Functional Aesthetic Dentistry

How to Achieve Predictable Aesthetic Results Using Principles of a Stable Occlusion

Neeraj Khanna

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Acknowledgments

As you know, this book could not have been a reality without the many people that are a part of my life. I am forever indebted to Dr. Peter Dawson who was responsible for igniting the fire in my belly which has allowed me to pave the path to help so many dentists along the way. The incredible team at the Dawson Academy, including Ms. Joan Forrest, has been very instrumental and supportive of my passion to teach Dr. Peter Dawson's principles. This book is a compilation of experiences that I have been able to share with you because of so many great patients in my practice. I am honored and humbled that they have entrusted me with something that means so much to them—the health of their entire masticatory system. I thank them for being so incredibly patient and understanding with me throughout all of their treatment procedures. Those patients could not have gone through this process without the help of my dedicated team. My talented team consists of Gina Lazzerini and Taylor Bianchini. Through the years, both Gina and Taylor have witnessed and endured the challenges of transforming a practice from general dentistry to comprehensive, aesthetic, and functional dentistry. They have helped embrace, support, and implement my vision into the practice. Gina has been by my side for over 20 years, and I will always be so grateful for her loyalty, commitment, and dedication to me and my practice. I cannot forget all those patients (especially the ones who have been mentioned in this book) who entrusted me with the responsibility to take care of them throughout the process of treatment. It has been my honor to serve you.

My parents, Shiv and Kavita have been my well-wishers since the day I was born. They have always believed in me and have always supported my ambitions and dreams. Their spiritual faith and belief were a reminder that one day this book would be written. I am so blessed and grateful that they are going to see this book come to fruition. I can remember growing up hearing my father's well-known quotes of wisdom and inspiration. Later in life, I have come to appreciate them as they have provided me with a deeper understanding of myself and others. My only younger brother Manoj, who has been with me spiritually throughout my personal and professional journey. He had seen my life from a different perspective and watched the transformations over the years; I have so many great memories and moments with him. He has always been my great friend and supporter. Thank you to my entire family.

Finally, there is always a great woman behind a successful man. I can boast that I am blessed to have a great woman by my side, who is my wife, Jeanie. Her grace

and simplicity of life is a gift that only a few possess. From the moment I was awakened (professionally) by Dr. Peter Dawson, she has been my best supporter and played a significant support role in helping me write this book. She has given me my two children, Raj and Maxime, who have shown me what love, patience, and understanding really mean. I am so blessed to have such beautiful and loving children. Thank you for the incredible support in allowing me to "be what I want to be," "go where I want to go," and "write what others will read." This book could not have been completed without my family's loving support and encouragement.

Please read this book with an open mind. I hope it teaches you the important principles that will help you elevate your understanding of dentistry and, hopefully, allow you to implement this understanding with your patients and team members. Finally at the beginning of each chapter, there will be an example of a quote from my father and a few of my own that are meaningful to me and my life. Below I leave you with the first one that is very appropriate. Enjoy!

Live as if you were going to die tomorrow, learn as if you were going to live forever.
Mahatma Gandhi

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Introduction

If you were to tell me at the time of my graduation from the dental school in 1993 that one day I would be writing a book, then I would be telling you that you have lost your mind. That would have been a young graduate from the University of Detroit Mercy School of Dentistry who was inexperienced but was ready to take on the world! The idea of writing a book would have been the furthest thing on my mind. It is safe to say that destiny had other plans. Since graduation from the dental school, my life (professional and private) has taken many turns, including significant events along the way. One of those events will be described in more detail as you continue to read. In hindsight, I truly believe that all the significant events in my life have played a key role that has led me to what I am at this point in time. This book was written with purpose and passion from years of teaching and inspiring so many. This next "chapter" in my life is to write a book about something that I am very personal and passionate about.

In March of 2000, I started my own dental practice, and like many of you, my primary goal was to grow, and pay my bills. My patients liked me, my practice became very busy, and I could do no wrong. I was a confident dentist, and I loved the results of my treatment. With the growth that I experienced, I started to hire more staff and began to realize that this is what was expected as a result of being successful. At one point, I also realized that the space that I was occupying was not enough. I would have to consider relocating to a larger space or higher associates to keep up with the demand.

