that were selected by \geq 80% (consensus) of the experts were essential anatomical structures and were not presented in round 2 for further review. Items with less than 50% consensus were also excluded from round 2. Consequently, only items with an agreement level of 50–79% in the first round were presented to the participants for consensus in round 2. Furthermore, 8 new items proposed by respondents in round 1 were also submitted for the consensus.

RESULTS

The overall response rate was 97.22% (n = 35 of 36) in the first round and 71.4% (n = 25 of 35) in the second round. In the second round, all the comments and suggestions from the panel members were included. The expert panel reached consensus ($\geq 80\%$) on 137 anatomical structures of 154 as critical knowledge for the safe and efficient practice of nonsurgical facial aesthetics. Cronbach's alpha for the Delphi process was 0.94, which showed a high level of internal consistency and reliability.

A summary of the final consensus organized by anatomical theme is as follows:

Anatomical Layers of the Face

Of the 14 anatomical layers of the face and neck included in the Delphi process, there was complete consensus ($\geq 83\%$) among the experts that 12 structures were "Very Important" for the inclusion in the core syllabus: mimetic muscles, muscles of mastication (temporalis, masseter, pterygoid), subcutaneous and deep fat layers, true retaining ligaments (osteocutaneous retaining ligaments), anatomical spaces (Ristow's space, prezygomatic, premaxillary), periosteum (bone), superficial musculoaponeurotic system (Table 3). However, there was no consensus ($\leq 71\%$) on the inclusion of false ligaments (fascia-cutaneous ligaments) and skin histology and thickness.

Topographical Landmarks

Of the 13 topographical landmarks of the face and neck included in the Delphi process, there was complete consensus ($\geq 89\%$) to include them all in the core syllabus: tem-

Table 2. Example of the Questionnaire (1 = Not at all Important; 2 = Slightly Important; 3 = Fairly Important; 4 = Very Important; 5 = No Opinion)

Anatomical Structure	Not at all Important	Slightly Important	Fairly Important	Very Important	No Opinion
Facial artery					

Table 3. Summary of consensus of inclusion to Core Syllabus of anatomical layers, topographical landmarks, fold, crease, and grooves of face and neck per Delphi Method Survey identified as "Very Important" by \ge 80% of experts.

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Submental fat compariments94YesSubmental fat pad (pre/postplatysmal)94YesRetroorbicularis oculi fat89YesSubmorticularis oculi fat compartment89YesMedial, middle, lateral temporal-cheek fat86Yescompartment "malar"7070Deep medial cheek fat86YesSuperior and inferior jowl fat compartment85YesCervical fat compartment85YesNasolabial fat compartments83YesFat compartments83YesBuccal fat83YesFat compartment of upper and lower lip80YesThe central, middle, lateral fat69Nocompartment in the forehead70NoMedial and lateral corrugator fat63Nocompartment63NoSuscles100YesFrontalis100YesGlabellar complex (corrugator supercilii, 100Yesdepressor labii inferioris2Zygomaticus major, minor, levator labii100YesMasseter and risorius100Aleque nasi97Mentalis and platysma100YesYesCarporalis, temporoparietalis muscle91YesYesMasseter and risorius91YesYesYesYesYesYesSuperioris, levator labii superioris91YesYesYesYesYes <td>Fat compartments</td> <td>04</td> <td>Voc</td>	Fat compartments	04	Voc
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Temporalis, temporoparietalis muscle91YesNasalis, dialator naris, depressor septi muscle86YesMalaris muscle51No	Orbicularis oculi	97	Yes
Nasalis, dialator naris, depressor septi muscle 86 Yes Malaris muscle 51 No	Temporalis, temporoparietalis muscle	91	Yes
Malaris muscle 51 No	Nasalis, dialator naris, depressor septi muscle	86	Yes
	Malaris muscle	51	No

poral crest, orbital rim, inferior maxillary border, pyriform fossa, gonial angle, middle and lateral border of the iris, foramina (infraorbital, supraorbital, supratrochlear, zygomaticofacial, mental), and anterior border of the masseter.

Facial Grooves, Creases, and Folds

Of the 9 facial grooves, creases and folds of the face and neck included in the Delphi process, there was complete consensus ($\geq 89\%$) to include 7 of them in the core syllabus: nasolabial fold, supra-tarsal fold, nasojugal groove, medial corrugator crease, labio-mental crease, forehead lid crease, and alar crease. There was no consensus ($\leq 66\%$) on preauricular and neck crease. One of the experts emphasized the importance of the folds and creases as landmarks for the underlying neuro-vasculature.

