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Anterior Anatomy and the Science of a Natural Smile

John C. Ness CDT

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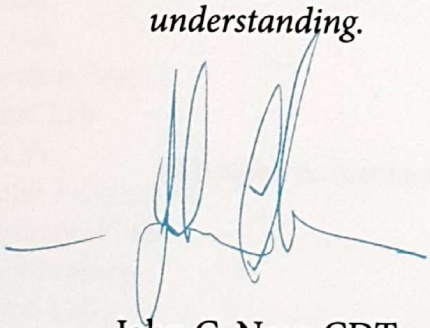
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Dedicated to

all the dental educators who have given so much of themselves under such diverse demands. You are the ones who persevere just for the joy of seeing the bright eyes of understanding.



John C. Ness, CDT

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Printed in the USA. Revision 2015.01.19

Published by

Productivity Training Corporation
360-A Cochrane Circle
Morgan Hill, CA 95037

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The following companies donated materials or technical support to make this publication possible
D4D Technologies, Basil Haymann
D4D Technologies, Gary Maxon, CDT
Hemlock Implants, Axel Kirsch, DDS
Henry Schein/Zahn Dental, Norm Weinstock
Interdent, Douglas A. Ralston, DDS
Ivoclar, Patrick Signeri and Herb Baird
Noritaki, Robert Miller
Norbert Ulmer, Sirona USA

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Vol 1: *Introduction to Dentogenic Restorations*
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Anatomical Reference
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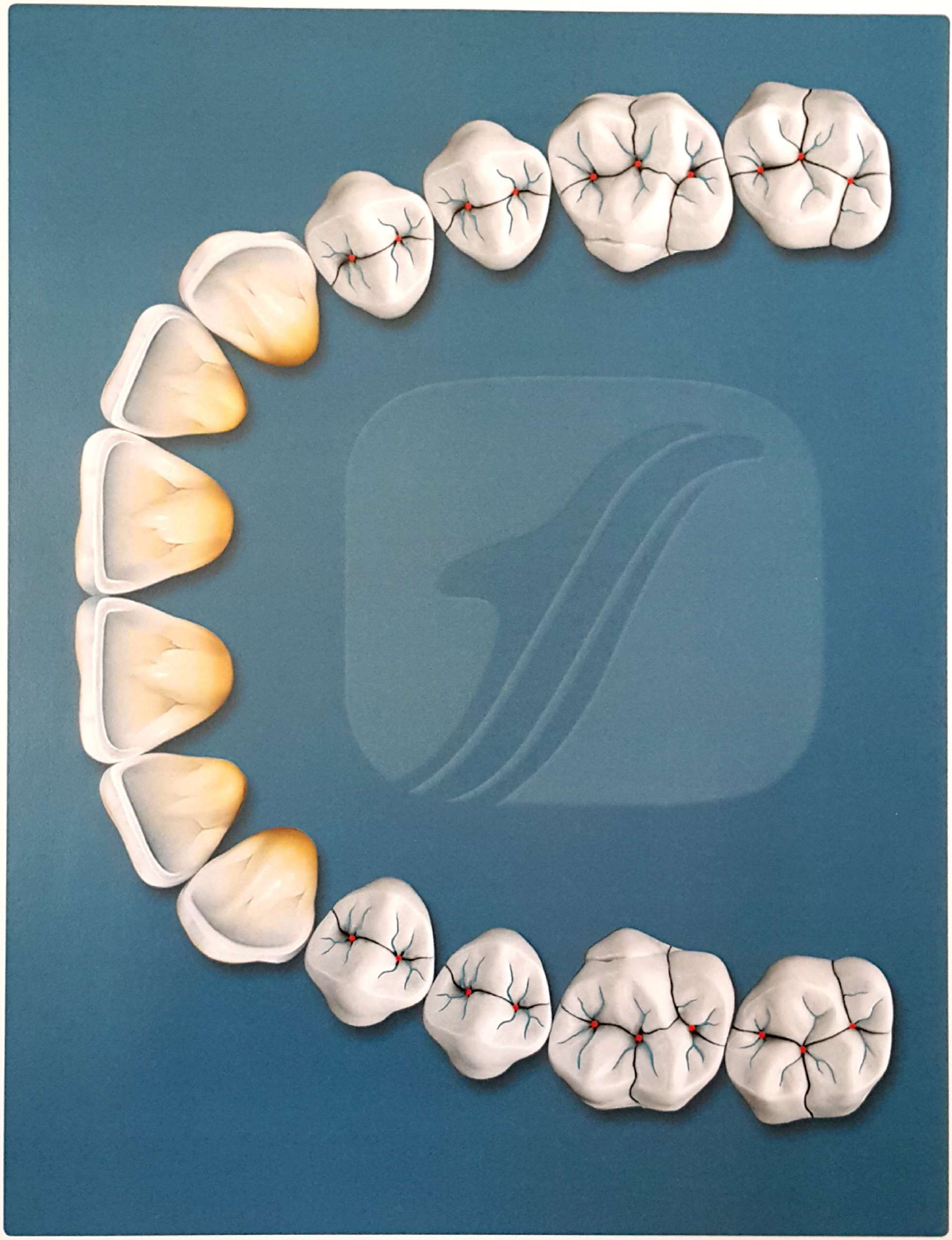
Introductory Reference

Maxillary and Mandibular Full Arch Reference



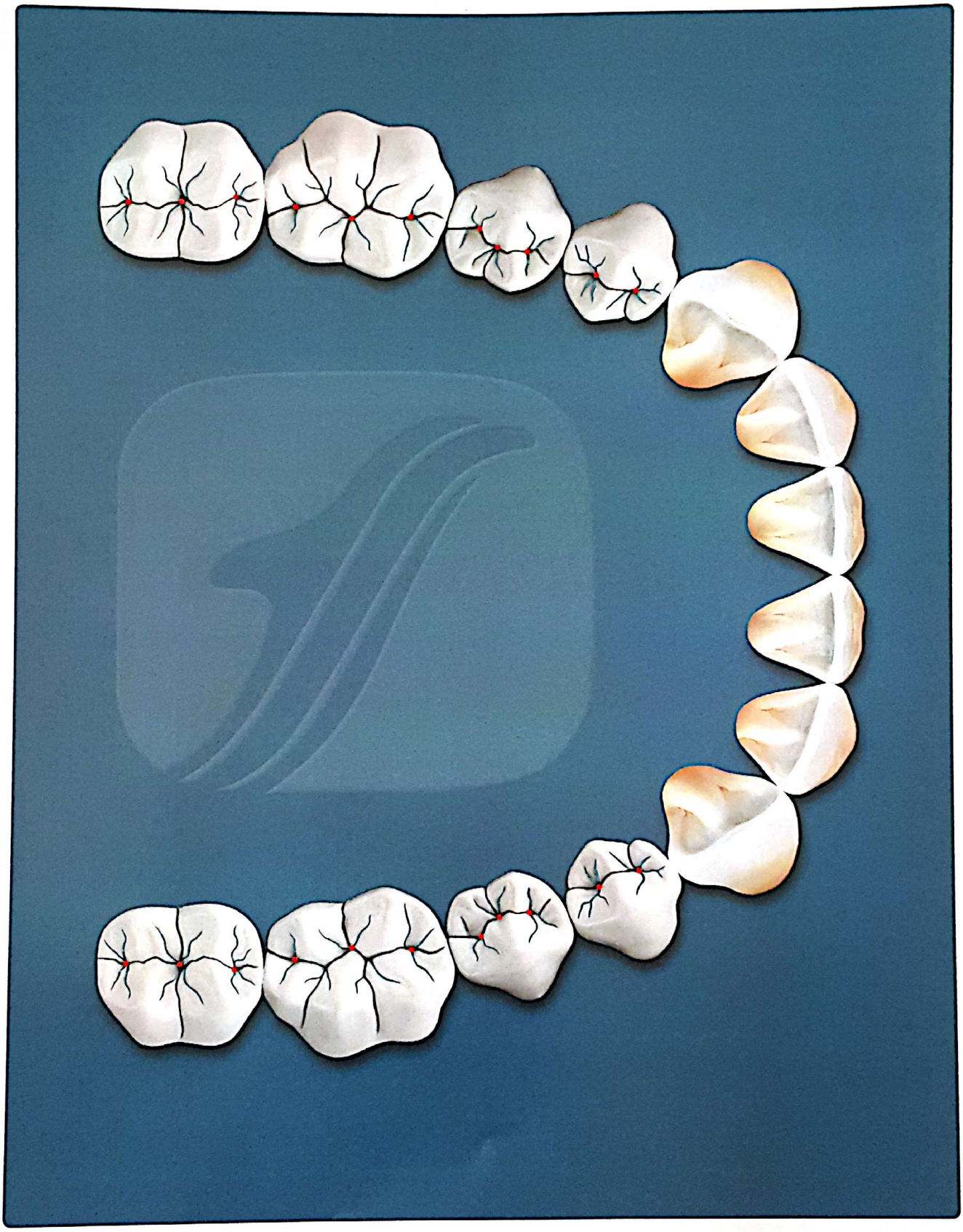
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Maxillary



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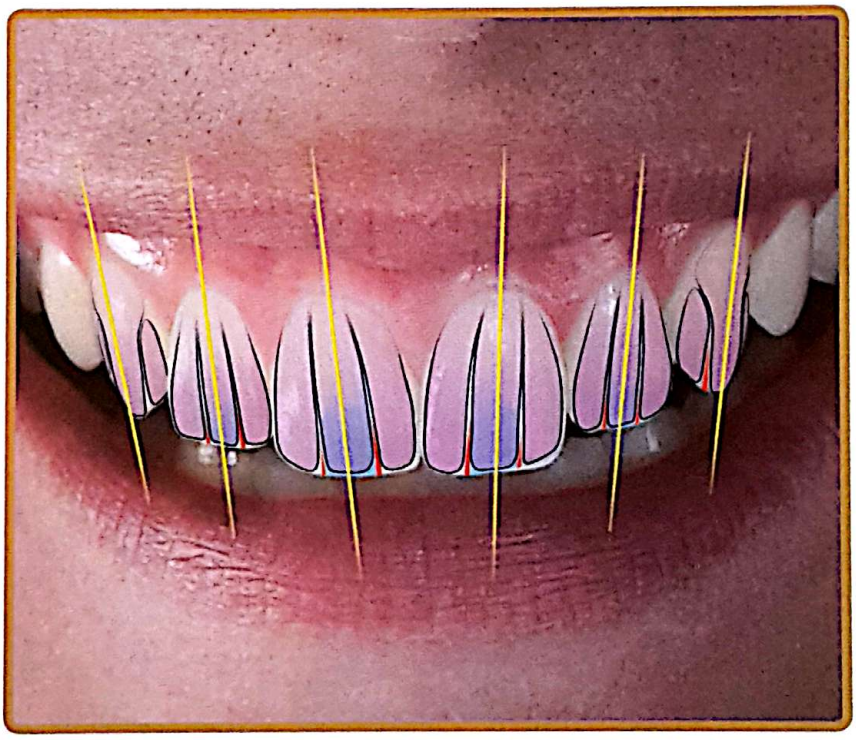
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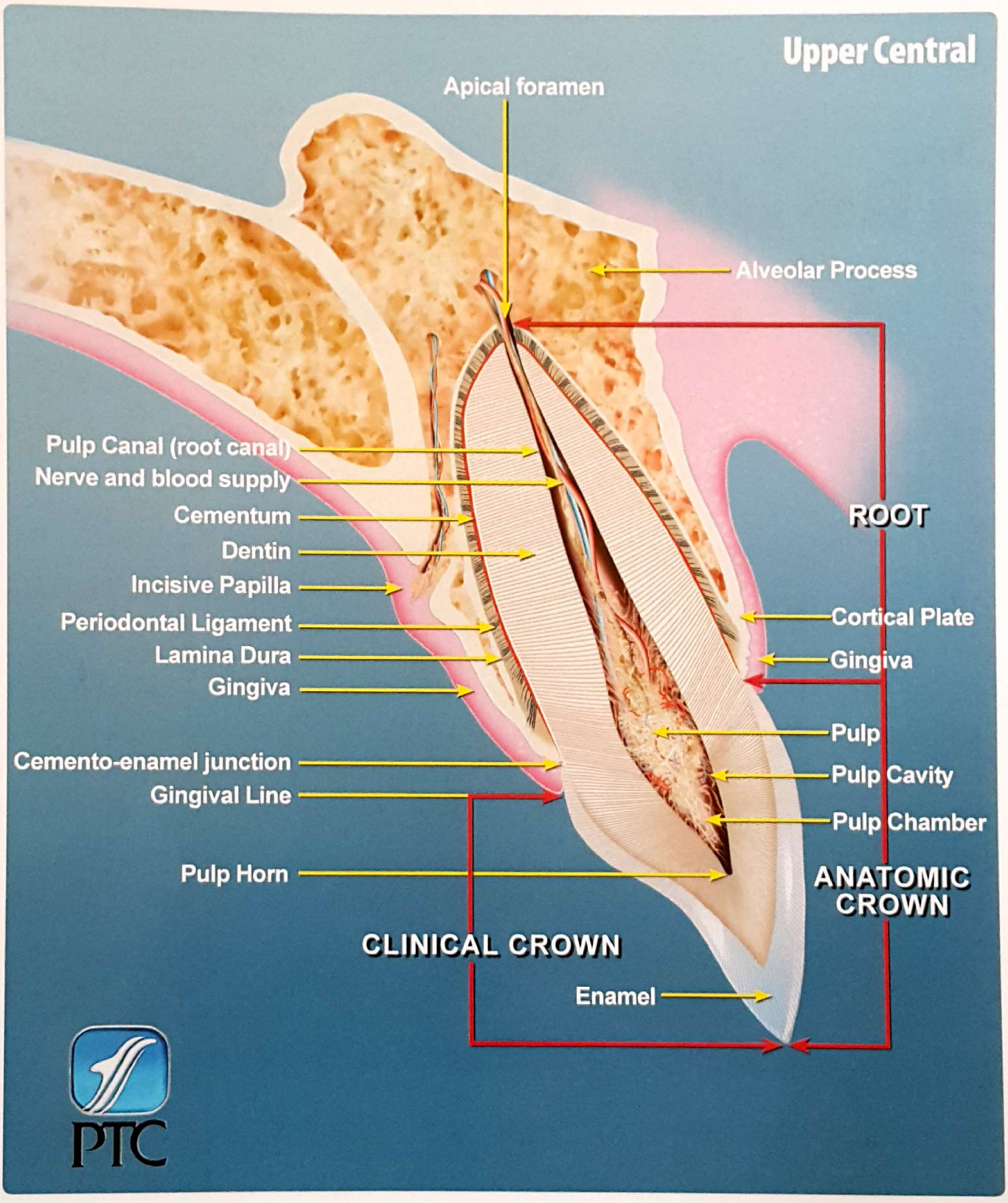
Part One