Fortunately (I say this in hindsight) in late 2005, I was starting to feel disconnected emotionally and physically from my practice. I no longer enjoyed the practice of dentistry. The novelty of being "busy" had worn off and the clinical frustrations of being a dentist became very apparent. You may relate to this example as this was frustrating me for years: A second molar was being treated for a crown preparation. I reduced at least 1.5 mm from all aspects. I prepared the tooth with ideal reduction (1.5 mm from all sides), and when it came time to confirm the preparation (having the patient close down), I could see there was very little interocclusal space to fabricate a provisional crown. At that point, I further reduced the occlusal preparation to give me space for the provisional crown. The provisional restoration was still very thin, and the final impression was sent to the lab. Upon the cementation appointment, the amount of time spent adjusting the occlusion resulted in the

entire occlusal anatomy being obliterated. Figure 1 illustrates the same example of a patient whom I saw 2 years ago presenting with the same situation on tooth #18 (or 3.7), except the crown restoration that did not last. This patient experienced the same scenario elsewhere. Figure 2 illustrates the same patient not having adequate interocclusal space, and finally Fig. 3 clearly shows the results and what caused the restoration to come off. Had I seen this patient 13 years ago, I am not sure if I could have understood nor solved this problem. Today, there are many dentists all over the world who are still experiencing these same issues with preparing restorations on second molars. The same patient as illustrated in Figures 1–3 has undergone treatment to solve this problem with a different process that involves understanding the occlusion. Today, this same tooth has been restored in a predictable way to respect the patient's occlusion and function. What was even more startling was the fact that over time I started to see my patient's clinical results change, especially with anterior restorations. The frustration began to get worse as I was experiencing patients returning for multiple occlusal adjustments, and when my patients asked why, I did not have the clarity to provide them with the answers to the current problem. In 2004, one of my patients (post-treatment completion) continued to present on multiple times to address occlusal issues which required many adjustments to the occlusion. Figure 4 illustrates this patient (smile view). Furthermore, Figures 5, 6, 7, and 8 illustrate the aesthetic results (I cringe when I look at these photos!) and the changes that have taken place over time—perforations, fractured porcelain on cuspid teeth, diastema, and many other issues. Patients like these spend time and money and deserve the very best in dentistry that is predictable and long lasting. Unfortunately, at the time I could not provide the patient with an amazing result.

Instead of looking for an external reason, I began to look inward. This was the moment when I began taking the steps in my career to be truly reborn. Perhaps then I realized that just treating teeth was not working in the best interest of my patient nor myself (my mental stress). There had to be something more than just treating teeth.

The dental school does not teach enough to solve complex problems or deliver predictable results. The dental school has an obligation to educate students, so they acquire enough intellect and aptitude to complete a board examination that allows them to obtain a professional license. I reached a crossroad in my career where I had to either continue down the same path (which would have ended my career sooner) or choose another one. I chose the latter and had the good fortune of having a team member who was previously employed by a Roth-trained orthodontist who was passionate about occlusion. This team member suggested that I investigate occlusion as a possible solution to my dental frustrations.

After some research, I decided to take a class in 2006 and hear Dr. Peter Dawson speak about occlusion. During the first day of class, I experienced an epiphany, a moment where my professional life had been permanently changed. In a lecture room with over 250 people, I truly felt that Dr. Dawson was speaking to me and only

me, and it was loud and clear. I had clarity and a new purpose. I realized two things at that moment. First, I needed to master this process of "complete dentistry" and, as he stated so eloquently, be a "physician of the masticatory system." Second, I needed to help as many dentists as possible to understand this process of complete dentistry. During a timeline of just over a year, I completed Dr. Dawson's curriculum and implemented everything into my practice.

Fast-forward and today I write this book to share my interpretations and experiences to help you understand the importance of providing your patients with the very best results possible that are predictable and long lasting. I have learned over the years through teaching and speaking that a dentist sometimes can be very critical about another professional work and/or results. This mind-set is what I like to call "the box." Every dentist lives and breathes in their own professional "box." They get comfortable and eventually complacent. All that I ask of you is to read this book with an open mind, and hopefully your "box" can be expanded. This book is not meant to be a book of before and after photos, but one that explains the principles of occlusion and how this philosophy can be applied to patients from all walks of life. This philosophy does not discriminate, nor does it assume anything.

