"Medically necessary" orthodontic care: Challenges and applications

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Medicine targets health in issues of saving life and improving quality of life. Most orthodontic procedures deal with the latter goal. Medical necessity is presented within the scope of pediatric orthodontics, stratified in medically guided treatment, when orthodontic procedures contribute to the correction of a systemic problem, whether or not associated with a local orofacial problem (respiration and sleep disorders, emotional problems, and hospital calls); and orofacial-guided treatment, when addressing growth matters, craniofacial anomalies, and orofacial functions (mastication, understandable speech, and temporomandibular pain). Medical necessity that may involve the care of the orthodontist alone or in a medical team, also brings up the issue of separation between dentistry and medicine, at educational and various operational levels, posing a challenge regarding their integration in the context of health being indivisible. (Semin Orthod 2016; 22:167–176.) © *2016 Elsevier Inc. All rights reserved.*

"Medically necessary orthodontic care is defined as the treatment of a malocclusion (including craniofacial abnormalities/anomalies) that compromises the patient's physical, emotional, or dental health. This treatment should be based on a comprehensive assessment and diagnosis done by an orthodontist, in consultation with other health care providers when indicated". 2014 House of Delegates; American Association of Orthodontists (AAO)

This statement may be viewed from two perspectives. First, the association of "medically necessary" with insurance coverage would exclude from this description procedures unrelated to critical health improvement, albeit possibly augmenting well-being and self-image, such as cosmetic procedures. In this context, orthodontics may possess less procedures that are medically necessary than other dental specialties.

At another level, the AAO statement camouflages the fact that medicine and dentistry are separate, from education through even public perception, prompting the question: is the line between a headache, even mild, but life-disrupting and a toothache, whether mild or debilitating, real or artificial? Health is indivisible—a "self-evident" truth. If medicine seeks health, oral health is a component of total health. The immediate implication is that they must be integrated.

Part 1 of this article relates the level of integration, if only to provide an intellectual framework for what increasingly seems as an artificial rather than convenient separation. Part 2 groups under the umbrella of pediatric orthodontics the commonly recognized "medically necessary" orthodontic treatments, which actually presume a continuum of dental and medical entities.

Medicine and dentistry: One and separate?

The schism likely stems from ensconced history and entrenched stakeholders, thus must be considered regarding dentistry in general from a historical depth, and regarding orthodontics

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specifically within the frame of the discipline itself. Integration, when approached, may be cast in various scenarios.

Historical issues and the prevalence of morphological outcome

Is orthodontic treatment compatible with medical necessity? To answer this question, one must consider the urgency of the medical conditions, defined in relation to sustenance of life (life and death issues), or quality of life. By and large, dentistry, and particularly orthodontics, pertains to quality of life. This relationship may have maintained the dental profession set apart from the rest of medicine, notwithstanding the historical rooting of tooth extraction. Avulsion was the most common solution to toothache, within the repertoire of the barber-surgeon, who performed "surgical" procedures including the removal of damaged diseased teeth, bloodletting, and even amputating limbs badly injured in war.[1]

In this sense, countless medical procedures, if not their majority, are not life-threatening and may be classified under maintenance or improvement of quality of life. Nevertheless, dealing with pain moves dentistry to center stage medicine, if only witnessed by the fact that tooth pain (usually following extraction of third molars) has served for long as a research model to test the efficacy of pain medication.[2]

The seminal description of "normal" orthodontic outcome in orthodontics as a morphological interdigitation between maxillary and mandibular teeth, the universal Class I or neutroclusion, seemingly undermines the alignment of orthodontics with medicine, or even true science.[3] The "science of occlusion" has been labeled "pseudoscience," like astrology, because it has been driven more technologically than biologically or physiologically.[3,4] It is probably this conceptualization that places the orthodontist on the "medical defensive."

Rather than barricade (or resign) themselves in such an arena, dentists and orthodontists can adopt a dual approach—assert their role as medical care providers, and educate physicians and patients about their important role in the indivisible health care chain. The former panel relates to professional and personal self-image and is not within the scope of this article. The latter panel is developed in Part 2 of this article, focusing on pediatric orthodontics.

The challenge of a paradigm shift to medical integration: Targeting health

Despite the burden of history, the separation between medicine and dentistry is not an issue of educational disparity or professional equality. It is inherently a matter of definition: the unity of health, and health care. Should dentists and physicians engage in the question of integration, they would soon realize that from conceptual and scientific outlooks, present boundaries seem artificial, and thus integration may not follow only one mold.