The Internal Structure of the Teeth



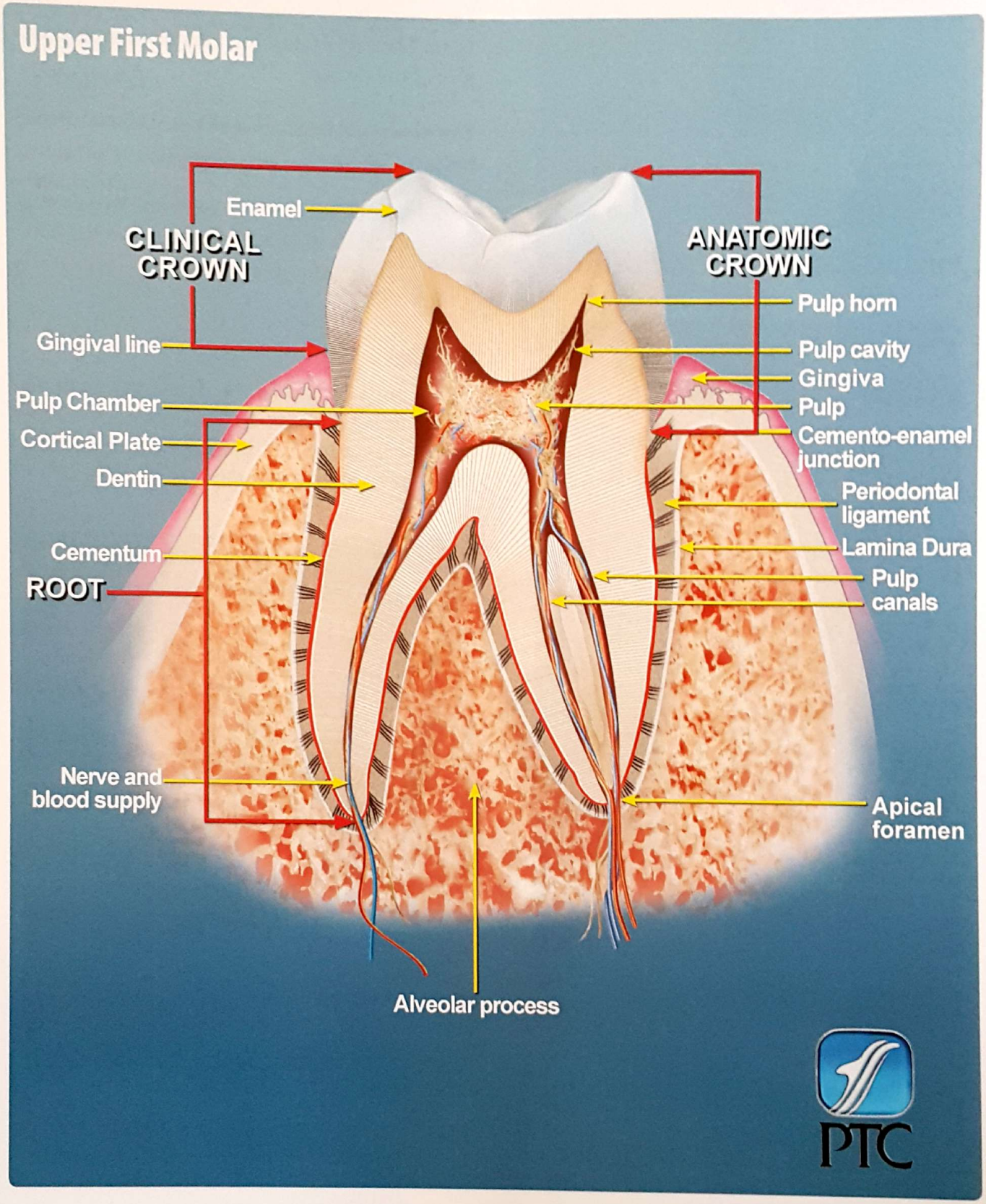
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Internal Tooth Structure



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Internal Tooth Structure



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Fig. 1 | *incisors*

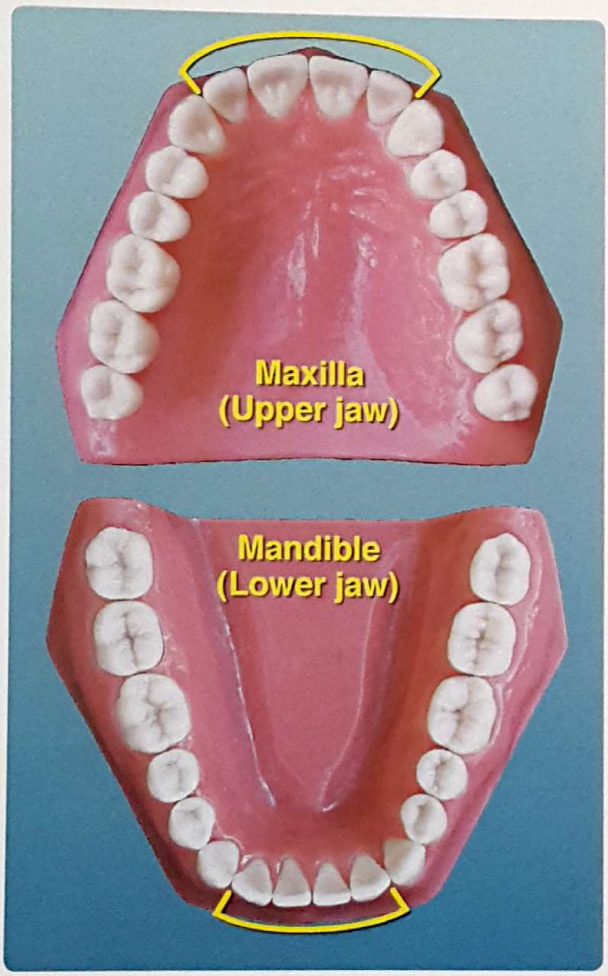


Fig. 2 | *incisors*

The Anterior Teeth

Let's begin by learning the names of the anterior teeth. Then we'll take a look at the internal structure of the teeth.

The anterior teeth are divided into two basic groups. They are:

- Incisors (of which there are two kinds: central incisors and lateral incisors), and
- Cuspids.

Incisors

The incisors are the cutting teeth, the teeth we use for biting and cutting food. The incisors are the four front teeth of both the upper and the lower jaws. *(Figs. 1, 2 and 3)*

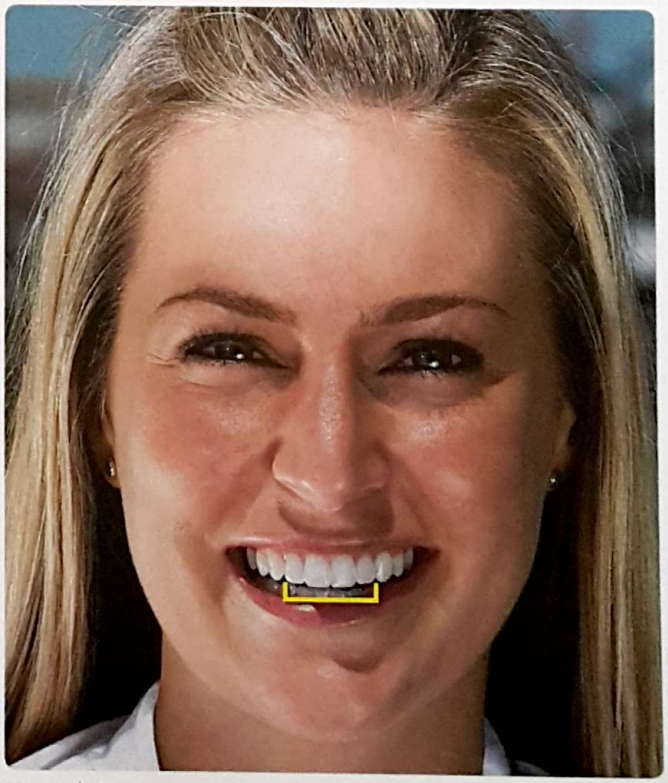


Fig. 3 | *incisors*

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Central Incisors

The **central incisors** are the two teeth in the center, at the midline of the mouth. *(Fig. 1)*

Lateral Incisors

The **lateral incisors** are the teeth next to the centrals, the second tooth from the midline on each side. *(Fig. 2)*



Fig. 1 | *central incisors*



Fig. 2 | *lateral incisors*

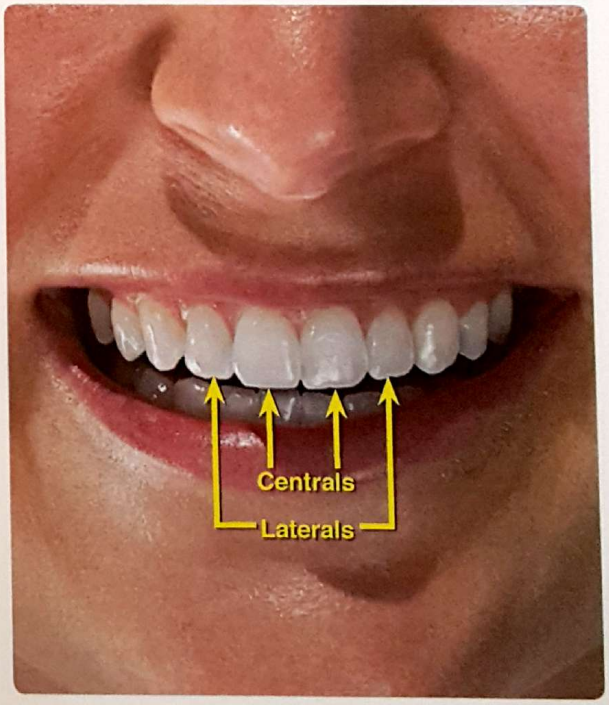


Fig. 3 | *centrals and laterals*

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Fig. 1 | *cuspids/canines*

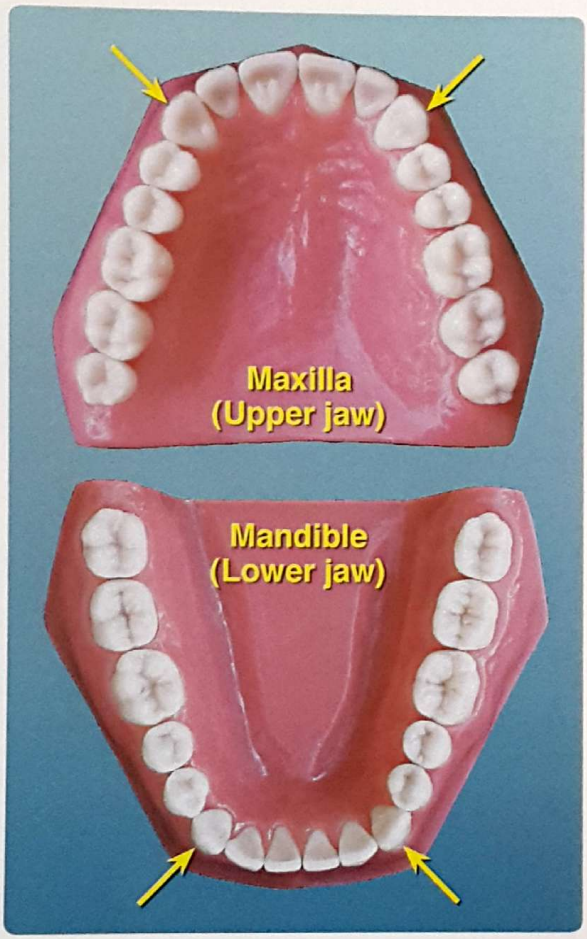


Fig. 2 | *cuspids/canines*

Cuspids

The cuspids are next to the laterals, the third tooth from the midline on each side. Cuspids have a single, rounded point, or cusp, and are used for tearing food.

They can also be referred to as canines. *(Figs. 1 and 2)*

"Cuspid" and "canine" are both common terms and are used interchangeably.

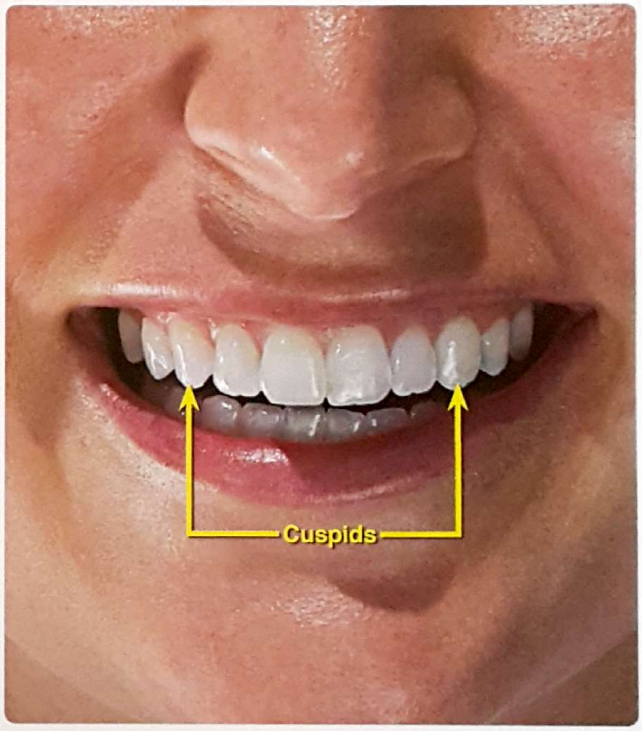


Fig. 3 | *cuspids/canines*

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Internal Tooth Structure

There are a several features you need to know about the internal structures of teeth. Because all anterior and posterior teeth have the same basic structure, we will use the upper central and upper first molar as shown at the start of this section for clarity.