Fig. 1 Patient example of second molar crown prep

Fig. 2 Patient example of same second molar preparation and the occlusal relationship to the opposing tooth

Fig. 3 Patient example of existing crown restoration of the same second molar

Fig. 4 Patient example of previous dentistry—Smile view

Fig. 5 Patient example of previous dentistry—Maxillary occlusal view

Fig. 6 Patient example of previous dentistry—Mandibular occlusal view

Fig. 7 Patient example of previous dentistry—Retracted anterior closed view

Fig. 8 Patient example of previous dentistry—Retracted anterior open view

Functional Aesthetics

1

You never fail until you stop trying.

Albert Einstein

Contents

It is well known that the eyes are the gateway to a person's soul and a smile is the gateway to a person's personality. This is true fact as the practice of aesthetic dentistry is documented as far back as 2500 BC [1]. It was not till scientists discovered skulls dating back to the Mayan civilization between 300 and 900 AD where ancient tools (bow drill—see Fig. 1.1) were used to drill holes in the facial surfaces of anterior teeth [2]. These holes were filled with stones like jade and turquoise, see Figs. 1.2 and 1.3. The importance of this ritual simple was based on social status. The evolution of dentistry has transformed from filling holes, to recreating life like restorations.

In the 1990s, the US dental industry was in a time of an aesthetic revolution. It was known as the American "Hollywood Smile" which was pure "white" teeth. There were reality TV series with cosmetic dentists creating beautiful smiles. It became cultural norm where patients just wanted "white" teeth. This was a boost in Dentistry as so many patients were seeking aesthetic treatment. I often wonder for the dentists that were jumping on the aesthetic bandwagon, how many aesthetic procedures were completed without seriously taking into consideration the patient's function and occlusion? Most published articles and advertisements show aesthetic results that only focus on changes in color and shape. For many decades, the concept of

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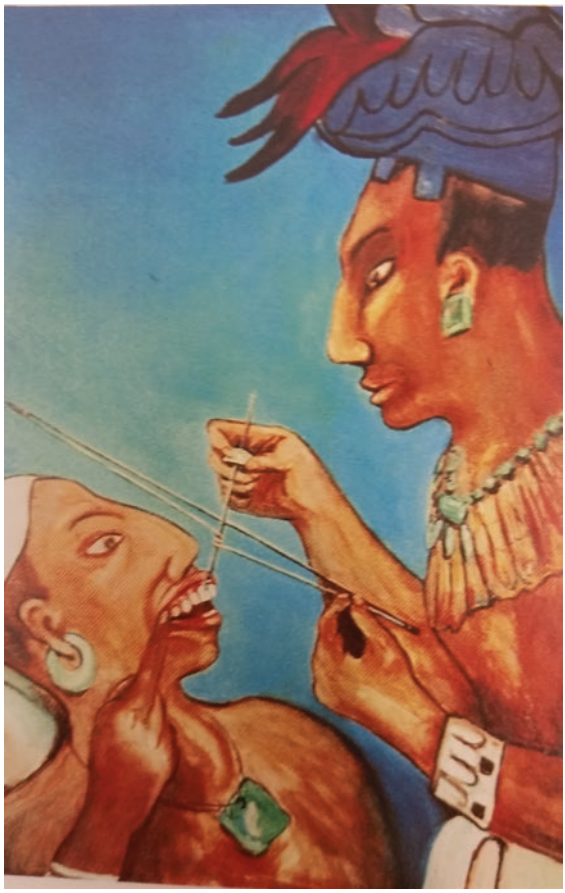