Dentofacial sciences could indeed belong to an independent department within the medical school, but other alternatives could be viable, such as oral medicine being part of internal medicine, oral surgery and periodontics grouped in a division within the department of Surgery, pediatric dentistry in the department of Pediatric and Adolescent Medicine, and orthodontics as a division in Otolaryngology/Head and Neck Surgery, and possibly in Plastic Surgery or Pediatrics. The department of Dentistry, per se, might include restorative/reconstructive dentistry and endodontics. "Oral biological" sciences would also be grouped under a copyrighted umbrella or merged within the respective medical basic sciences pedigrees.

In the educational process, it would be conceivable for students of medicine to rotate in the "dental" department, as they would in other "medical" departments, then choose to specialize in general dentistry through a corresponding residency, or any other current "dental" discipline. In such a scheme, the "generic medical" student may fulfill an ambition of specializing in periodontics or oral surgery. The latter discipline has already moved toward integration within medicine at various universities where a medical degree is required after dental school for maxillofacial surgery training. Organized dentistry shall remain in its present independent status, much like various medical specialties organize within their respective specialty or subspecialty.

The current of integration may be difficult to resist at some future point, particularly when developments in genetic science force deeper the roots of amalgamation or make it inevitable.

More importantly, within such boundary-less integration, would the definition of "medically necessary" dental treatment differ in nature or in scope?

Pediatric orthodontics

Adhering to the AAO definition would be practical to discern medical necessity in orthodontics. The following two key components emerge from the definition: (1) malocclusion compromising physical, emotional or dental health and (2) treatment by the orthodontist alone or with other providers when indicated. Health issues are approached in this section as they relate to the target of treatment being medically, or orofacially guided.

Medically guided treatment

This section involves the application of orthodontic procedures to heal or help correct a systemic problem, whether related or unrelated to a local orofacial problem.

Respiration and sleep disorders

Mouth breathing and respiration-related disorders have consequences on health and craniofacial morphology. Breathing problems range from snoring (3–12%) to obstructive sleep apnea (OSA = 1–10%).[5] However, an insidious silent form of mouth breathing exists that has not been accounted for in epidemiologic studies, when the child sleeps with the lips apart without snoring noises of various degrees. Excluding a category of habitual mouth breathing with adequate nasal patency, enforced mouth breathing develops through nasal resistance or obstruction, which can occur in the anterior (maxillary) airway, in the posterior (pharyngeal) airway, or both. The maxillary section is more prone to obstruction, because it offers greater resistance in the nasal airway that can be raised by conditions affecting hard tissues (e.g., deviated septum; turbinate irregularities; congenital, traumatic, or therapeutic asymmetries of the nasal cavity) and soft tissues (e.g., catarrhal and allergic rhinitis, nasal polyps).[6]

The association between hypertrophied adenoids and tonsils and facial morphology is well documented, represented in the nearly synergetic relationship between airway clearance and the inclinations of palatal and mandibular planes in mouth breathing children. The effects of decreased airway clearance on facial morphology follow a sequential process, starting in structures closest to the obstruction, namely inferior–posterior tip of the maxilla; in turn, the mandibular plane rotates backward.[7] However, individual response is such that various malocclusions may develop, including Class II, open bite, anterior crossbite, and maxillary arch constriction. The more severe effects may reflect more medical necessity than others (Fig. 1).

OSA often results from adenotonsillar hypertrophy, neuromuscular disease, and craniofacial