Dentin is the hard, bony substance which forms the main body of a tooth. It extends from the top of the tooth, close to the incisal, to the tip of the root. It is composed of dental tubules which radiate outward from the center as shown in *Figures 1 and 2.*

The **pulp cavity** is the hollow center of the tooth. The widest part of the pulp cavity is called the **pulp chamber**. The pulp chamber of an incisor usually has two small elongations toward the incisal edge called **pulp horns**. On a molar they extend toward the cusp tips. *(Fig. 1)*

Where the pulp cavity narrows and extends through the root it creates **the pulp canal**, or **root canal**. *(Figs. 1 and 2)*

The **pulp** is the delicate connective tissue organ which supports the nerves and blood vessels inside the pulp cavity. The pulp is the vital, or alive, part of the tooth and supplies nutritional elements to the tooth. The opening of the pulp canal through the root tip is called the **apical foramen**. *(Fig. 2)*

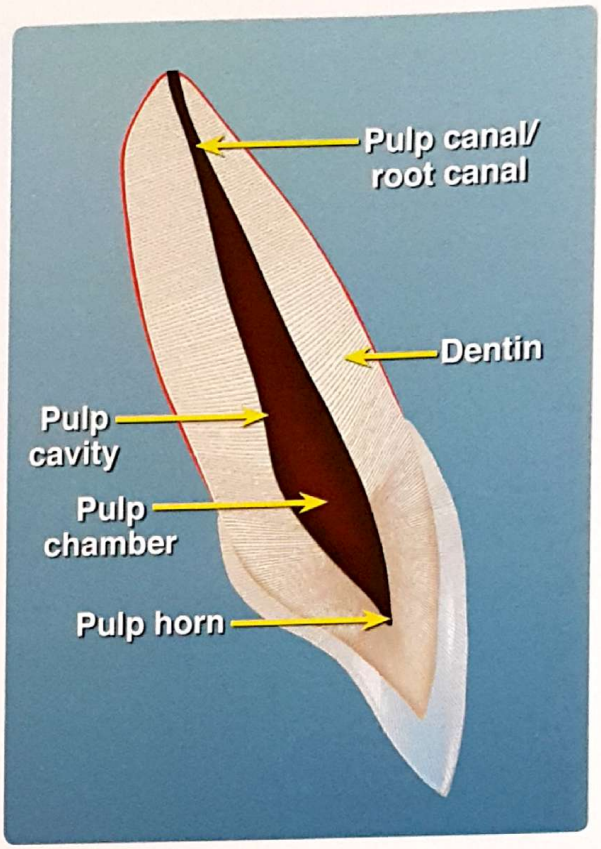


Fig. 1 | *internal structure*

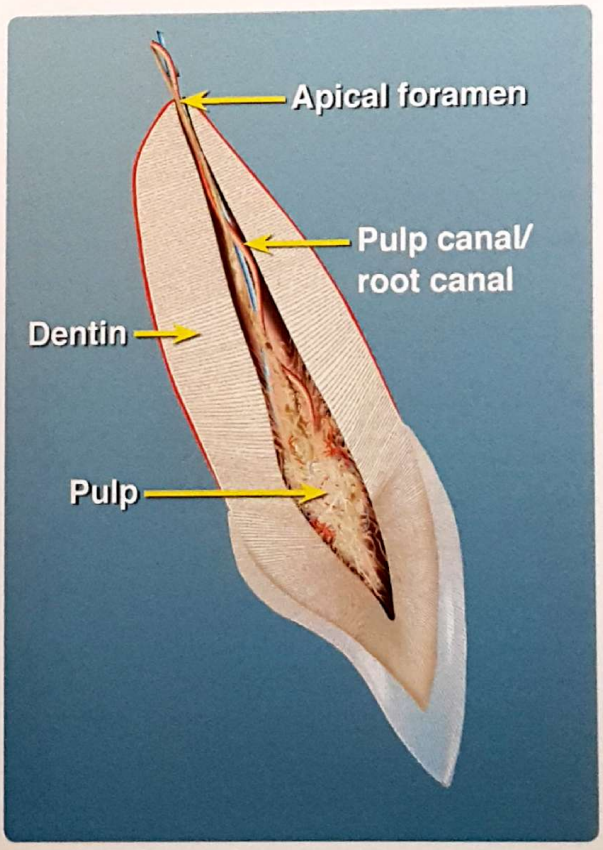


Fig. 2 | *vital internal structure*

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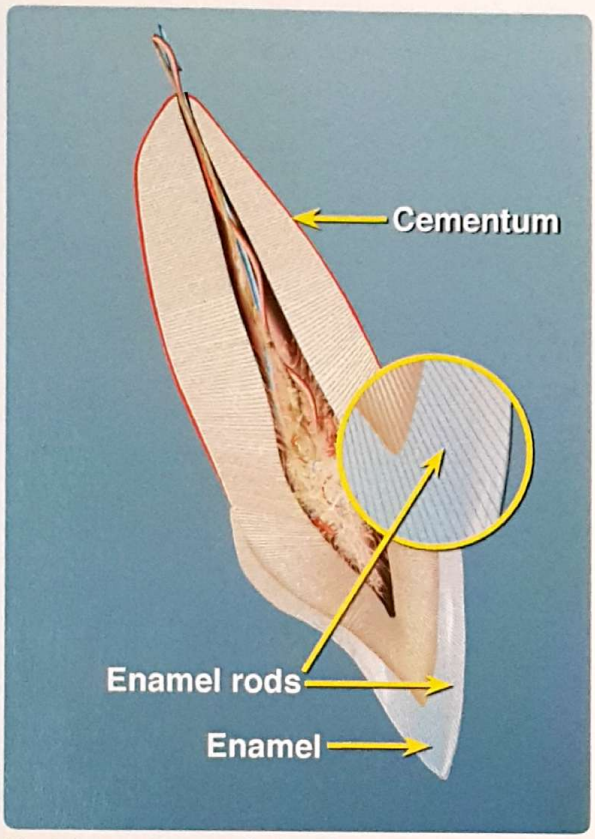


Fig. 1 | cementum and enamel

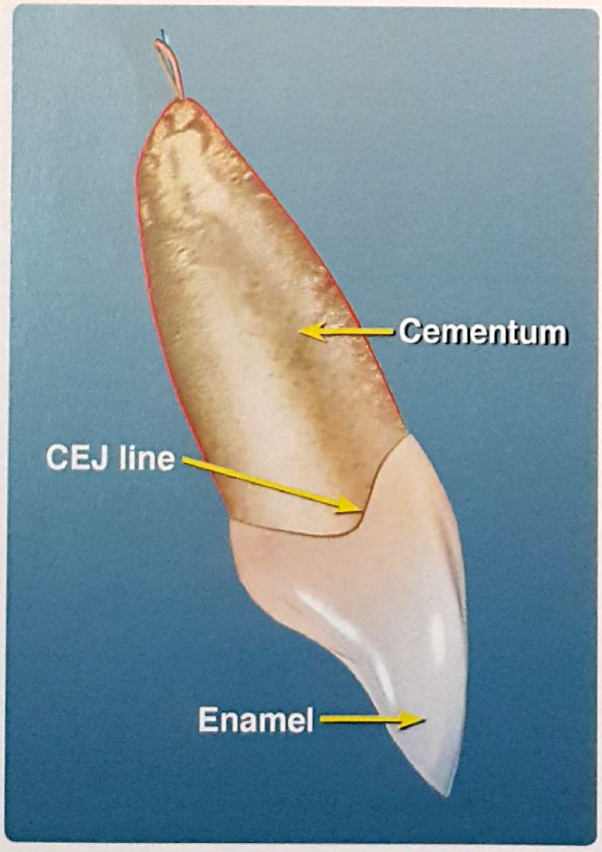


Fig. 2 | cemento-enamel junction

Enamel is the hard, mineralized tissue which covers the crown, or the exposed part of the tooth.

The **enamel** is composed of prisms, or rods, that align perpendicular to the surface of the dentin and radiate outward, just like the dentinal tubules. *(Fig. 1)*

Cementum is a thin layer of bony tissue covering the root. The cementum is less dense than the dentin and provides an attachment to the surrounding tissue. *(Fig. 1)*

The line on the surface of the tooth where the cementum meets the enamel is called the **cemento-enamel junction**. The cemento-enamel junction is often referred to as simply the "CEJ". The CEJ extends around the circumference of the tooth. *(Fig. 2)*

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The tooth sits in a socket in the **alveolar process**, the bone that supports all the maxillary and mandibular teeth. Rather than being solid, the alveolar process is made of a porous, spongy bone. The hard, outer shell of the alveolar process is known as the **cortical plate**. *(Figs. 1 and 2)*

The socket that contains each individual tooth is called the **alveolus**.

The alveolus is lined with a thin layer of bone called the **lamina dura**. A layer of fibrous connective tissue called the **periodontal ligament**, or **periodontal membrane**, attaches to the lamina dura and the cementum of the root, holding the tooth in the socket.

Bite down on your teeth now and you can feel the cushioning effect of the periodontal ligament.

The soft tissue that directly surrounds all the teeth is called the **gingiva**. *(Figs. 1 and 2)*

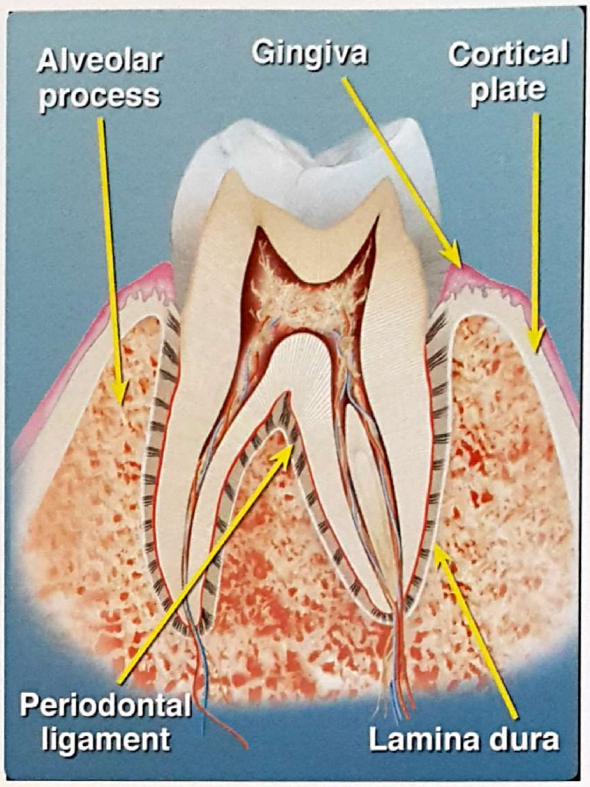


Fig. 1 | *the alveolar process*

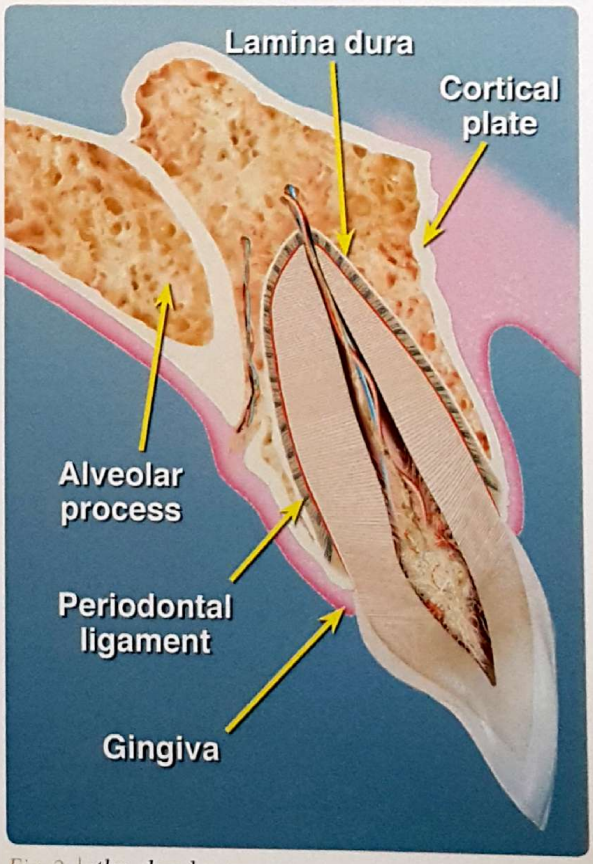


Fig. 2 | *the alveolar process*

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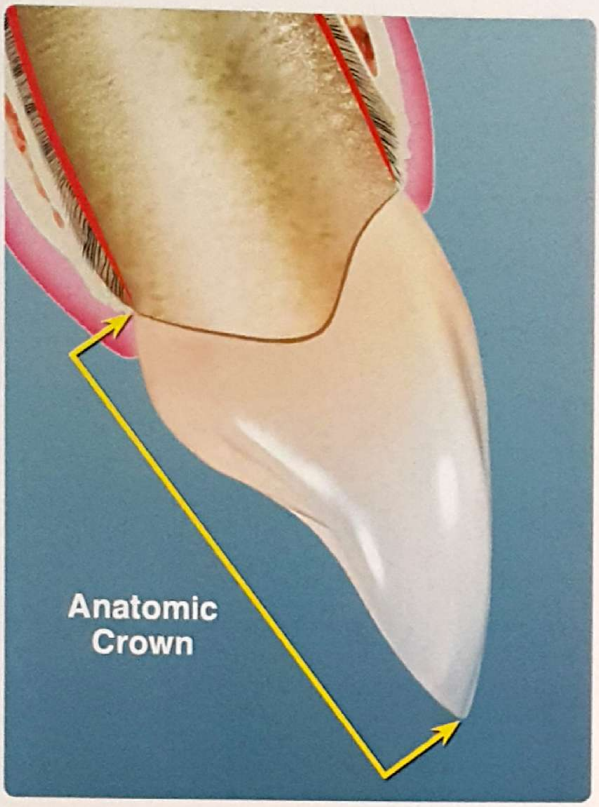


Fig. 1 | *the anatomic crown*

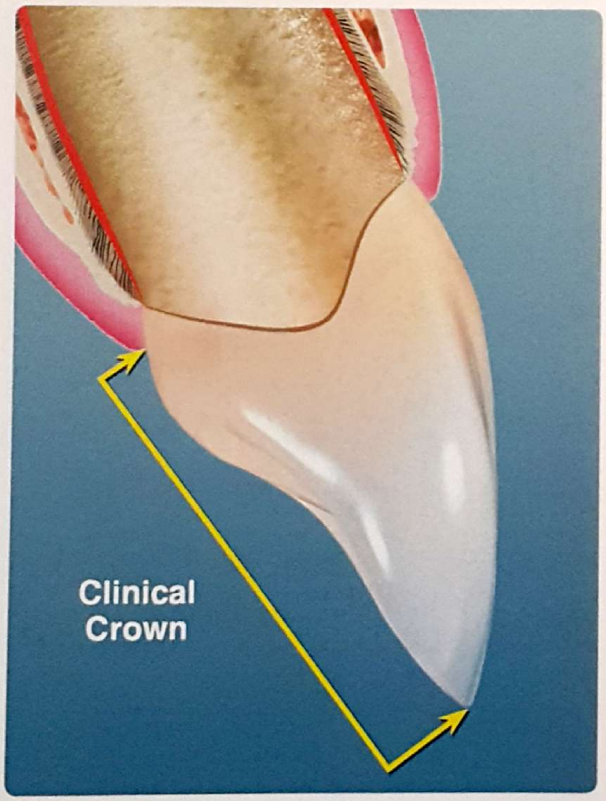


Fig. 2 | *the clinical crown*

The Crown

We aleady know that the crown is the exposed portion of the tooth. Lets look at the crown more closely.