Fig. 1.1 Depiction of Mayan dentist, Circa 750 A.D

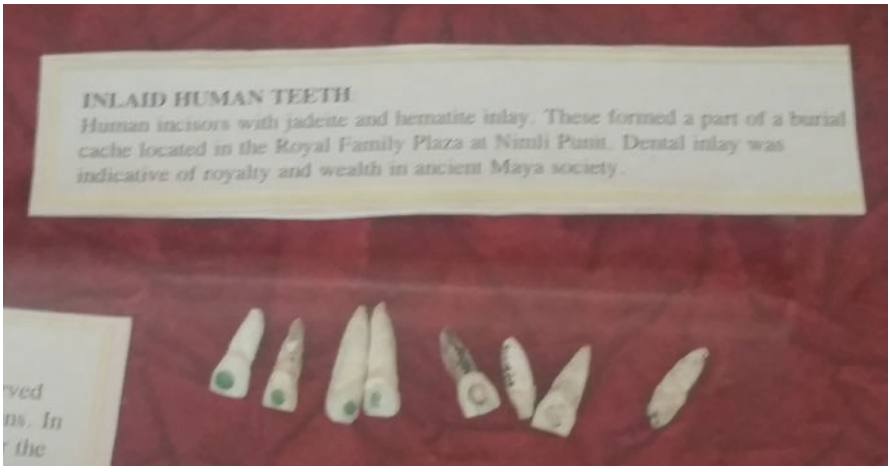

Fig. 1.2 Ancient Mayan teeth inlayed with jade, Circa 750 A.D

Fig. 1.3 Close up of Mayan teeth inlayed with jade, Circa 750 A.D

aesthetics in dentistry has stayed focused on just these results. From the perspective of the patient, they seek changes in these two areas. There was a time in my practice where I thought I was giving my patient's the very best aesthetic results. At that time, I was proud of the fact that the results delivered was the best possible and there could be no more improvement needed. However, when I review my past photos, I realized how much I did not know and how much now I appreciate aesthetics now! My expectations were similar to my patients, color, and shape. As long as those two items were achieved, they were pleased and as a result, I was happy too. This process and understanding of "complete dentistry" truly allow the dentist to be in control of the outcome by preplanning the outcome before the tooth preparation begins. However, the perspective from the Dentist must go beyond these two parameters. There is a better way to achieve results that are not only dictated by color and shape.

Today, patients who are demanding aesthetic treatment have higher expectations and are now asking for natural appearing smiles. This can include not only color and shape but also characteristics such as texture, pigments, and translucency, just to name a few. What they are asking is "make it look natural" or make it look like it belongs in my mouth. I like to compare this to a bad "hair piece." In other words, you can tell if a gentleman is wearing a bad hair piece because it does not look natural. A hairpiece that is undetectable and appears very natural can provides the best outcome for the person wearing it. The reality today is patients have access to unlimited information. With this access, they can form their own opinions on what they want before you have an opportunity to see them. Because of the higher dental IQ of today's patients, we must acknowledge their desires and opinions, and also advise with the need to restore teeth aesthetically inclusive of function and occlusion. Changing the shape (contours, length, etc.) to improve the aesthetic results may also change the functional component. Sometimes this change can backfire if the existing function was not well understood. Our goal is to improve the outcome while maintaining ideal function for comfort and stability.

In order to appreciate the relationship between aesthetics and function, let us first understand the design features of anterior teeth. These features contain specific contours and planes which are important for aesthetics and function. We will discuss both anterior and posterior teeth but with a strong emphasis on the anterior teeth.

1.1 Anterior Teeth

The anterior teeth are designed primarily to tear food during the initial stages of mastication. The shape and root morphology of these teeth proves this point. The upper canine teeth usually have the longest and widest roots in the entire dentition [3]. This serves to not only grab and tear food but also withstand pressures during eccentric movements as a protective mechanism. In addition, the anterior teeth also provide soft tissue support, specifically the upper and lower lips. To fully appreciate and understand the anterior teeth, one must review the design and anatomy of the corresponding upper and lower anterior teeth. The maxillary central incisor, lateral incisor, and canine, as well as the mandibular incisor will be dissected into the following areas: (1) facial surface; (2) lingual surface; (3) incisal edge.

1.1.1 Maxillary Central Incisor (Fig. 1.4a, b)

1.1.1.1 Facial Surface

We can look at this in two planes (lateral and facial planes). From the lateral side, we can see three distinct planes. The first one (in red) is the emergence from the CEJ. This is important since it supports the gingival margin and reflects a smooth transition from the root to enamel surfaces. If we continue past the emergence, the second plane (in green) exhibits a flatter plane that is slightly more lingual. The