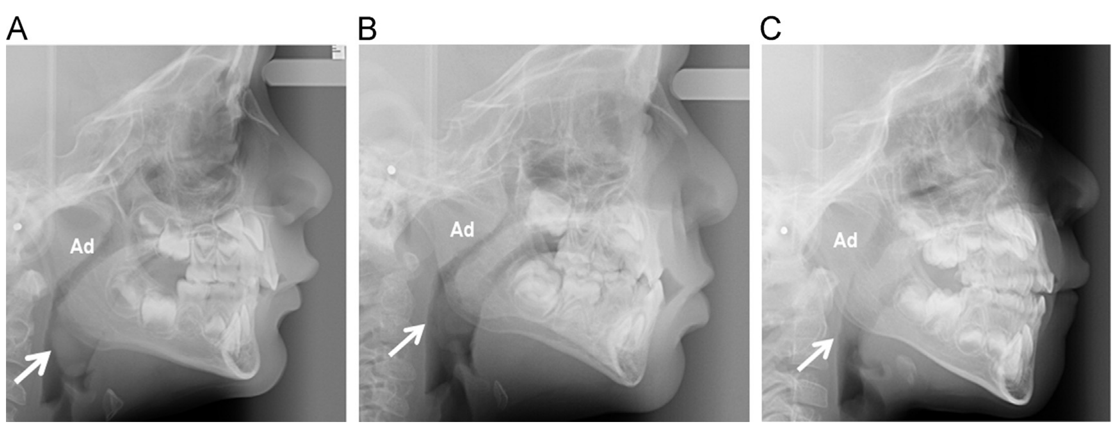

Figure 1. Cephalograms of three children (less than 6 years old) with chronic mouth breathing and nearly total airway obstruction by enlarged adenoids (Ad) and tonsils (arrows). Different malocclusions may result from mouth breathing: Class II, division 1 (A), Class III (B), and open bite (C). Whereas similar medical conditions of impaired breathing existed, the definition of medically necessary orthodontic care may differ based on the severity of dysmorphologic features.

abnormalities. The majority of children with OSA have mild symptoms, and many outgrow the condition.[5] OSA can lead to serious clinical consequences such as failure to thrive, behavior problems, enuresis, and corp ulmonale. Sustained mouth breathing with or without OSA can result in some or all characteristics of the long-face syndrome.

Treatment ideally should address the etiology. Accordingly the following two important considerations are noted:

(1) Inasmuch as the lymphoid tissues (adenoids and tonsils) are the main culprit and research indicates their early removal, parents and actually ENT specialists may resist such approach, particularly when the concern is over developing long-face syndrome characteristics rather than medical consequences.[8] Dealing with hypertrophied turbinates (often the inferior turbinates) is a more contested issue, because the problem may be grafted on that associated with adenoids and tonsils, or stand alone, and research is lacking relative to that on adenoids and tonsils. Interaction between orthodontist and laryngologist is crucial for mutual education and practice.
(2) Orthodontic methods potentially improving respiration include functional appliances and palatal expansion. Orthodontists have been involved in OSA treatment because of their expertise in Class II functional appliances, which increase airway patency when the mandible is positioned forward. Such appliances specifically target OSA in adults; in children, they may serve dual purposes of simultaneously correcting Class II malocclusion and addressing OSA. The intervention must be coordinated with the treating physician and after proper diagnosis, including polysomnogram data.

Improvement of nasal breathing following palatal expansion is not predictable. Even an initial amelioration may not be sustained. Various parameters are at play, including nose width, turbinate hypertrophy, amount of expansion, and stability of results. Methodologically standardized studies on 3-D cephalometric analysis are still needed[9]; nonetheless, it is arguable whether clinically relevant results from 3-D imaging studies of nasal volume (using CBCT) following rapid palatal expansion are different from prior 2-dimensional cephalometric studies. The key determinant is the location of the "bottle neck" in the nasopharyngeal airway blocking nasal breathing, nearly irrespective of volumetric changes within the nasal cavity. Palatal expansion might impact breathing only if the maxillary/nasal airway is involved, either in its hard tissue components, or in the differential "leeway" between hard tissue widths and soft tissue hypertrophy within the nasal cavity. Focused research is needed to sort out the contribution of all such variables.

Psychological issues

The AAO definition of "medically necessary" places physical and emotional components of health before dental health. Psychological issues are often under addressed, if not underestimated. Not readily tested like the visible malocclusion, the emotional dimension may be the most difficult to grasp, possibly associated with simple habits (e.g., digit sucking) or malocclusion, ranging from increased overjet to skeletal dysplasia.

In the past 2 decades esthetic imperatives have nearly matched or surpassed the requirements of function in justifying orthodontic treatment, probably helped by cultural and peer pressures for improved appearance and self-image. However, the priority of the psychologic panel has yet to be asserted. Most studies relating malocclusion to self-esteem and perception do not show, on average, a strong correlation. Early reduction in overjet did not produce the "claimed" psychological effects[10] or affect the child's self-esteem, including the child's concept of self-worth.[11] Yet individual variation from central tendency deserves consideration, as the stigma of a "buck teeth" image can weigh heavily on a child's present and potentially future development (Fig. 2). While the panel of interaction between esthetics and psychology is richly developed in countless studies, the interface between function and psychology, although less researched, merits distinction, such as the impact on social perception and life of masticatory deviations (e.g., speech, sounds, and appearance), tooth grinding, or temporomandibuar joint dysfunction.