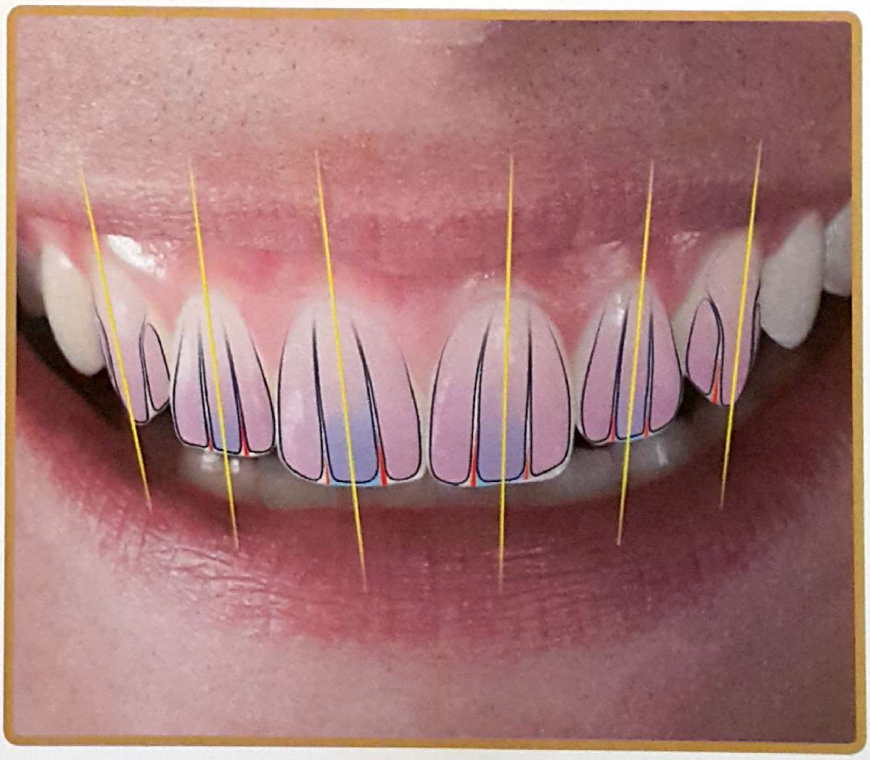
There are two definitions for the term "crown" when talking about teeth. The first definition of crown is the **anatomic crown**, the portion of the tooth that is covered by enamel and extends to the cemento-enamel junction, usually below the gingiva. *(Fig. 1)*

The second is the **clinical crown**, that part of the tooth that is visible above the gingiva. *(Fig. 2)*

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Part Two

Simplifying Anterior Dental Anatomy



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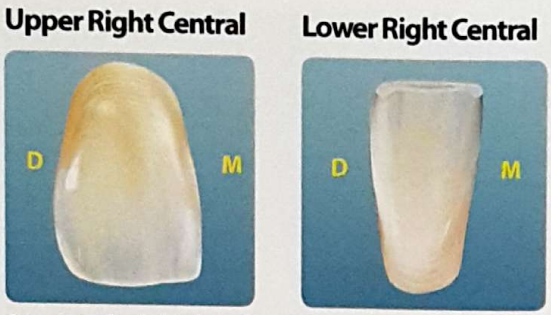


Fig. 1 | the labial surface

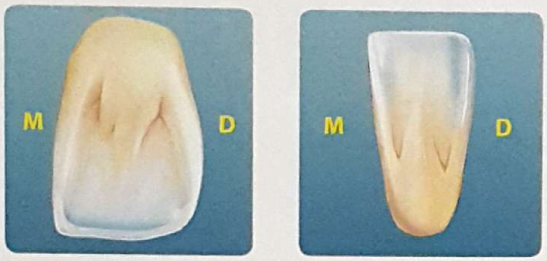


Fig. 2 | the lingual surface



Fig. 3 | the mesial surface



Fig. 4 | the distal surface

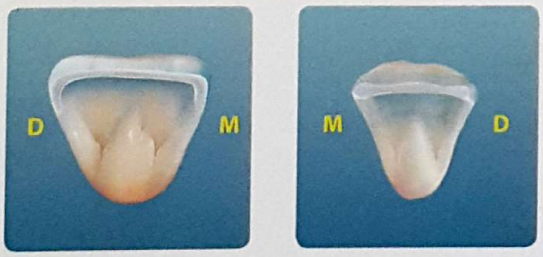


Fig. 5 | the incisal surface

The Tooth Surfaces

Each anterior tooth has five exposed surfaces.

Labial

The labial surface is the surface of the tooth toward the lips. It is also called the facial surface. *(Fig. 1)*

Lingual

The lingual surface is the surface toward the tongue. *(Fig. 2)*

Mesial

The mesial surface is the surface of the tooth that faces toward the midline of the mouth. *(Fig. 3)*

Distal

The distal surface is the surface that faces away from the midline. *(Fig. 4)*

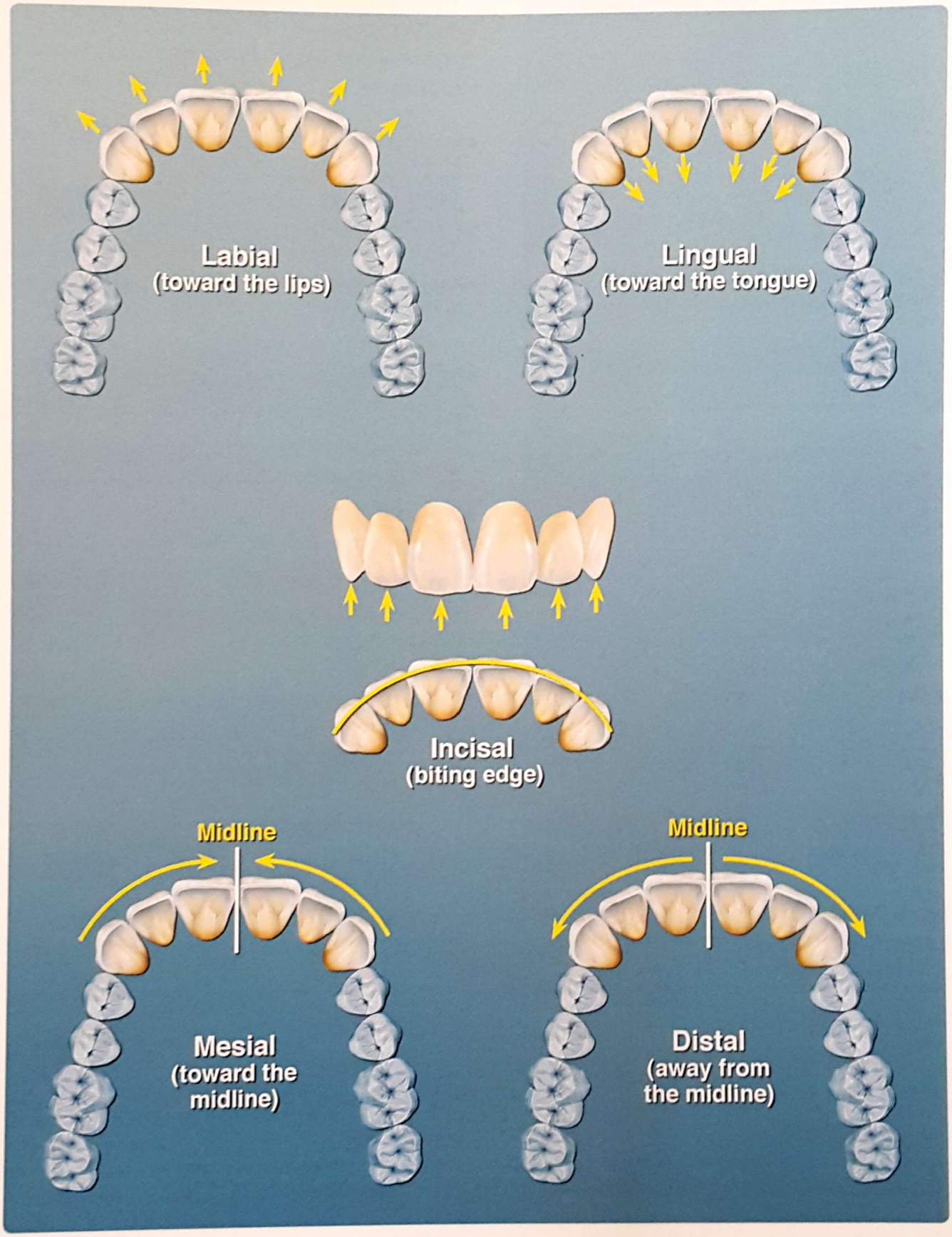
Incisal

The incisal surface is the biting edge of the tooth. *(Fig. 5)*

The surfaces are called the same whether they are on the maxillary (upper) teeth or on the mandibular (lower) teeth.

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The Tooth Surfaces



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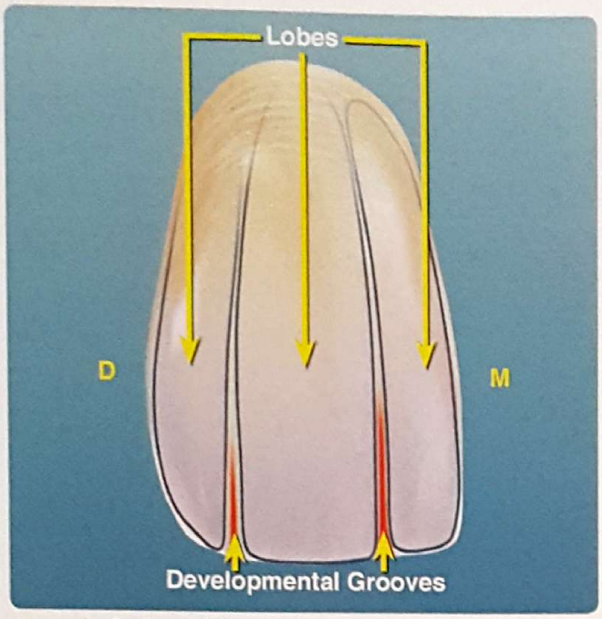


Fig. 1 | the basic labial features

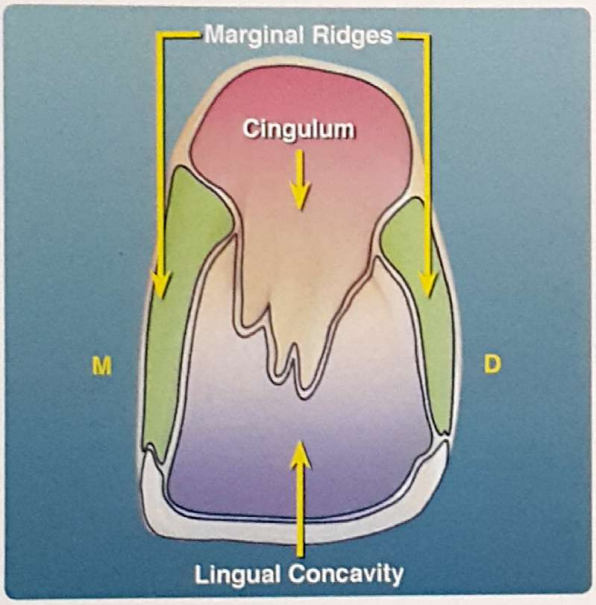


Fig. 2 | the basic lingual features

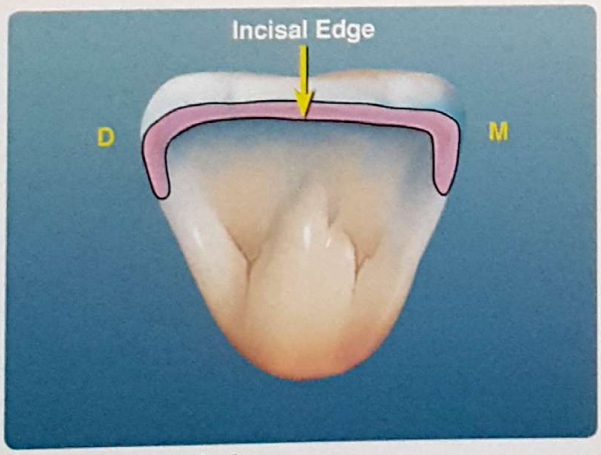


Fig. 3 | the incisal edge

The Basic Features

Each surface has a series of convexities and concavities which make up the anatomical features. They are:

Lobes

Lobes are convexities, or raised areas, that run vertically through the tooth. The three lobes are the first part of the tooth to develop. They grow together, creating the final overall shape of the tooth.

Developmental Grooves

Developmental grooves are concavities that were developed when the lobes grew together, leaving slight depressions in the labial surface. *(Fig. 1)*

Cingulum

The cingulum is the large convexity on the lingual surface, close to the gingival tissues (the gums).

Marginal Ridges

Marginal ridges are the convex areas that form the mesial and distal borders of the lingual surface.