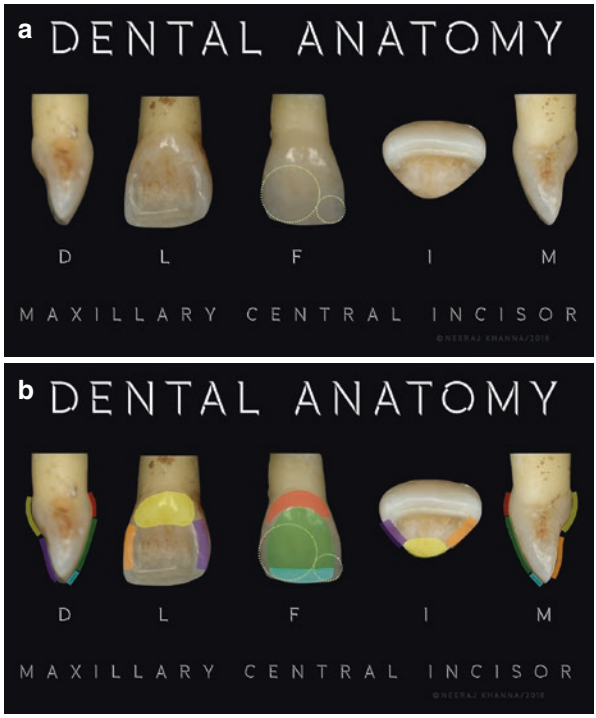

Fig. 1.4 (**a**) Anatomy of Maxillary Central Incisor from the facial, lingual, mesial, distal, and incisal views. (**b**) Maxillary Central Incisor illustrating anatomical landmarks from facial, lingual, mesial, distal, and incisal views

angle of this plane moves inward (lingual) to more than two-third (2/3) the way. The final plane is at the final one-third (1/3) (in blue) and again appears to be slightly tipped lingual and ends at the incisal edge. These three planes are important when designing anterior teeth. The purpose of these planes (especially the last two) is related to lip support and phonetics. The maxillary central incisor is supported on the facial side by both upper and lower lips, while the tongue provides this same support on the lingual side. Phonetics is generated with air flow and the coordination of the tongue and lips. We will discuss further in Chaps. 6 and 7.

From the facial side, we usually do not see the three planes as distinctly described from the lateral side, but we do see a difference between the mesial and distal contours. The mesial incisal contour is less convex than the distal one. The circumference of the convexity can be further distinguished when drawn out, and this creates differences in the incisal embrasures such that as we move away from the central incisors, we find the embrasure spaces increasing. Another way to view this is to divide the facial surfaces into thirds. Here, if you were to extend or continue to follow the contours of the mesial facial incisal line angle, it will form an imaginary circle. The circle at the distal will occupy two-third (2/3) of the facial surface, while the mesial side only occupies one-third (1/3) (see Fig. 1.4 (a and b) facial surface). In addition, the second plane as seen from the lateral side appears to be flat when viewing it from the labial side. When taking photos of these teeth from the labial side, you will observe this plane by noticing the light reflection from the camera flash appears at the mesial and distal facial line angles.

1.1.1.2 Lingual Surface

Similarly, we will view this side of the central incisor from the same two planes (lateral and lingual planes). From the lateral side, the cervical area begins with a cingulum (in yellow). This bulbous area does in fact have a purpose, which is related to phonetics. In many cases laboratories fail to create proper cingulum on their restorations. This may be due to a lack of detail requested by the dentist, or simply the lab not paying attention to these details. Either way, it must be the role of the dentist to outline the importance of this landmark to the laboratory. This part of the surface has a specific purpose and will be discussed in further details later in Chap. 7. Continuing from the end of the cingulum, the lingual surface becomes concave and extends toward the incisal edge. This concavity is outlined by both mesial and distal marginal ridges (in orange and purple, respectively). In most cases these marginal ridges are used as an outline or support during protrusive movements of the lower anterior teeth. The goal is to allow the posterior teeth to disclude during protrusive movements.

1.1.1.3 Incisal Edge

The incisal edge of this tooth is very significant. Most importantly this position will provide both proper aesthetics, phonetics and function. The incisal edge must be accurately positioned in both a horizontal and a vertical position. At a relaxed position, our upper lip drapes over the facial surface, while the lower lip rests on the incisal facial one-third (1/3) of the central incisor. In addition, the tongue rests against the lingual surface. It is very important to remember that when restoring

central incisors, the position of the incisal edge is paramount. Any deviation away from ideal incisal edge position will affect how the upper and lower lips relate to the tooth position. It is a common complaint of dental laboratories that preparations in the incisal one-third (1/3) of the central incisors are usually not adequate, and as a result the incisal edge position is usually restored too thick facially. Depending on the thickness, this may slightly change the lower lip position as well as alter the function of how the mandibular teeth interact with the new incisal edge position.