Moorrees[12] captured the significance of patient individuality in his provision of a constitutional assay of the "total" person comprising anatomic

Figure 2. While research showed that on average early correction of a severe overjet did not affect a child's self-esteem, this child refused to attend school because of the jibes of her peers, whereby her orthodontic treatment became a "medical necessity."

(somatotype, dentofacial morphology, and dysplasia), physiologic (growth and development and functional occlusion), immunologic (susceptibility and reaction to infectious disease and allergy), and psychobiologic (self-image and emotional maturity) components. He stated that by removing the stigma of unattractiveness or "ugliness," and thus "bolstering self-image and social adjustment," orthodontic treatment reflects an important health service for adolescents and adults. In this medical constitutional evaluation, Moorrees further explored the connection between dysplasias in bodybuild (Sheldon's somatotype assessment) and marked malocclusion or facial dysmorphology.

From this standpoint, appearance begets judgment, particularly that most people encountered in life are "passers by," not acquaintances whose personality and human qualities overcome the "first impression." A body physique or facial type suggests stereotyped attributes, such as obesity foretelling inactivity and laziness (Table). People with mandibular prognathism may be perceived as aloof, becoming isolated by their peers and consequently more introverted. A child with a severe overjet may be the prey of cruel teasing by peers in a society that often portrays decreased intelligence with severely "buck teeth." The effects of those portrayals on the mind and personality of a child growing with the burden of a physical stigma may be remarkable. Therefore, personalized treatment, today's central axis of any medical intervention, encompasses the heretofore nearly outcast emotional component of malocclusion.

Hospital calls

These consultations are usually of general dental aspect (infections and trauma) provided by general and pediatric dentists and oral surgeons. However, orthodontists have been called to deal with traumatic emergencies (e.g., to help reestablish prior occlusal contacts), oncologic treatment (such as removal of orthodontic fixed appliances before cancer treatment or designing tissue-shielding appliances before radiation therapy), or pediatric intensive care units (e.g., to provide for appliances that prevent self-injury). These interfaces emphasize the importance of the medical model in dentistry, within the above discussed necessary integration between medicine and dentistry.[13] Associated with this practice is the consideration of the advantages of specialty training within the medical model, compared with the dental model.[14]

Orofacial-guided treatment

This treatment targets orofacial health in its relationship to the growth and functions of the body.

Table. Potential interpretation by peers of a child's body or facial appearance, and possible psychologic/behavioral consequences on the child.

Appearance	*Interpretation*	*Possible consequence*
Body		
Tall and muscled person	Strong	Intimidation
Obese child	Inactive and lazy	Slow and disorganized
Frail child	Weak, more prone to disease	Avoidance or more attention
Face		
Mandibular prognathism	Aloofness	Peer isolation, more introversion
Severe overjet (buck teeth)	Less intelligent	Cruel teasing, aggressiveness

Growth matters

In the presence of a Class II, division 1 malocclusion, often related to mandibular retrognathism, growth is critical for treatment outcome and success: the more severe the skeletal discrepancy, the more essential the needed amount of mandibular growth. Would the determination of medical necessity be equivalent to that inferred from a child with short stature, concerned with not reaching at least average height? Seeking body height increase may not be of health consequence, excepting a chronic psychologic stigma. However, if the severe Class II coexists with sleep apnea, compromised facial esthetics, and emotional discomfort, treatment may be more medically necessary. This comparison discloses the fact that medical necessity carries various individual weights, and personalized decisions are not always straight forward, whereby the difficulties encountered by funding agencies in gauging medical necessity.

This comparison underscores the value of growth and the importance of its monitoring in children. The orthodontist must be aware of growth variations and the means of its evaluation, and maintain a rapport with the pediatric endocrinologist when aberrations exist. Not only growth opportunities related to skeletal growth are observed, but also those associated with dental development. Amount of skeletal growth, sequence of dental development, and timing of both affect timing of treatment. Dentally, the optimal timing would be prior to the loss of the primary second molars in the late mixed dentition, to preserve the leeway space.[15] For skeletal growth, the following considerations are noted for the two basic malocclusions whose treatment is affected by growth namely, Class II and Class III:

(1) Clinical trials on the early treatment of Class II, division 1 malocclusion concur about starting treatment before the onset of puberty, albeit in late childhood as the first phase of a one-stage treatment.[15–17] Nevertheless, patients with severe malocclusion were likely to maintain a Class II phenotype, suggesting the limitation of growth modification to affect growth potential, yet indicating the merit of maximizing the contribution of growth during treatment.[18]

(2) A reverse rationale applies in the treatment of Class III malocclusion. Further mandibular growth, unbalanced by concomitant growth of a maxilla growing at a comparatively slower rate, coupled with the inaccuracy of mandibular growth forecasting, requires the orthodontist to anticipate the growth spurt to minimize its effect (e.g., favoring maxillary growth or mandibular rotation to counteract additional mandibular growth).[19] Often, early treatment combines maxillary expansion and facemask and aims at overcorrection, that is, increase of overjet, which results from both the maxillary protraction (with a side effect of counterclockwise rotation) and mandibular clockwise rotation. Barring excessive mandibular growth that may steer treatment toward later orthognathic surgery, the interaction between overjet overcorrection and mandibular growth defines success through one of these possibilities (Fig. 3).
    (i) Mandiblular forward growth equals the amount of overcorrection; then, the present compensatory incisor angulations are maintained.
    (ii) The mandible grows less than the amount of overcorrection; thus the mandibular incisors are proclined for the residual overjet correction.

Accordingly, also from a medical perspective, the orthodontist is a growth "specialist," a student of somatic growth by training and practice who must take advantage of growth opportunities (both dental and skeletal) when needed, and who may actually be the first to determine growth deviations (delay or advancement).

The majority of clinicians routinely seek information on general growth mostly in the above delineated instances (Class II and Class III) associated with discrepancies such as mandibular retrognathism or prognathism.[20] Often, growth evaluation is limited to assessing skeletal maturation on hand–wrist radiographs, and gauging the physical expression of the adolescent growth spurt through height increase or sexual maturation signs (onset of menarche in girls; facial hair or change of voice in boys). In the absence of accurate prediction, and in an attempt at individualizing time of treatment to benefit from craniofacial growth changes, the clinician deems it adequate to locate the child's growth as either prepubertal, pubertal, or postpubertal. However, passage through

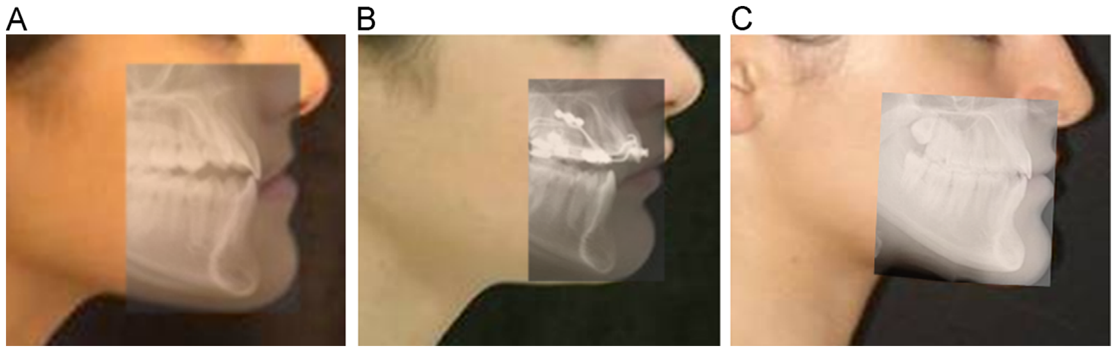

Figure 3. Lower face profile views with superimposed lateral cephalometric mandibular anterior components of 10 years and 9 months old female who presented with Class III malocclusion and concave profile (A). She was treated with maxillary expansion and protraction facemask to an overcorrected overjet in a first phase of treatment lasting 6 months (B). After an extended period of retention that lasted beyond the adolescent growth spurt, fixed appliances were used to achieve the well interdigitated neutroclusion nearly 6 years later (C), and improvement (reversal of steps) in the relation between upper and lower lips. The overjet was overcorrected in anticipation of one of two possibilities: (1) mandibular growth equal to the amount of overcorrection would lead to maintaining pretreatment mandibular incisor angulations or (2) mandibular growth less than the amount of overcorrection would justify proclination of the mandibular incisors for the remainder of overjet correction. The actual outcome was a combination of more proclined mandibular incisors, than at pretreatment, and a facial profile more orthognathic than the original concave outline. Orthognathic surgery was avoided at the expense of a long treatment because appliances were kept beyond a late-occurring adolescent growth spurt. (Adapted with permission from Ghafari et al.[19])

pubescence may be rapid or slow. Deviations from average tendencies reflect the need to develop dependable growth prediction models, particularly when the imperatives of dental development may require a timing of treatment independent of the requirements of craniofacial growth.