Fat Compartments

Of the 23 facial fat compartments of the face and neck included in the Delphi process, there was complete consensus ($\geq 86\%$) to include 20 of them in the core syllabus: orbital (infra, superior, inferior, lateral), temporal cheek (medial, middle, lateral), nasolabial, retro-orbicularis oculi fat, sub-orbicularis oculi fat, deep medial cheek, buccal, upper and lower lip, chin, superior and inferior jowl, submental (pre/postplatysmal) fat compartments. There was no consensus ($\leq 69\%$) on the inclusion of forehead (central, middle, lateral), corrugator (medial, lateral), and periauricular fat compartments in the core syllabus. One of the experts commented that trainees should be required to distinguish the differences in function and morphology of the static (deep) versus the dynamic (superficial) fat pads and the importance of treating a particular fat compartment for a specific indication.

Muscles

Of the 22 muscles (mimetic and mastication) of the face and neck included in the Delphi process, there was complete consensus (\geq 89%) to include 21 of them in the core syllabus: frontalis, corrugator supercilii, depressor supercilii, procerus, orbicularis oculi, zygomaticus major, zygomaticus minor, levator labii superioris, levator labii superioris alaeque nasi, nasalis, dilator naris, depressor septi nasi, orbicularis oris, risorius, depressor anguli oris, depressor labii inferioris, mentalis, platysma, temporalis, temporoparietalis, and masseter. There was no consensus (\leq 51%) on the malaris muscle.

Vasculature and Innervation

Forehead Anatomy

All 9 anatomical structures of the forehead included in the Delphi process achieved complete consensus ($\geq 82\%$) as "critical" structures in the core syllabus (Table 4). These included the supraorbital and supratrochlear foramina, vessels, and nerves; the deep branch of supraorbital nerve and its associated artery; the central forehead artery; and the galea aponeurotica.

Temple Anatomy

Of the 12 anatomical structures of the temple region included in the Delphi process, there was complete con-

Table 4. A Summary of consensus of inclusion to Core Syllabus of aesthetic zones of face and neck per Delphi Method Survey identi ed as "Very Important" by \geq 80% of experts.