1.1.2 Maxillary Lateral Incisor (Fig. 1.5a, b)

1.1.2.1 Facial Surface

From the lateral view, there is a similar pattern of three facial planes, but smoother and less prominent. The facial surface of this tooth is similar to the central incisor, except for the size and shape. The mesial line angle is slightly rounded, while the distal is more curved. As a result, the embrasures between the mesial and distal will differ in size, with the distal embrasure being larger. In addition, there is a distinct flat facial plane (in green) observed on this surface that sometimes can take up most of the surface of this tooth. The size of this tooth is narrower and shorter as compared to the central incisor. When viewing the facial surfaces of the upper anterior teeth, you

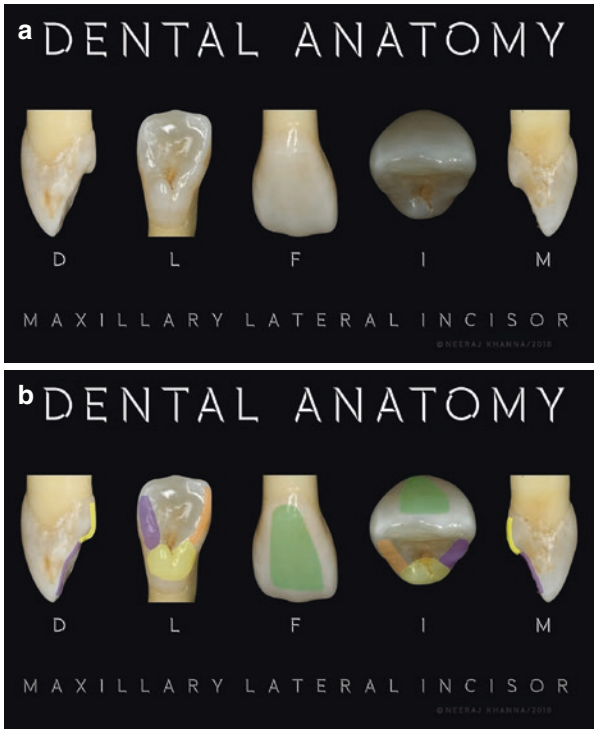

Fig. 1.5 (**a**) Anatomy of Maxillary Lateral Incisor from the facial, lingual, mesial, distal, and incisal views. (**b**) Maxillary Lateral Incisor illustrating anatomical landmarks from facial, lingual, mesial, distal, and incisal views

will see a distinct incisal "step" between the central and lateral incisors. It is important to remember that the lateral incisor is designed to be shorter incisally to avoid a possible interference with the mandibular canine during protrusive movements.

1.1.2.2 Lingual Surface

The lateral side again is very similar to the central incisor. The cingulum and the concavity (in yellow) are not as pronounced. From the lingual side, both mesial and distal marginal ridges (in purple and orange, respectively) exist to aid in anterior guidance to help separate the posterior teeth.

1.1.2.3 Incisal Edge

The incisal edge on this tooth can appear to be straight or curved. Either way, it will follow the contour of the maxillary central incisor.

1.1.3 Maxillary Canine (Fig. 1.6a, b)

1.1.3.1 Facial Surface

The lateral view of this tooth begins with the emergence and continually follows a concave contour till the incisal edge. However, from the labial side, this tooth has two planes that change at a demarcation point. The first part of the plane begins at

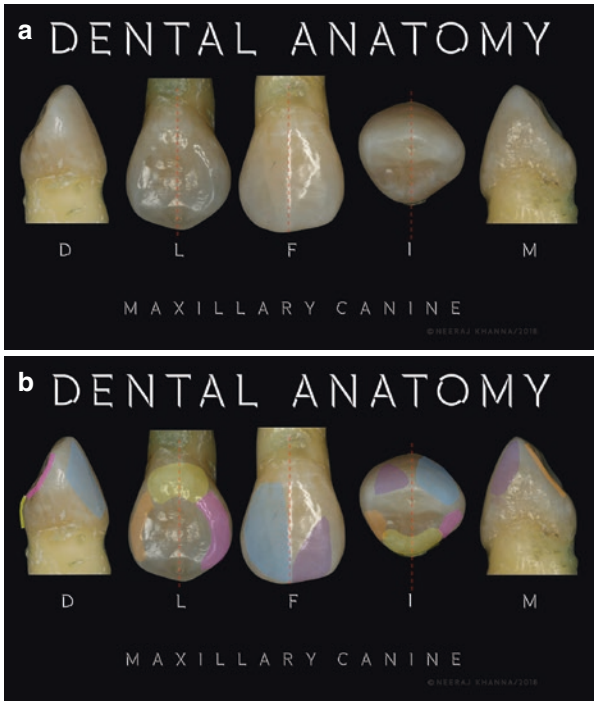

Fig. 1.6 (**a**) Anatomy of Maxillary Canine from the facial, lingual, mesial, distal, and incisal views. (**b**) Maxillary Canine illustrating anatomical landmarks from facial, lingual, mesial, distal, and incisal views