Growth monitoring has been limited to measures of height and skeletal maturation because of the difficulty in identifying and collecting other biological data that may correlate with facial development. In addition, the provision of concomitant frequent measures of facial growth correlates and parameters of treatment outcome is hindered by the contraindication to expose patients to multiple radiographs in short period of time; venipuncture to gauge hormonal levels on a routine basis in children is deemed an invasive procedure. Attempts at using more practically obtainable salivary levels of various biochemical substances included serum and salivary DHEAS and osteocalcin, which did not increase the accuracy of growth depiction.[20] Salivary levels of testosterone and estradiol did not yield the accuracy of blood levels, while IGF1, a growth hormone proxy, has shown initial promise, but not yet a confirmed advantage (Fig. 4). Further exploration of potential substances in cohorts of patients requires multilayered research.

Craniofacial anomalies

These conditions represent the ultimate multidisciplinary challenge and most readily recognizable for medically necessary orthodontic (and non-orthodontic) care. Severity and functional handicap (mastication, speech, and respiration) are the primary determinants of medical necessity. Arguably, craniofacial anomalies would belong to medically guided treatment as well, particularly in relation to more vital functions and psychology. However, they are categorized in this section because of the prevalence of orthodontic intervention throughout treatment.

The primary and most common condition in this category is cleft lip and palate (with all variations), followed by hemifacial microsomia and many other syndromes. These dysmorphologies mostly fit the definition and scope of pediatric orthodontics, as treatment spans the periods of infancy through young adulthood.

Vital functions: Speech and mastication

When these functions are compromised within more encompassing conditions, such as craniofacial anomalies (speech and mastication), or when associated with pain (temporomandibular joint [TMJ] dysfunctions), their treatment is