Forehead anatomySupratrochlear artery and vein100YesYesSupraorbital artery, vein100YesYesSupraorbital nerve and its deep branch88YesYesCentral forehead artery82YesYesSuperficial temporal artery/vein100YesYesSuperficial temporal fascia100YesYesAnterior and posterior deep temporal94YesYesAnterior and posterior deep temporal94YesYesMiddle temporal vein82YesYesMiddle temporal onerve65NoNoAuriculotemporal nerve65Orbital septum100YesOrbital septum100YesArcus marginalis85YesLateral canthal tendon76Nose anatomy77Angular artery100YesAngular artery100YesAngular artery100YesAngular artery100YesAngular artery100YesNasal bone, septal cartilage, alar95YesIntercanthal artery and vein85YesIntercanthal artery and vein85YesIntercanthal artery97YesNasal valves (internal and external)71NoMasel hone, septal cartilag	Anatomical Structure	Level of Agreement (%)	Consensus
Supratrochlear artery and vein 100 Yes Supratrochlear artery and vein 100 Yes Galea 91 Yes Supratrochlear artery, vein 100 Yes Central forehead artery 85 Yes Supartical temporal artery/vein 100 Yes General facia (superficial and 100 Yes deep layers) 100 Yes deep layers) 100 Yes Superficial temporal fascia (superficial and 100 Yes deep layers) 100 Yes Anterior and posterior deep temporal 94 Yes arteries 74 Frontal branch of the 7th nerve 94 Yes Sentinel vein 82 Yes Middle temporal nerve 76 No Auriculotemporal nerve 76 No Auriculotemporal nerve 76 No Priorbital anatomy 97 Yes Orbital septum 100 Yes Lateral canthal tendon 76 No Nose anatomy 97 Yes Lateral anasi artery 97 Yes Artery 100 Yes Columellar branches of superior labial 100 Yes artery 97 Yes Nasal bone, septal cartilage, alar 95 Yes cartilage, upper lateral cartilage, anterior nasal spine 88 Yes Intercanthal artery 97 Yes Nasal valves (internal and external) 71 No Mid and lower face anatomy Facial artery 100 Yes Middle alar compartment 79 No Nasal valves (internal and external) 71 No Mid and lower face anatomy Facial artery 100 Yes Columellayes (internal and external) 71 No Mid and lower face anatomy Facial artery 94 Yes Masseteric cutaneous ligament 81 Yes Lip anatomy Superior and inferior labial artery 100 Yes Columental arteries (horizontal and 91 Yes Yes Nork anatomy Marginal mandibular nerve 97 Yes Marginal mandibular nerve 97 Yes Marginal mandibular nerve 97 Yes Marginal mandibular nerve 97 Yes Manginal mandibular spands 94 Yes Submantibular ligament	Forehead anatomy		
Supraorbital artery, vein100YesGalea91YesSupraorbital nerve and its deep branch88YesSupratrochlear nerve82YesSupratrochlear nerve82YesTemple anatomy100YesSuperficial temporal artery/vein100YesDeep temporal fascia100YesAnterior and posterior deep temporal94Yesarteries100YesFrontal branch of the 7th nerve94YesSentinel vein82YesMiddle temporal nerve76NoAuriculotemporal nerve65NoPeriorbital anatomy97YesOrbital septum100YesTear trough ligament, and it's anatomy97YesArcus marginalis85YesAuterior antasal artery100YesArtery100Yesartery100YesArtery100Yesartery100YesArtery100YesArtery100YesArtery100YesArtery100YesArtery100YesArtery100YesArtery100YesArtery100YesArtery100YesArtery100YesArtery100YesNasal bone, septal cartilage, alar95YesYesMiddle alar com	Supratrochlear artery and vein	100	Yes
Galea91YesSupraorbital nerve and its deep branch88YesCentral forchead artery82YesSupratrochlear nerve82YesSuperficial temporal artery/vein100YesDeep temporal fascia (superficial and100Yesdeep layers)Superficial temporal fascia100YesSuperficial temporal fascia100YesAnterior and posterior deep temporal94YesSentinel vein82YesKygomaticotemporal vein82YesZygomaticotemporal nerve65NoPeriorbital anatomy00YesOrbital septum100YesArcus marginalis85YesArcus marginalis85YesColumellar branch of superior labial100YesArcus marginalis85YesArtery100YesArcus marginalis85YesColumellar branches of superior labial100YesAngular artery100YesColumellar branches of superior labial100YesArtery97YesNasal bone, septal cartilage, alar95YesCartilage, upper lateral cartilage, anterior nasal spineYesSupratip arterial plexus88YesPhiltral artery100YesPasal valves (internal and external)71NoMiddle alar compartment79NoNasal valves (internal and external)71 <td>Supraorbital artery, vein</td> <td>100</td> <td>Yes</td>	Supraorbital artery, vein	100	Yes
Supraorbital nerve and its deep branch88YesCentral forehead artery85YesSupartical temporal artery/vein100YesSuperficial temporal fascia (superficial and100YesDeep temporal fascia (superficial and100YesSuperficial temporal fascia100Yesarteries94YesFrontal branch of the 7th nerve94YesMiddle temporal vein82YesMiddle temporal nerve76NoAuriculotemporal nerve76NoPeriorbital anatomy97YesOrbital septum100YesTear trough ligament, and it's anatomy97YesOrbicularis retaining ligament97YesArcus marginalis85YesLateral canthal tendon76NoNose anatomy100YesLateral canthal tendon76NoNasal bone, septal cartilage, alar95Yescartilage, upper lateral cartilage, alar95YesSupartip arterial plexus88YesIntercanthal artery and vein85YesMiddle alar compartment79NoMid and lower face anatomy71NoMid and lower face anatomy72NoSupartip arterial plexus88YesIntercanthal artery and vein85YesPhiltral arteries85YesProvid gland and Stensen's duct91YesVergomatic ligament<	Galea	91	Yes