the mesial contact area and continues to approximately mid one-third (1/3) of the facial surface (in purple). At this point, there is a distinctive line angle (orange dotted line) that demarcates the remaining two-third (2/3) of the facial surface. Along with this demarcation, this marks the longest part of the tooth incisal. The remaining facial two-third (2/3) distal to the demarcation line is flat (in blue), while the mesial one-third (1/3) is more rounded as it approaches the contact area toward the distal of the lateral incisor.

1.1.3.2 Lingual Surface

The maxillary canine's lingual surface has a distinctive cingulum (in yellow) followed by a relatively straight lingual surface that extends to the longest incisal point on the facial side. In some cases, you will find mesial and distal marginal ridges (in orange and pink, respectively), and in some others, you will not.

1.1.3.3 Incisal Surface

When viewing this tooth from this angle, you will notice that the mesial third appears thicker (labiolingual) than the distal two-thirds. This would make sense when you understand that canine guidance usually occurs on the mesial side during excursive movements.

1.1.4 Mandibular Incisors (Fig. 1.7a, b)

1.1.4.1 Facial Surface

The facial surface of these teeth has a very distinct plane. Most of the facial surface of the mandibular incisors are flat, extending from the incisal edge toward the cervical area (in red). This plane tapers toward the cervical of this tooth where the widest part of the plane is at the incisal edge that the thinnest at the 1–2 mm from the CEJ. When viewing this tooth from the facial side, you will see the mesial and distal portions of the facial surface having a softer look. This is due to the change in the plane from the flat portion to a more rounded surface. This demarcation or change in the facial angle reflective of the line angles.

The lateral view of these teeth will further illustrate these characteristics. It is important to understand that there is a very well defined incisal-labial line angle. This angle is vitally important in establishing a proper natural incisal contact against the lingual side of its opposing anterior tooth. The incisal edge is flat from the labial to lingual sides.

1.1.4.2 Lingual Surface

The lingual side of these mandibular teeth also has two contours. The lingual incisal one-third is relatively flat but then becomes convex toward the cervical one-third. In most cases, you will see this in the form of a cingulum (in blue).

1.1.4.3 Incisal Surface

When viewing these teeth from the incisal, all of the facial contours as described earlier become more visible. For example, the flat facial plane and both mesial/distal

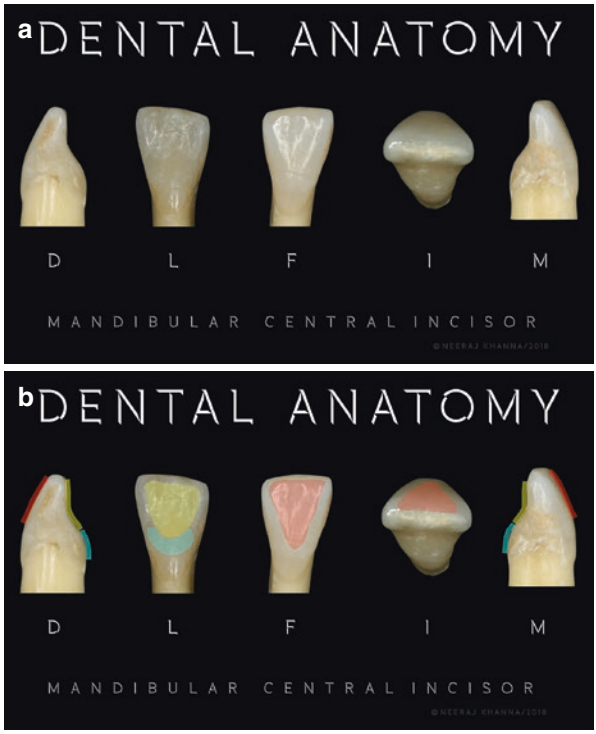

Fig. 1.7 (**a**) Anatomy of Mandibular Central Incisor from the facial, lingual, mesial, distal, and incisal views. (**b**) Mandibular Central Incisor illustrating anatomical landmarks from facial, lingual, mesial, distal, and incisal views

line angles can be clearly seen here. In addition, the overall shape can take on a more convex appearance.