Lingual Fossa

The lingual fossa, or lingual concavity, is the large depression on the lingual surface. It is bordered by the marginal ridges, the cingulum, and the incisal edge. *(Fig. 2)*

Incisal Edge

The incisal edge is the biting surface of the tooth. *(Fig. 3)*

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Simplifying Anatomy

You'll be surprised to know that once you learn the anatomy of one tooth, you will have learned the anatomy of several teeth. *(Figs. 1 and 2)*

Remember that a tooth on one side of the mouth is the mirror image of the corresponding tooth on the other side of the mouth. For example, the upper central on the right side looks just like the central on the left side if you hold it up to a mirror. *(Fig. 3)*

Note: *The purpose of learning anterior anatomy is for each student to be able to differentiate these anatomical features in order to replicate them in wax, porcelain and other technologies such as CAD/CAM manufacturing.*

As we proceed through the book, note that the terms "right" and "left" are always used to describe the patient's right and left, not our own. *(Fig. 3)*

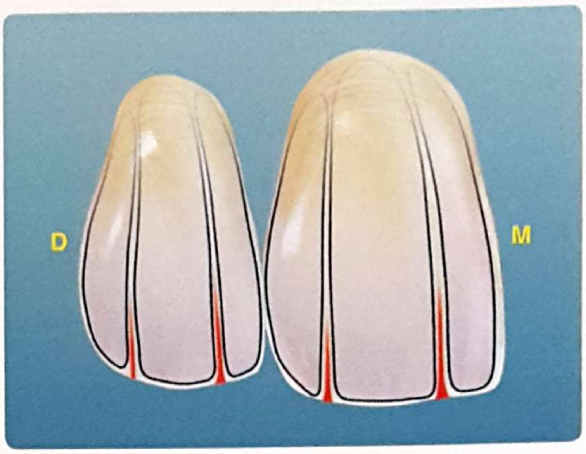


Fig. 1 | *tooth similarities*

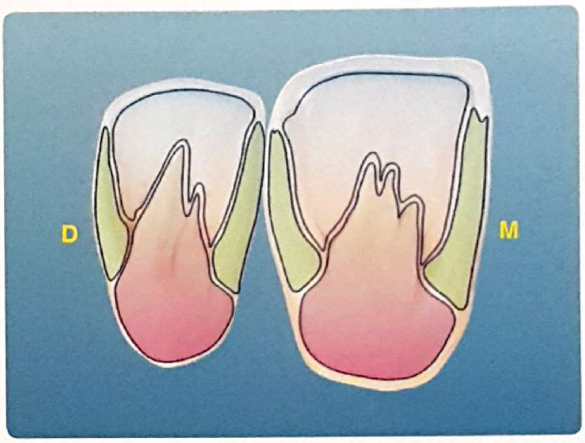


Fig. 2 | *tooth similarities*

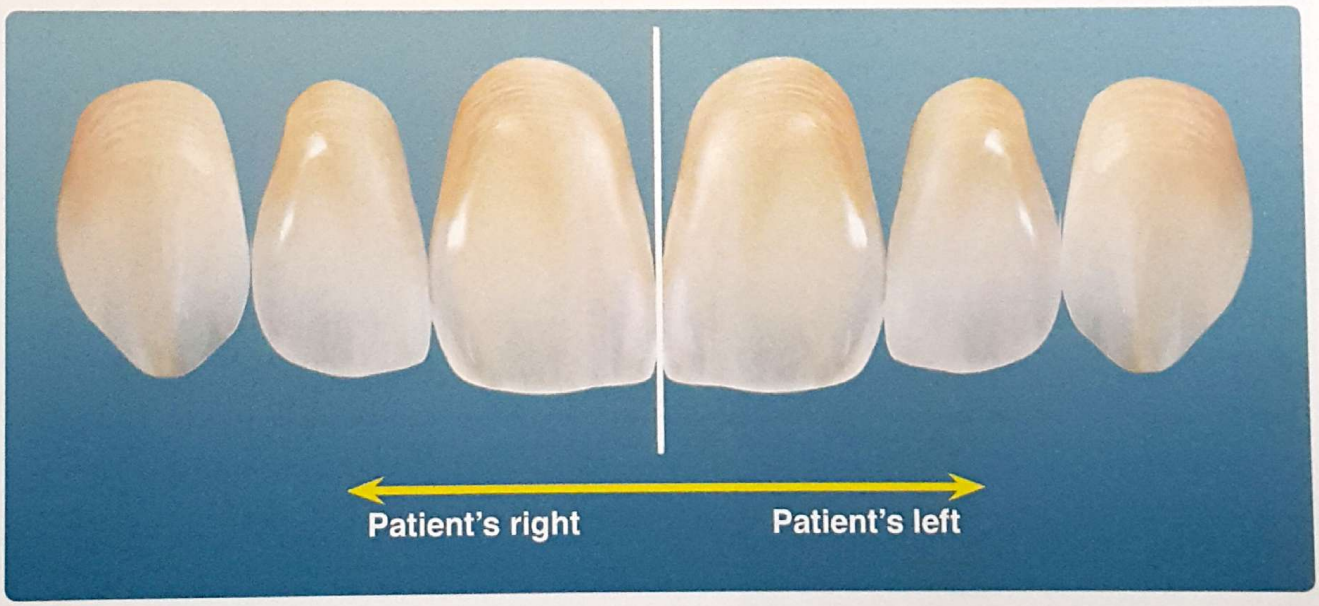


Fig. 3 | *mirror image*

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Fig. 1 | *the Ness Teeth*

Let's look at the upper and lower teeth and find out how the anatomical features are arranged, and how the features are similar in all the teeth. Later, we'll describe the few unique features that are found on some of the teeth.

Note: *Refer to the Anatomical Reference at the end of this manual for illustrations of all the individual upper and lower anterior teeth. Keep the anterior Ness Teeth™ close at hand while you study. You can see, as well as feel, the features we are talking about as we go. (Fig. 1)*

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The Long Axis

The last thing we need to discuss before we go into detail about the anatomical features is the **long axis** of the tooth.

Consider an imaginary line through the middle of the longest part of the tooth from the incisal to the gingival. Because the overall body of the tooth is not perfectly vertical, neither is the line. It aligns with the body as you can see on this central. This is the long axis of the tooth. *(Fig. 1)*

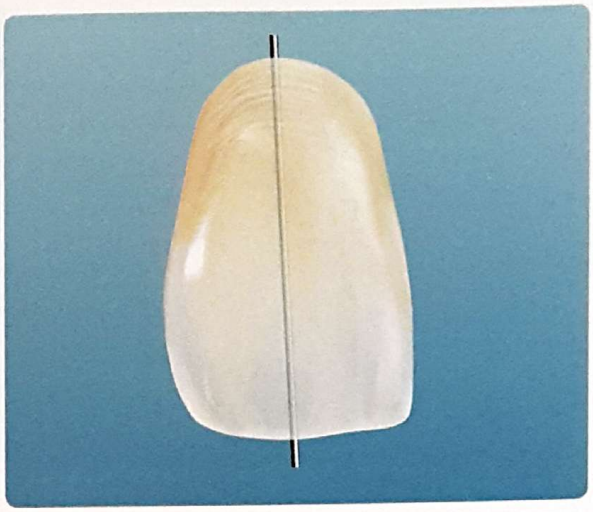


Fig. 1 | *the long axis*

You may be familiar with the leaning tower of Pisa. When the architects designed it, they of course placed all the walls, windows and columns vertically, in line with the long axis of the tower. *(Fig. 2)*

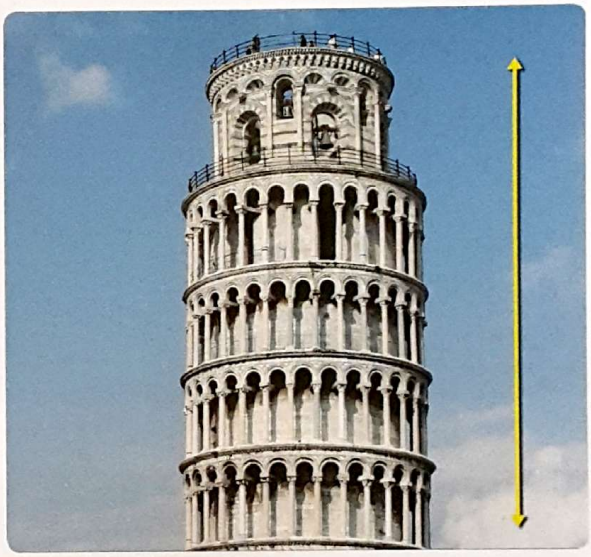


Fig. 2 | *the Tower of Pisa*

Due to a problem with its foundation, the tower shifted over the years to the leaning position in which we see it today. The long axis of the building has tilted. However, all the walls, windows and columns remained in alignment with the axis, moving with it as the tower leaned. *(Fig. 3)*

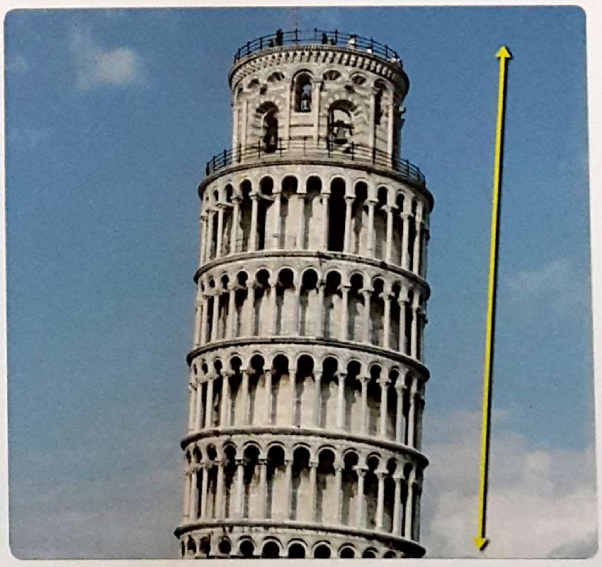


Fig. 3 | *the leaning tower*

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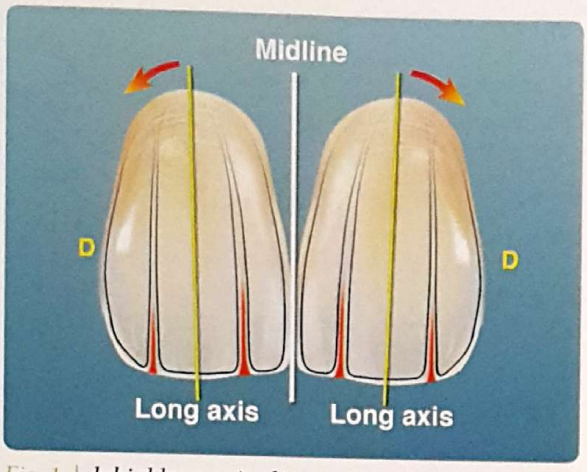


Fig. 1 | labial long axis alignment

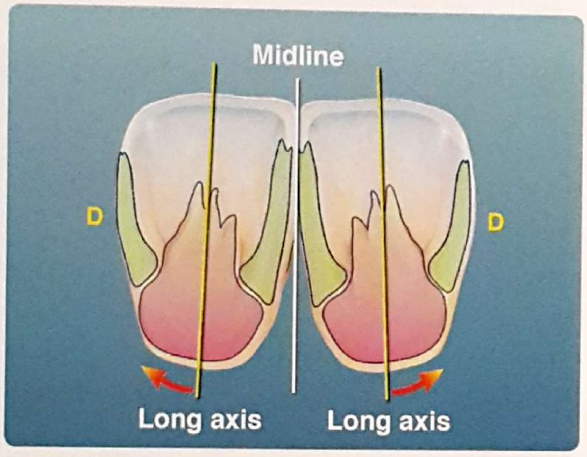


Fig. 2 | lingual long axis alignment

It is important to know that, in the same manner, the anatomical features of each tooth were formed in alignment with its long axis.

For example, the lobes, developmental grooves, marginal ridges and cingula of the centrals align with the long axes as shown in *Figures 1, 2 and 3.*

Note: *The long axis is important when we communicate how teeth are arranged in the patient's mouth. When the restorative dentist wants to modify or change the appearance of one tooth, understanding the long axis gives us a way to communicate and modify the features to match his request.*

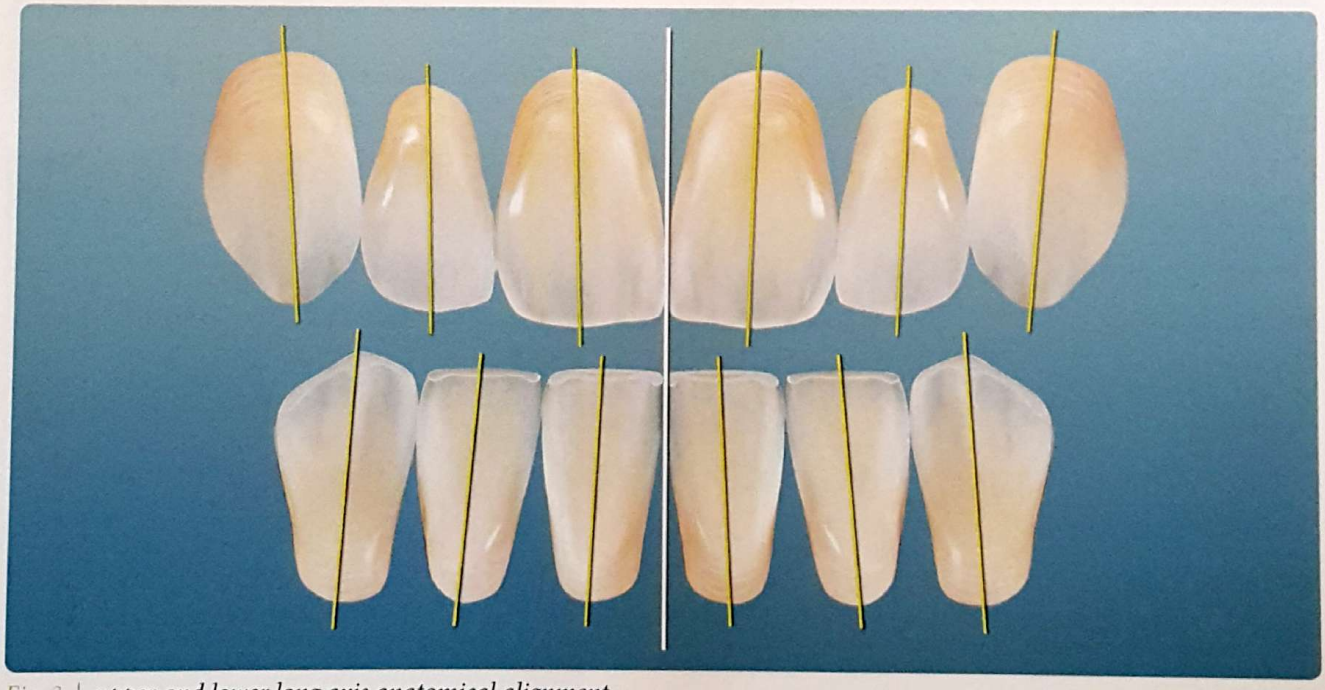


Fig. 3 | upper and lower long axis anatomical alignment

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The Lobes

Each anterior tooth has three labial **lobes**, the mesial lobe, the central lobe and the distal lobe.