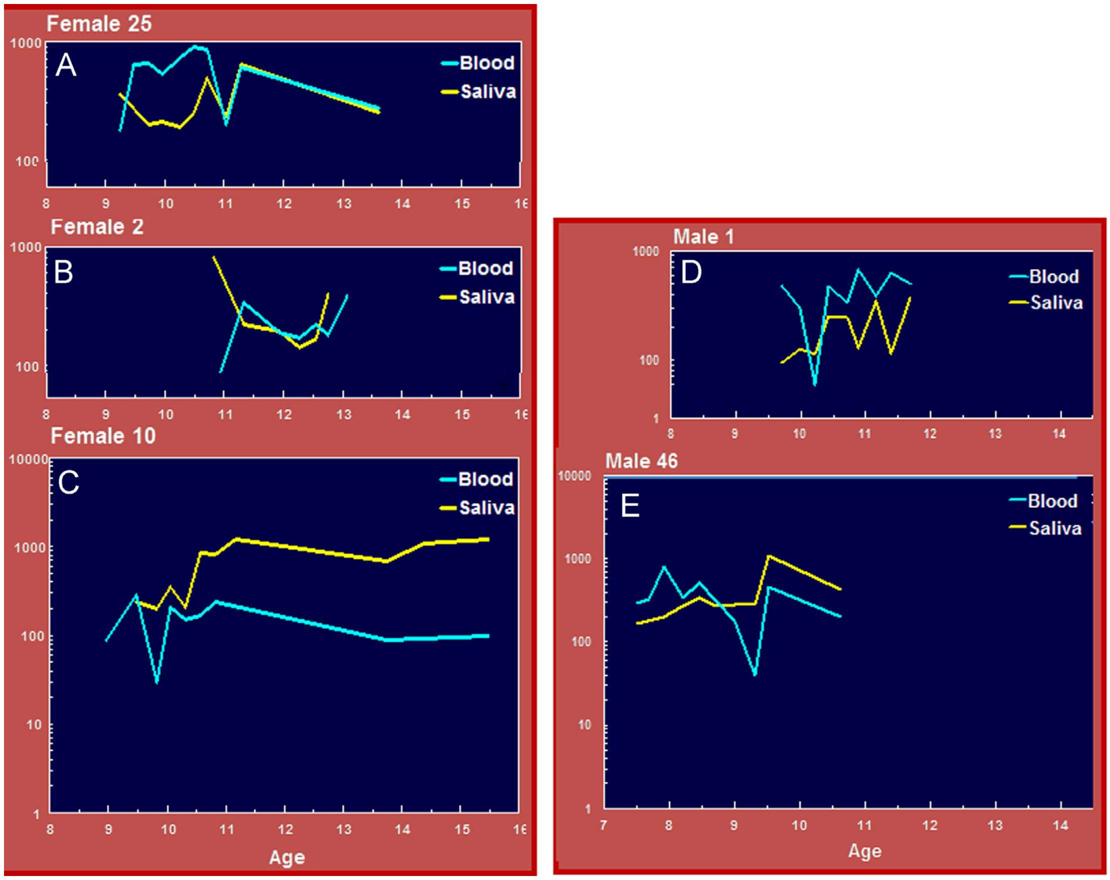

Figure 4. Blood and saliva levels of IGF1 were analyzed in a study on early treatment of Class II, division 1.[20] A montage of five graphs scaled on age are shown for three girls (A–C) and two boys (D and E) demonstrating saliva levels comparable to or higher than serum levels (A, B, C, and E). In one male (D), blood levels are higher. While the possibility of detection of saliva levels was demonstrated, unlike other substances investigated in this study (e.g., DHEAS, testosterone, and estradiol), additional research is needed to explore the possibility of gauging biological markers of growth in saliva as dependable as the gold standard serum levels.

branded medically necessary. However, the label is usually dropped when a lisp is associated with an open bite or a Class III malocclusion.

Defining medically necessary orthodontic care (MNOC)

The discussion of MNOC recalls the question of whether a malocclusion is malformation or malady.[21] Orthodontic conditions are inherently of a chronic nature, and do not pose an immediate health risk. Given that severity varies across malocclusions, should medically necessary care be subjected to the evaluation of need, as delineated through various orthodontic malocclusion severity indices [treatment priority index,[22] ICON,[23] IOTN,[24] PAR index,[25] ABO discrepancy index (DI),[26] Salzman handicapping malocclusion index,[27] and handicapping labio-lingual deviation (HLD)[28])]? Can such complexity be summed up in a score that is based on the weight assigned to the various components of the malocclusion, knowing that weight should be shifted to certain components?

Nearly all indices, except for the ABO DI, are based on occlusal assessment without cephalometric evaluation of the underlying skeletal tissues. Most indices do not take into account facial esthetics or handicap, or growth potential. To adhere to the AAO definition of MNOC, such indices address the dental component, not the physical and emotional panels. Therefore, any index carries some level of arbitrary assessment. Should a MNOC index be developed, assigning weights and scores to all three panels would require tremendous work and testing, prompting the question: why is not any treatment sought by an entity called "patient" be medically necessary, if it affects or "handicaps" physical, emotional, and dental health?

At this point, dental health weighs heaviest on the definition, probably because it is more objective to assess by all orthodontists. But, the real dilemma lies in the range of severity, its assessment, and the questionable predictability of growth when it is a critical component of treatment success in a child presenting particularly with sagittal (Class II and Class III), vertical (open bite and deep bite), and transverse (asymmetry and posterior crossbite) deviations. The challenge is always in drawing the line between objective and subjective assessment, but also in determining the future health consequences of a current condition, whose long-term impact may be more severe than its short-lived effects.

Conclusions

The issue of health essentially reflects the role of a competent health provider, for any part of the body, in a world where medicine is compartmentalized in various specialties and subspecialties. However, if the goal of medicine is "seeking health," health is an indivisible concept, despite the specificity of its parts.

Dentistry is a discipline of "medicine" that aims mostly at improving quality of life. Medical necessity was presented in the general context of dentistry being a separate field from medicine, underscoring possible schemes of their integration, and within pediatric orthodontics, categorized in medically guided treatment, restoring biologic and physiologic normalcy, and orofacial-guided treatment, directly involved in orofacial functions. Orthodontic treatment of orofacial-occlusal symptoms is medically necessary when the treated condition involves bodily health (growth), vital functions (breathing, mastication, understandable speech, and absence of pain), and social adjustment (psychological well-being). In this angle, necessity also involves orthodontic care as part of a medical team.

The challenge to educators, practitioners, and health organizations is to investigate the impact of integrating dentistry and medicine at educational and operational levels on determining the "medical necessity" of the pertinent conditions when treated.

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