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Supratrochlear nerve82YesTemple anatomySuperficial temporal fascia (superficial and 100YesDeep temporal fascia (superficial and 100YesAnterior and posterior deep temporal94YesSuperficial temporal fascia100YesAnterior and posterior deep temporal94YesSuperficial temporal fascia100YesSentinel vein82YesYesMiddle temporal vein82VesYesMiddle temporal nerve76NoAuriculotemporal nerveOrbital septum100YesCarticularis retaining ligament97YesArcus marginalis85YesLateral canthal tendon76Nose anatomyAngular artery100YesColumellar branches of superior labial100YesColumellar branches of superior labial100YesCartilage, upper lateral cartilage, alar95YesMid and lower face anatomyFacial artery97Nosal valves (internal and external)71NoNasal valves (internal ant external)71Nasal valves (internal ant external)71NoMid all carlo onpartment79YesYasal borior, curred and fill artery90YesYesYes intercantal arteries (borizontal and91YesYes indical artery90	Central forehead artery	85	Yes
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Superitical temporal fascia (superficial and deep layers)100YesSuperficial temporal fascia100YesAnterior and posterior deep temporal94Yesarteries94YesFrontal branch of the 7th nerve94YesSentinel vein82YesZygomaticotemporal nerve76NoAuriculotemporal nerve65NoOrbital septum100YesTear trough ligament, and it's anatomy97YesOrbital anatomy97YesOrbital artery100YesLateral canthal tendon76NoNose anatomy76NoAngular artery100YesColumellar branches of superior labial100YesColumellar branches of superior labial100YesAngular artery97YesNasal bone, septal cartilage, alar95YesNasal bone, septal cartilage, alar95YesMiddle alar compartment79NoNasal valves (internal and external)71NoMidd and lower face anatomy88YesFacial artery94YesParotid gland and Stensen's duct91YesAvasteric cutaneous junction, top, wettil, junction, tubercleGental stensen's ductMiddle alar compartment81YesMasseteric cutaneous junction, column, vermillion-cutaneous junction, G-K point,* wet-dry junction, tubercleYesModiolus100Yes <td>Superficient and and anterny (using</td> <td>100</td> <td>Vaa</td>	Superficient and and anterny (using	100	Vaa
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Anterior and posterior deep temporal94YesarteriesFrontal branch of the 7th nerve94YesFrontal branch of the 7th nerve94YesSentinel vein82YesZygomaticotemporal nerve76NoAuriculotemporal nerve65NoPeriorbital anatomy100YesOrbital septum100YesTear trough ligament, and it's anatomy97YesOrbicularis retaining ligament97YesArcus marginalis85YesLateral canthal tendon76NoNose anatomy100YesAngular artery100YesLateral nasal artery100YesDorsal nasal artery97YesDorsal nasal artery97Yesnaterior nasal spineSupratip arterial plexus88Supratip arterial plexus88YesIntercanthal artery and vein85YesMiddle alar compartment79NoMid and lower face anatomy94YesFacial artery100YesTransverse facial artery94YesUperior and inferior labial artery100YesZygomatic ligament81YesLip anatomy100YesGraid artery94YesSuperior and inferior labial artery100YesCardia artery100YesTransverse facial artery94YesUp anatomy100 <td< td=""><td>Superficial temporal fascia</td><td>100</td><td>Yes</td></td<>	Superficial temporal fascia	100	Yes
Frontal branch of the 7th nerve94YesSentinel vein82YesMiddle temporal vein82YesZygomaticotemporal nerve76NoAuriculotemporal nerve76NoPeriorbital anatomy00YesTear trough ligament, and it's anatomy97YesOrbicularis retaining ligament97YesArcus marginalis85YesLateral canthal tendon76NoNose anatomy100YesAngular artery100YesColumellar branches of superior labial100Yesartery00YesDorsal nasal artery97YesNasal bone, septal cartilage, alar95Yescartilage, upper lateral cartilage, anterior nasal spine88YesSupratip arterial plexus88YesPhiltral arteries85YesMiddle alar compartment79NoMid and lower face anatomy71NoMid and lower face anatomy71NoFacial artery94YesParotid gland and Stensen's duct91YesParotid gland and Stensen's duct91YesColumn, vermillion-cutaneous junction, G-K point,* wetdry junction, tubercleModiolusModiolus100YesCentral branch of submental artery90YesSubmental arteries and nerve94YesSubmental arteries (horizontal and91YesVertical) <td< td=""><td>Anterior and posterior deep temporal arteries</td><td>94</td><td>Yes</td></td<>	Anterior and posterior deep temporal arteries	94	Yes
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Digastric muscle and anterior/external 70 No jugular vein	nyoid done Thyroid gland	/0 76	INO No
jugular vein	Thyrold gland Digastric muscle and anterior /external	70 71	INO No
	jugular vein	/1	INO