Let's take a closer look. The **mesial lobe** on the central runs from the incisal edge to the gingival, blending into and forming the gingival bulge. The mesial lobe is the longest and the most prominent of the three lobes. *(Fig. 1)*

Now look at the **distal lobe**. It's quite prominent, like the mesial lobe, but has a more soft, rounded look. It's also not as long as the mesial lobe. *(Fig. 2)*

The **central lobe** is a little different. It's wider than the others, and not as prominent. It varies a little from patient to patient, and is usually depressed slightly from the other two lobes. Occasionally, it will be more pronounced. *(Fig. 3)*

Notice how each lobe is aligned with the long axis of the tooth.

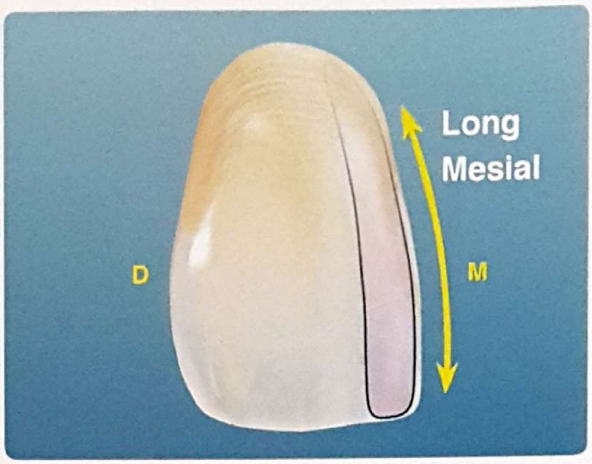


Fig. 1 | *mesial lobe*

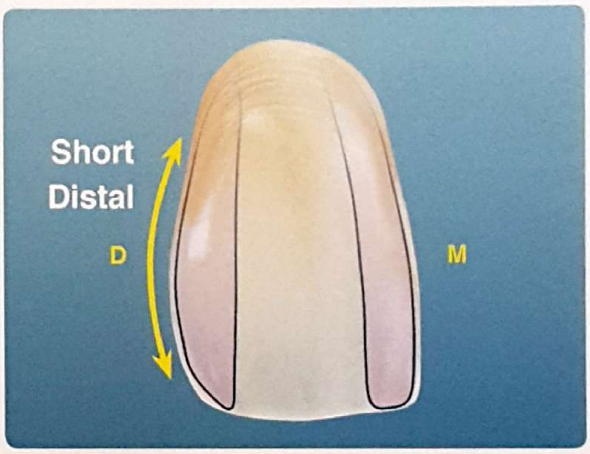


Fig. 2 | *distal lobe*

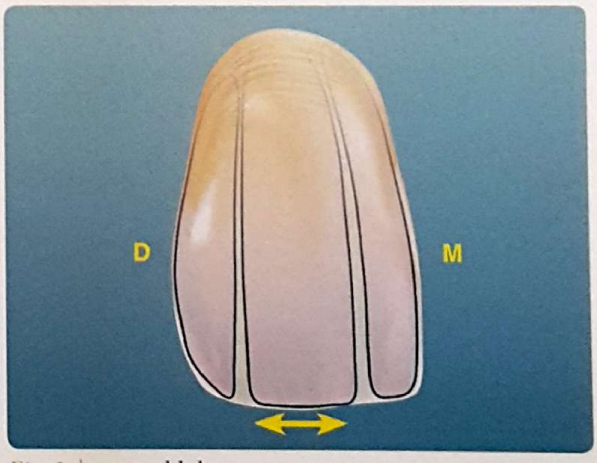


Fig. 3 | *central lobe*

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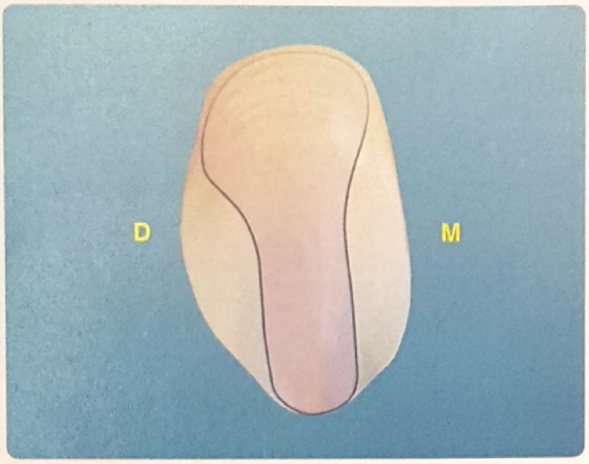


Fig. 1 | central lobe

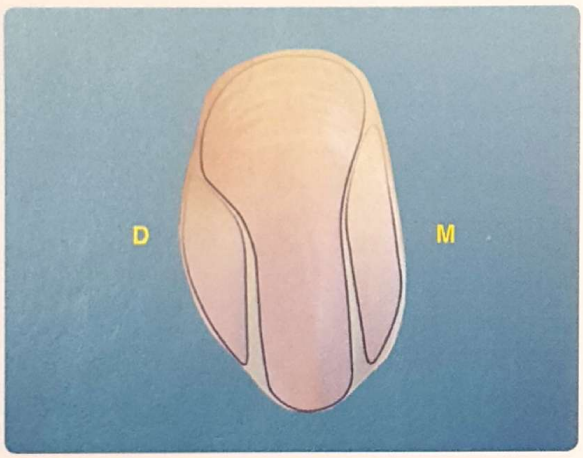


Fig. 2 | cuspid lobes

On the **cuspids**, the lobes have a different emphasis. The central lobe is the longest, widest and most prominent of the cuspid lobes. *(Fig. 1)* The mesial lobe is shorter and less prominent than the central lobe, while the distal lobe is the shortest and least prominent of the three. *(Fig. 2)*

Notice how the lobes of all anterior teeth align with the long axes, giving each tooth its form. *(Fig. 3)*

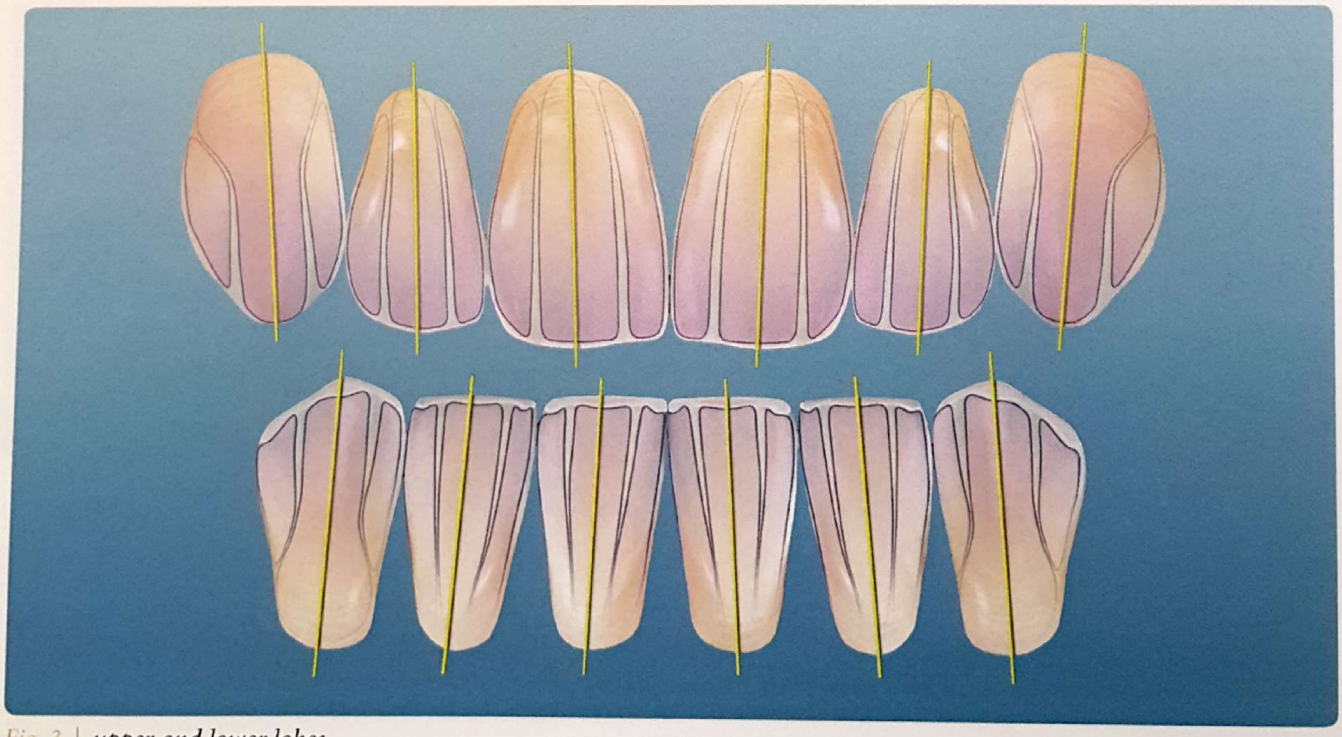


Fig. 3 | upper and lower lobes

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The Gingival Bulge

Where the tooth emerges from the gingiva on the labial surface, the enamel bulges out a little. This protects the gingiva from food during mastication, or chewing.

This gingival bulge is formed by the convergence of the three lobes coming together at the gingival third of the tooth. *(Fig. 1)*

When viewed in profile, this bulge forms the **emergence profile** of the tooth. *(Fig. 2)*

Note: "The emergence profile is the part of anatomic crown contour viewed along the long axis of a tooth that begins at the cemento-enamel junction, below the gum line at the base of the gingival sulcus, extending past the free margin of the gingiva into the oral environment." - Burney M. Croll, DDS

Notice that on all incisors, the long mesial lobe blends into the gingival bulge. The distal lobe is shorter and is less prominent where it blends into the bulge. The central lobe follows the long axis and completes the form of the bulge. *(Fig. 3)*

On the incisors there's also a shallow depression at the base of the central lobe called the "S" curve. We'll discuss the "S" curve in detail later. *(Fig. 4)*



Fig. 4 | the "S" curve

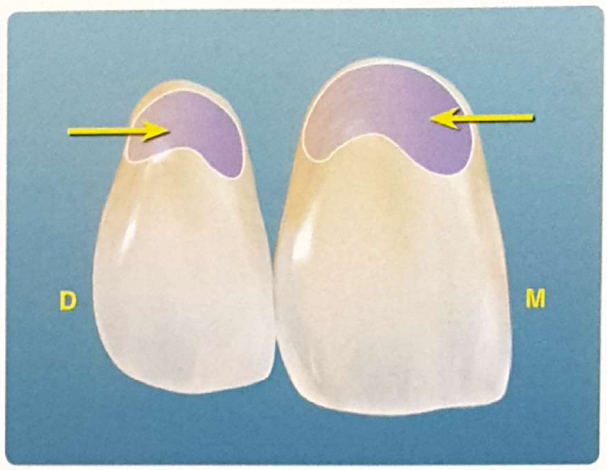


Fig. 1 | the gingival bulge

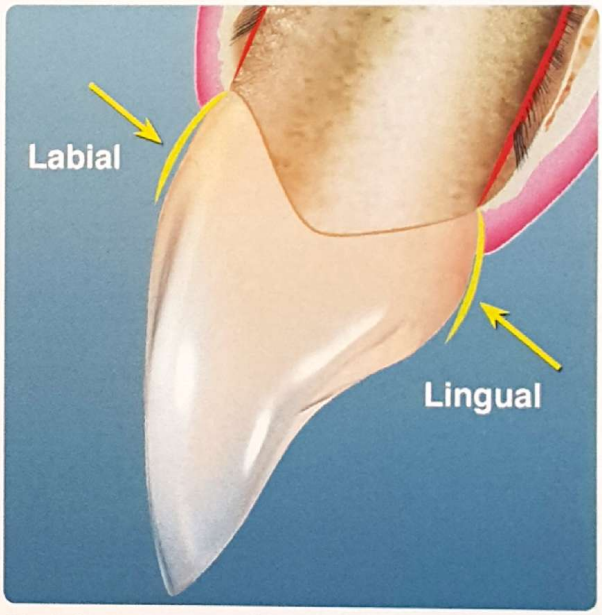


Fig. 2 | emergence profile

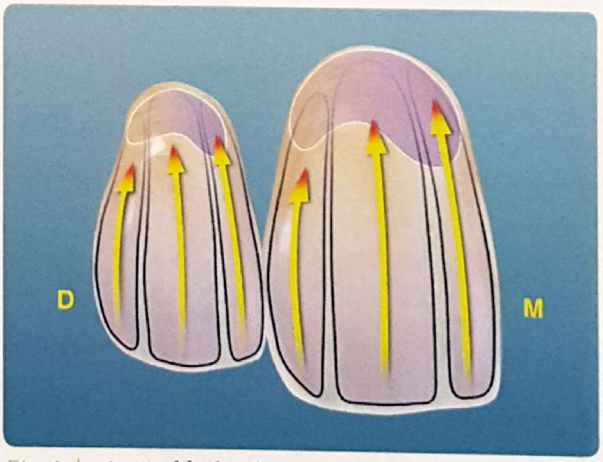


Fig. 3 | gingival bulge formation

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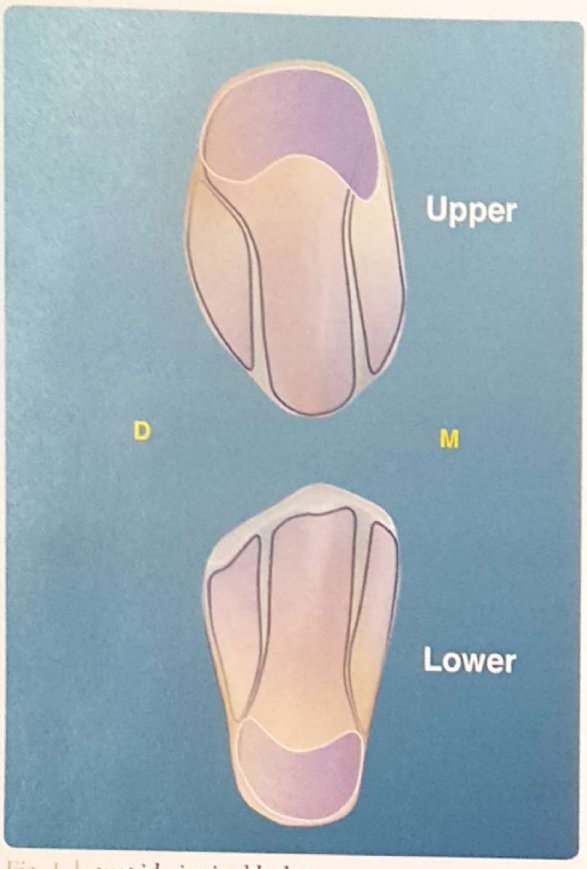


Fig. 1 | cuspid gingival bulge

On a cuspid, the central lobe extends into and forms the majority of the gingival bulge. The mesial lobe blends into the prominence of the central lobe. The distal lobe, being smaller, is separated from the gingival bulge by a slight depression. *(Fig. 1)*

Figure 2 demonstrates the gingival bulges on all anterior teeth.