1.1.5 Mandibular Canine

1.1.5.1 Facial Surface

The mandibular canine can be described in a similar fashion to the maxillary canine. It is smaller is size as compared to its opposing friend, and also has two planes. The incisal mesial one-third starts at the mesial facial line angle extending toward the highest point to which this ends the mesial plane. The second plane which comprises of the remaining two-thirds begins from the highest incisal point and tapers distally to form a rounded line angle. This point of transition is what separates the mesial and distal portions and represents the highest mark incisal. Remember, the height of this tooth is designed to provide adequate function against the opposing maxillary canine. Again, just like the maxillary canine, this represents the transition tooth between the anterior and posterior teeth. From the labial side (mesial or distal), this tooth exhibits a continuous taper toward the cervical, much like a convex shape.

1.1.5.2 Lingual Surface

The lingual surface forms a concave surface starting at the incisal edge and terminating at the cingulum. In most cases this concave surface is very subtle and appears fairly straight.

1.1.5.3 Incisal Surface

When viewing this tooth from this angle, you will continue to see the same pattern as seen in the central incisors, i.e., the facial surface may appear convex, while the lingual surface may appear concave.

The shape and contours of anterior teeth provide three important roles: phonetics, function, and vertical dimension. In the infancy period, tooth buds are genetically programmed to develop and eventually erupt into the oral cavity. We know from eruption sequencing that the mandibular anterior teeth (central incisors) are the first ones to develop and erupt, followed by the maxillary anterior teeth (central incisors). As these teeth continue to erupt, they are supported by the lips (upper and lower) and tongue. The soft tissues provide a positioning guide as these teeth erupt. Eventually at about 9 months of age, anterior teeth are finally occluding when the elevator masseter muscles contract. This anterior stop completes the tripod of stability between the TMJs and the anterior teeth. This anterior stop establishes the present vertical dimension of occlusion (Fig. 1.8).

On the other hand, when the mandibular and maxillary anterior teeth are not in contact, they are at rest. Here, teeth are slightly apart, but the upper lip drapes over the two-third (2/3) of the maxillary central incisor, while the lower lip rests over the incisal third. On the lingual side, the tongue is positioned and rests against the cingulum of the central incisors, and the hard palate. This balance of muscle force of the tongue and lips keeps the anterior teeth in place (see Fig. 1.9). This place is also

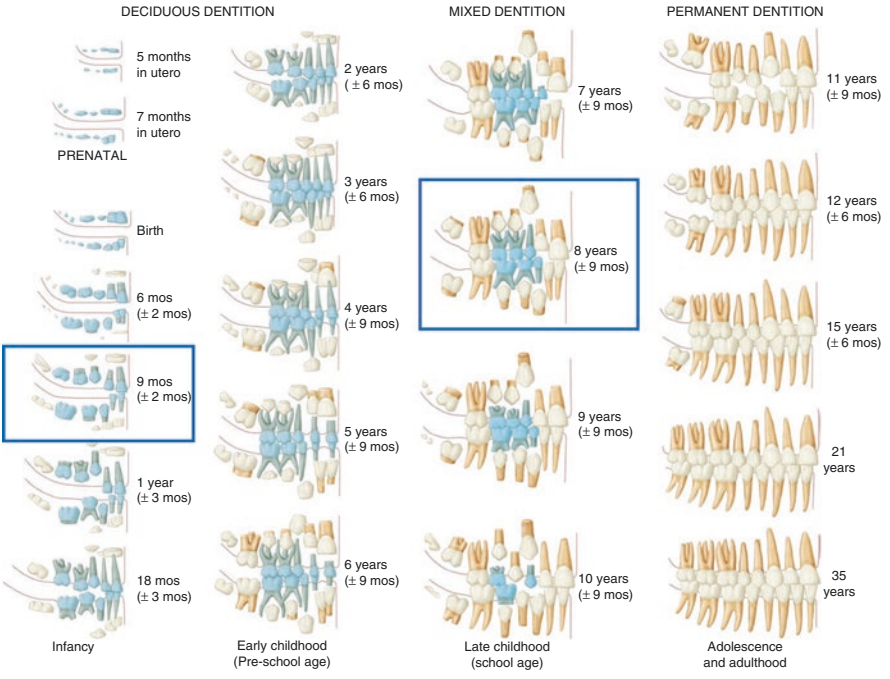

Fig. 1.8 Tooth eruption sequence for both primary and adult dentitions