*Glogau-Klein point

sensus ($\geq 82\%$) to include 10 of them in the core syllabus: superficial temporal artery and vein, anterior and posterior deep temporal arteries, middle temporal vein, sentinel vein, temporal branch of the facial nerve, superficial temporal fascia, both layers of the deep temporal fascia, the interposed extension of the buccal fat pad, and the temporal bone and pterion. There was no consensus on the inclusion of the zygomaticotemporal and auriculotemporal nerves ($\leq 76\%$).

Periorbital Anatomy

Of the 5 anatomical structure of the periorbital region included in the Delphi process, there was a complete consensus ($\geq 85\%$) to include 4 of them in the core syllabus: orbital septum, tear trough ligament, lid cheek junction, orbicularis retaining ligament, and arcus marginalis. There was no consensus ($\leq 76\%$) on the inclusion of the medial and lateral canthal tendons.

Nose Anatomy

Of the 16 anatomical nasal structures included in the Delphi process, there was complete consensus ($\geq 85\%$) to include 13 of them in the core syllabus: angular arteries, dorsal nasal arteries, lateral nasal arteries, columellar branches of the superior labial artery, intercanthal artery and vein, supratip arterial plexus, philtral arteries, nasal bone, septal cartilage, lower lateral cartilages, upper lateral cartilages, medial crura, and anterior nasal spine. There was an inadequate consensus ($\leq 71\%$) regarding the middle alar compartments and the internal and external nasal valves.

Mid and Lower Face Anatomy

There was complete consensus to include the facial artery (100%), the transverse facial artery (94%), the parotid gland, Stensen's duct (91%), and the masseteric ligament (81%) into the core syllabus.

Lip Anatomy

All 11 anatomical structures of the lip included in the Delphi process obtained complete consensus ($\geq 90\%$) for inclusion in the core syllabus: modiolus, oral commissure, cupid's bow and peaks, philtral columns, vermillion-cutaneous junction, Glogau-Klein point (G-K point), wet-dry junction, tubercle of the upper lip, superior labial artery, inferior labial artery, and teeth position/dental occlusion.

Chin Anatomy

All 5 anatomical structures of the chin included in the Delphi process achieved complete consensus for inclusion in the core syllabus: mental foramen, mental artery, submental (horizontal and vertical) arteries, and the central branch of the submental artery.

Neck Anatomy

Of the 8 anatomical structures of the neck included in the Delphi process, there was complete consensus to include 4 of them into the core syllabus: marginal mandibular nerve, submandibular glands, mandibular ligament, and cervical fat compartment. The experts polled did not achieve consensus to include the thyroid gland, hyoid bone, digastric muscles, and anterior/external jugular vein in the syllabus. One of the expert commented that for the treatment of submental fat pad, it is essential to know the position of the hyoid bone and thyroid gland.

Concerning the best approach for organizing the anatomy instructions, no consensus was achieved. Nonetheless, most experts polled preferred to structure the anatomy per aesthetic zones with exploration from superficial to deep.

DISCUSSION

This is the first reported global consensus to develop a "Core Syllabus" for teaching facial anatomy to aesthetic practitioners. Rising demand for minimally invasive facial aesthetic treatments such as botulinum toxin and dermal fillers has renewed interest in the detailed understanding of facial anatomy.25,26 A recent global consensus on avoiding complications related to injectable aesthetic procedures has emphasized the understanding of detailed facial anatomy.²⁷ A systematic and structured approach to anatomy teaching to aesthetic physicians is self-evident, as most of the present teaching is occurring outside of formal medical school systems. A lack of guidance in anatomical topic selection for prospective aesthetic specialists has led to a significant disparity in curricula among postgraduate continuing medical education initiatives. In this study, the authors aimed to define a list of essential content for a basic core syllabus.

The modified Delphi method using an online questionnaire has several advantages. It gives the flexibility of recruiting participants across vast geographical locations, and the anonymous construct provides an unbridled opportunity for all the panel members to express their opinion. The Cronbach alpha value of ≥ 0.90 obtained in this study indicates that there were enough members in the polled group to achieve consensus without significant controversy. This lack of divergence can be attributed to the authors' efforts to include only those anatomical elements that were selected based on genuine evidence.

As the number of the facial aesthetic courses are on the rise across the globe, there is an emergent need to standardize the content of the curriculum to facilitate uniformity in learning experience and activities. Hence, the result of this study can be adopted by the educators as a blue print while road mapping the learning objectives to craft a program. This will in turn help learners to have a comparable learning experience and will help educators to systematically identify the effectiveness or further improvement.

LIMITATIONS

The authors recognize the limitation of the study's design in that the geographical distribution of the specialities was not equal, and a high proportion of the group members polled were aesthetic plastic surgeons from North America, thereby introducing a perspective bias. Although basic human anatomy is similar in humans, cultural, racial, and ethnic preferences for aesthetic enhancement portend an experiential shift in plastic surgical practices, which could influence the ranking of essential facial anatomical landmarks. Future studies can address this issue by surveying the aesthetic physicians and dermatologists individually using the Delphi method and then pooling the result.

CONCLUSIONS

The outcome of this study has produced a consensus on 137 facial anatomical structures that are the core knowledge necessary for "safer" injection therapy. It represents an essential first step in systematizing a postgraduate evidence-based facial anatomy curriculum directed at aesthetic physicians and practitioners.

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