Fig. 2 | upper and lower gingival bulges

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Developmental Grooves

Anterior teeth have **developmental grooves**, shallow, vertical grooves or depressions that were formed where the three labial lobes grew together. These grooves help determine the fullness of the mesial and distal lobes. As you would expect, the developmental grooves run parallel with the long axis. *(Fig. 1)*

On the centrals, the mesial developmental groove is longer, extending from the incisal edge gingivally into the middle third of the tooth. This distinguishes the prominence of the mesial lobe from the central lobe. The distal groove is shorter, extending just into the middle third, but still in line with the long axis. It distinguishes the distal lobe from the central lobe. *(Fig. 1)*

On the laterals, the mesial developmental groove is like a central. However, the distal groove can sometimes be diminished due to the prominence of the central lobe blending with the distal lobe. *(Fig. 2)*

On cuspids, the mesial groove is shorter, extending only through the incisal third of the tooth. The distal groove is longer, extending through the middle third of the tooth. *(Fig. 3)*

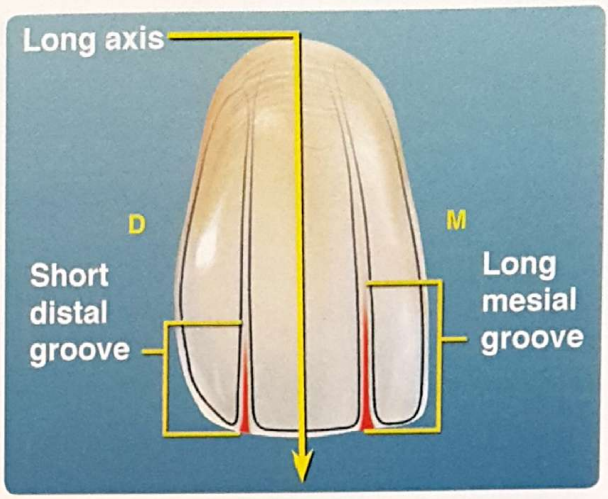


Fig. 1 | *developmental grooves*

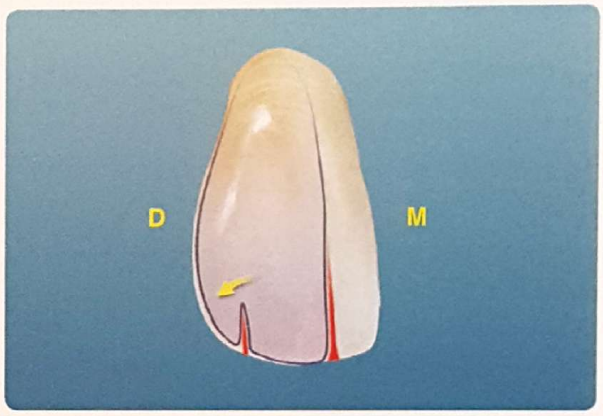


Fig. 2 | *lateral developmental grooves*

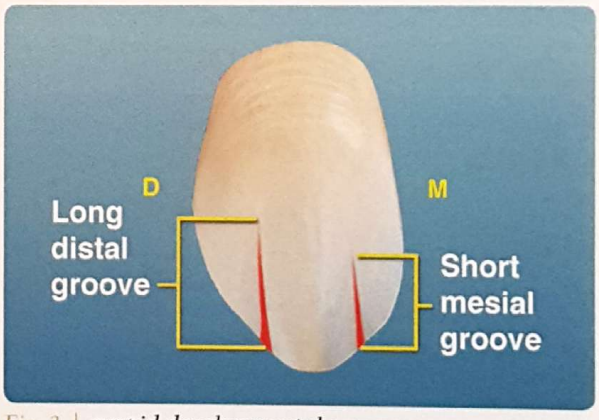


Fig. 3 | *cuspid developmental grooves*

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Figure 1 shows the developmental grooves in alignment with each tooth's long axis. Notice how on the centrals and laterals, the mesial grooves are longer, while on the cuspids, the distal grooves are longer.

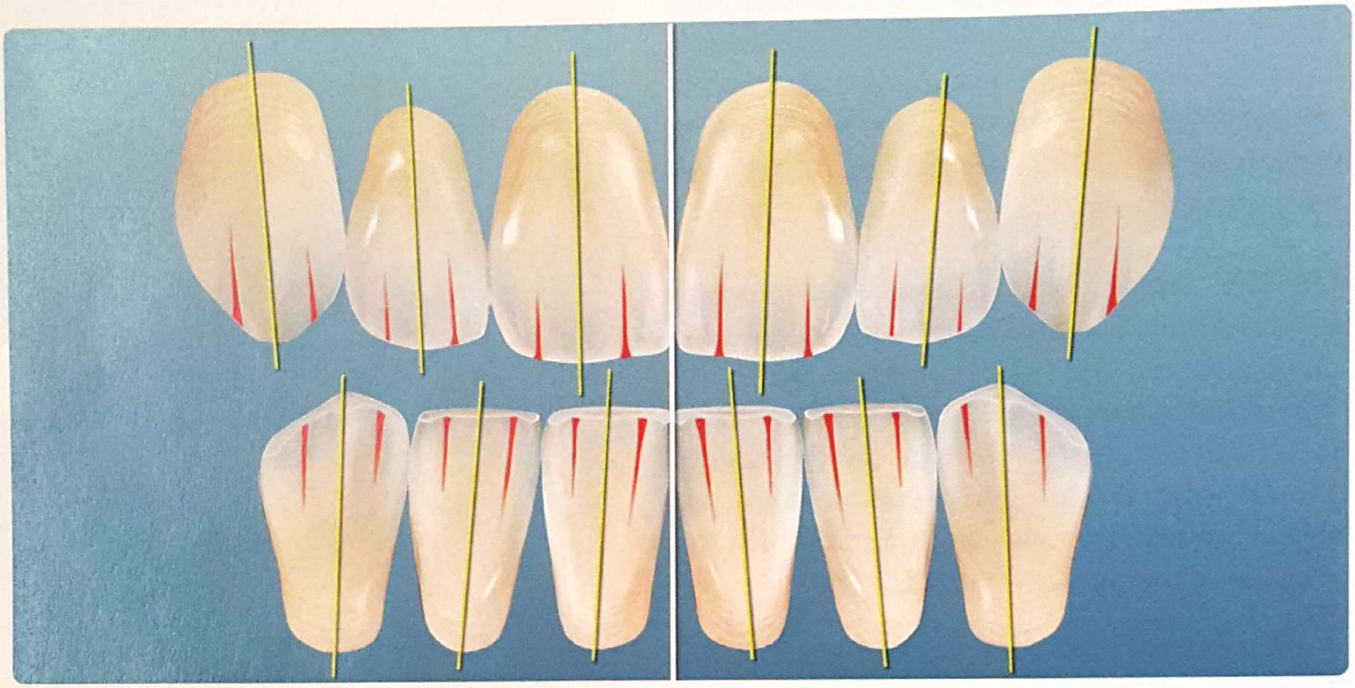


Fig. 1 | developmental grooves

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Cemento-Enamel Junction

We learned in Part One that the root of the tooth is covered by a hard substance called **cememtum** and that the crown of the tooth is covered by an even harder material called **enamel**. We also learned that where the two meet is called the **cemento-enamel junction**, or CEJ. *(Fig. 1)*

You can recognize the CEJ as an anatomical feature because the enamel creates a slight ledge in that area, called the **cervical line**. *(Fig. 2)*

Take a look at all the cemento-enamel junctions on the anterior teeth. *(Fig. 3)*

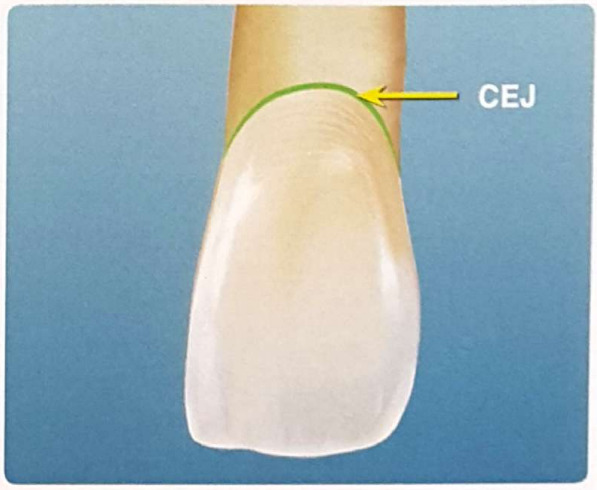


Fig. 1 | cemento-enamel junction

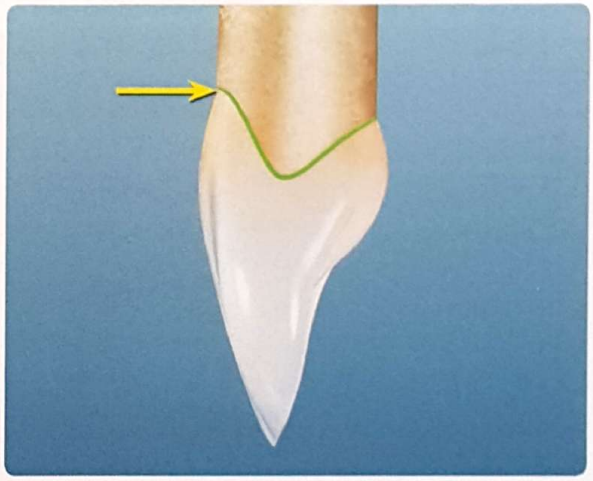


Fig. 2 | the cervical line



Fig. 3 | cemento-enamel junctions

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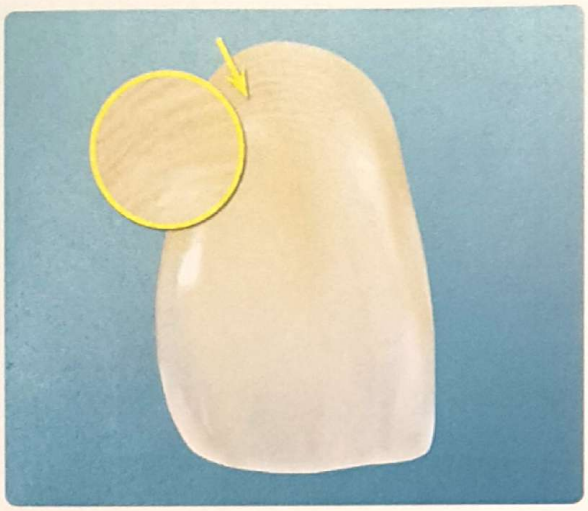


Fig. 1 | imbrication lines



Fig. 2 | perikymata effect

Imbrication Lines

From the cervical line to the gingival bulge, there are a series of subtle, broken, crescent-shaped ridges, called **imbrication lines**, running parallel to the CEJ. *(Fig. 1)*

These lines diffuse light and can be visible on all anterior teeth. However, they are less apparent on the laterals.

Above the imbrication lines, we find the surface texture to be highly polished due to normal wear of the teeth. However, in younger teeth, the middle and incisal thirds can exhibit what is known as the **perikymata** effect, which appears as subtle, horizontal surface striations, due to the original formation of the enamel rods. *(Fig. 2)*



Fig. 3 | imbrication lines

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Lingual Anatomy

The lingual anatomy is a little simpler to understand, as there are just four basic features.

The Cingulum

The **cingulum** is a large convexity which is formed as the fourth lobe and extends up from the gingiva, fading into the middle third of the tooth. The cingulum is convex in all directions and creates the gingival border of the lingual surface. *(Fig. 1)*

The convexity of the cingulum varies in shape and prominence. This example shows several configurations of how the cingula could be formed. *(Fig. 2)*

You can see in *Figure 3* the position of each cingulum on the upper and lower anterior teeth.

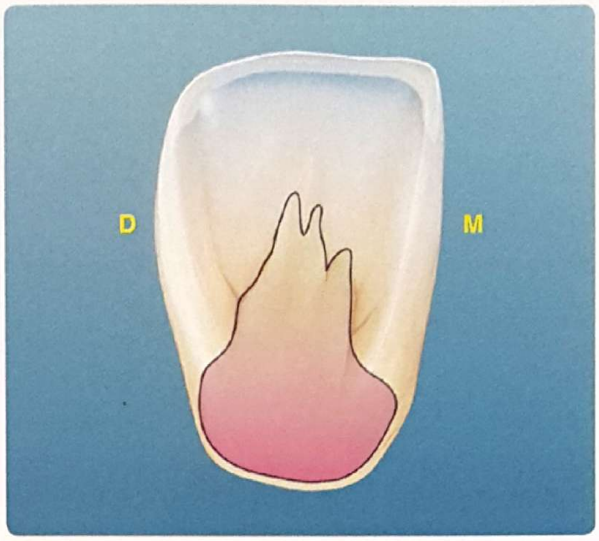


Fig. 1 | *the cingulum*

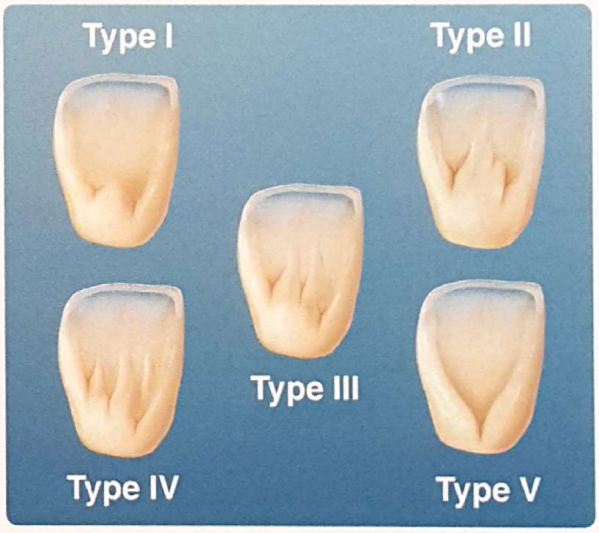


Fig. 2 | *cingulum variations*

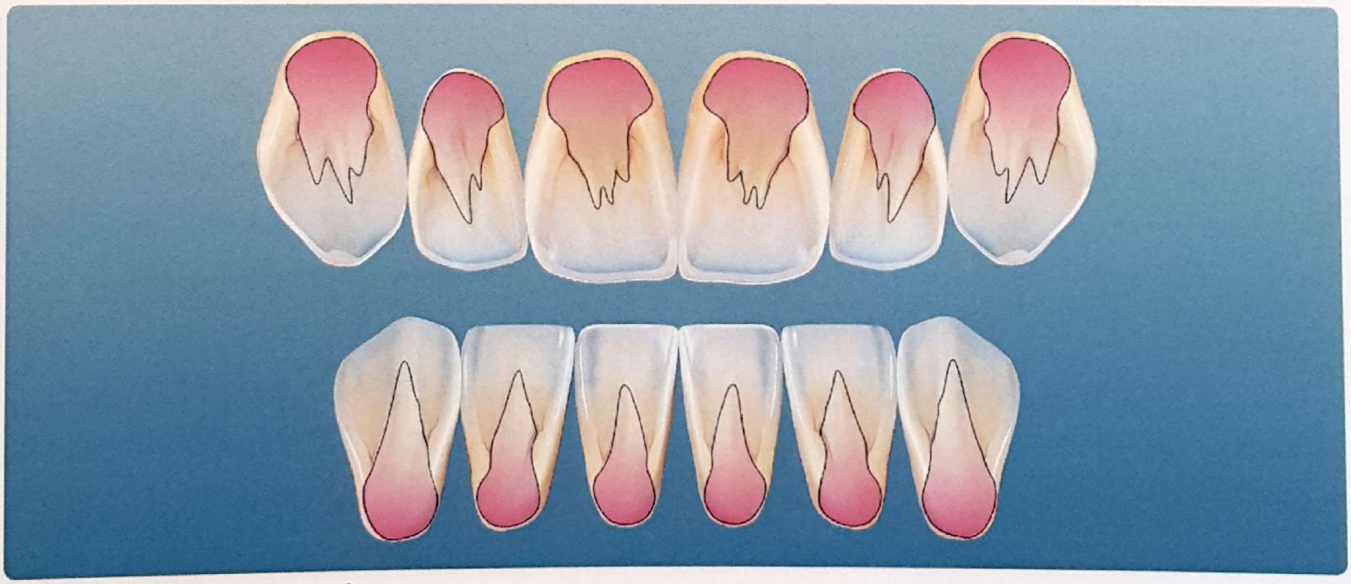


Fig. 3 | *upper and lower cingula*

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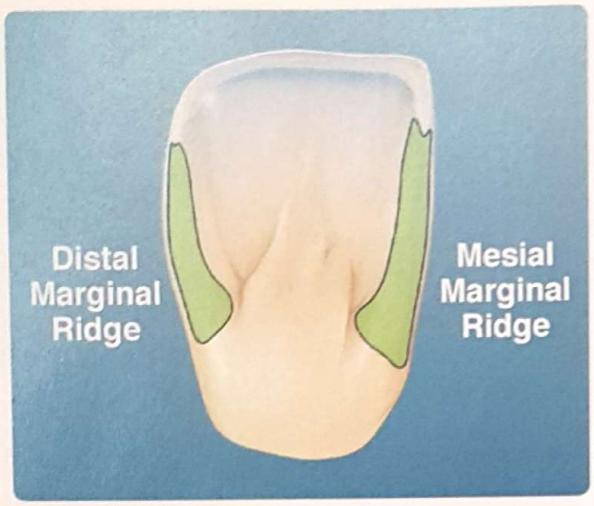


Fig. 1 | *marginal ridges*

Marginal Ridges

The **marginal ridges** form the mesial and distal borders of the lingual surface. *(Fig. 1)*

Marginal ridges vary in prominence. However, in all cases they blend into the cingulum as shown. *(Figs. 2 and 3)*

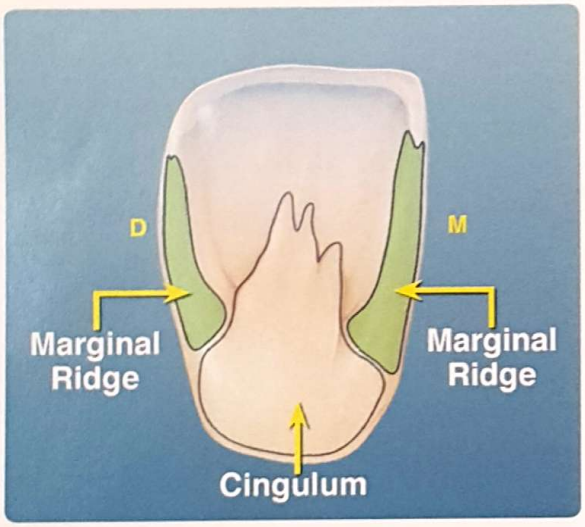


Fig. 2 | *lingual anatomy*



Fig. 3 | *upper and lower marginal ridges*

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The Lingual Fossa

The concave area of the lingual surface is called the **lingual fossa**, or **lingual concavity**. *(Fig. 1)*

The lingual fossa is bordered by the mesial and distal marginal ridges, the cingulum, and the lingual side of the **incisal edge**, which is our last feature to discuss. *(Fig. 2)*

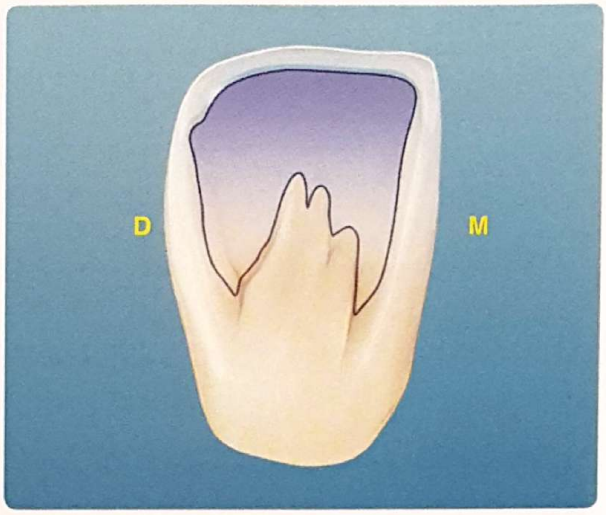


Fig. 1 | *the lingual fossa*

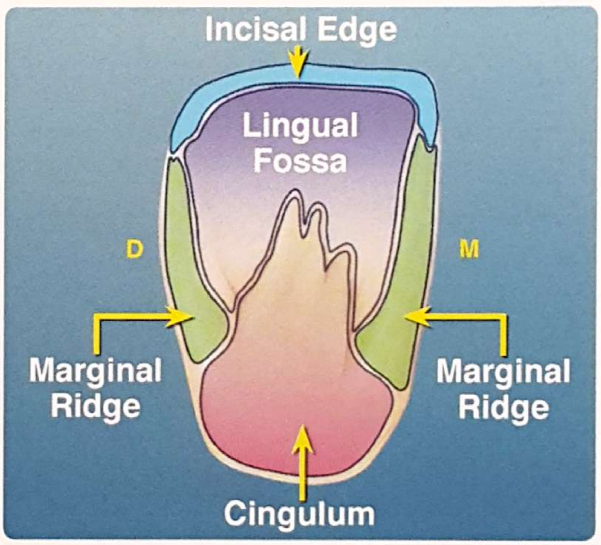


Fig. 2 | *lingual anatomy*



Fig. 3 | *upper and lower lingual fossae*

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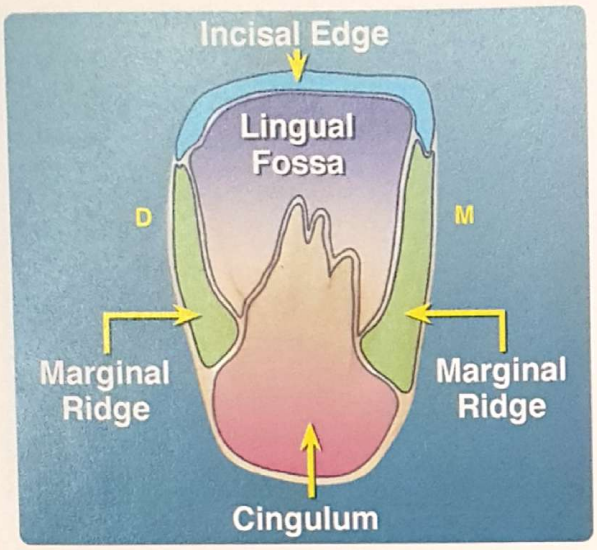


Fig. 1 | *lingual anatomy*

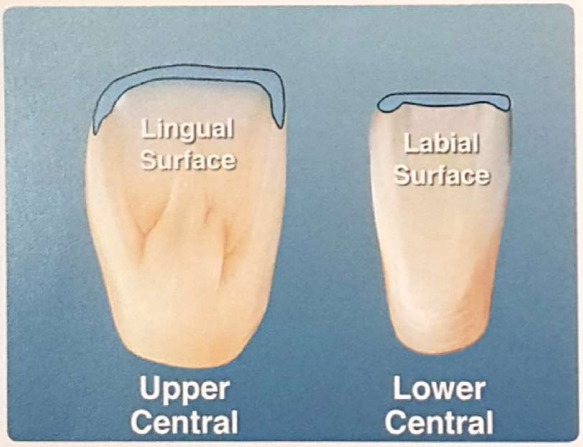


Fig. 2 | *incisal edges*

Incisal Edges

The cutting edge of an anterior tooth is called the incisal edge. "Incise" means to cut. *(Fig. 1)*

There are differences between the incisal edges of the upper and lower teeth. On the uppers, the incisal edge angle wears slightly toward the lingual. On the lowers, the angle wears slightly toward the labial at the opposite angle. *(Fig. 2)*

Figure 3 shows the incisal edges as they are visible from the lingual view on uppers, and from the labial view on lowers.



Fig. 3 | *upper and lower incisal edges*

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Wear Facets

As the lobes are developing, three rounded prominences, called **mamelons**, are formed at the incisal edge. *(Fig. 1-A)*

Contact between the upper and lower teeth causes the teeth to wear. As the mandible protrudes, the lower centrals and laterals slide on the longer upper centrals, abrading and flattening their incisal edges. As the teeth wear, the mamelons abrade away until the incisal edge becomes nearly straight. *(Fig. 1-B)*

As the incisal edges become flatter, they also become thicker. This flat, worn surface is called a wear facet. Due to the inclination of the upper and lower incisors, this abrasion occurs at an angle of around 35° to 40°. *(Fig. 2)*

The upper laterals, being shorter, are unaffected and therefore remain youthful looking until the centrals have worn sufficiently that the laterals begin to contact the lower teeth. They will then wear just as the centrals did. *(Fig. 3)*

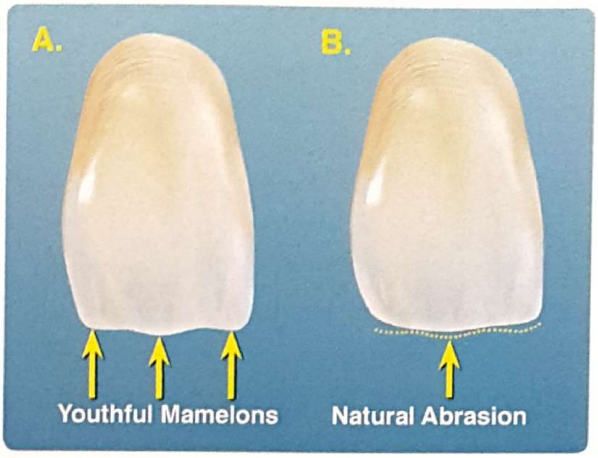


Fig. 1 | *incisal edges*

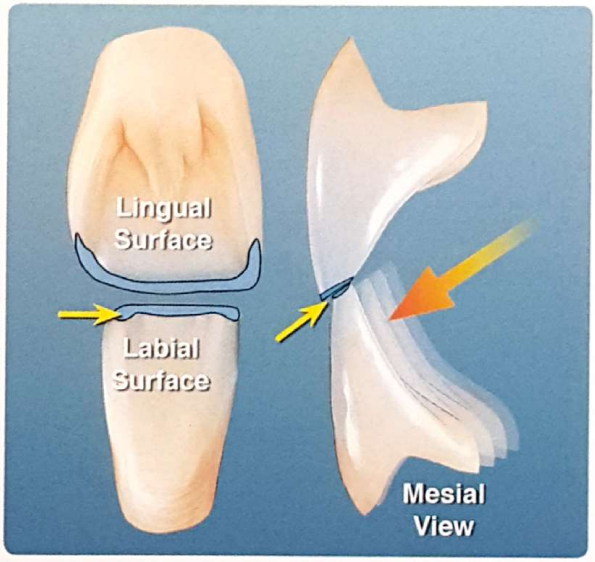


Fig. 2 | *incisal wear facets*

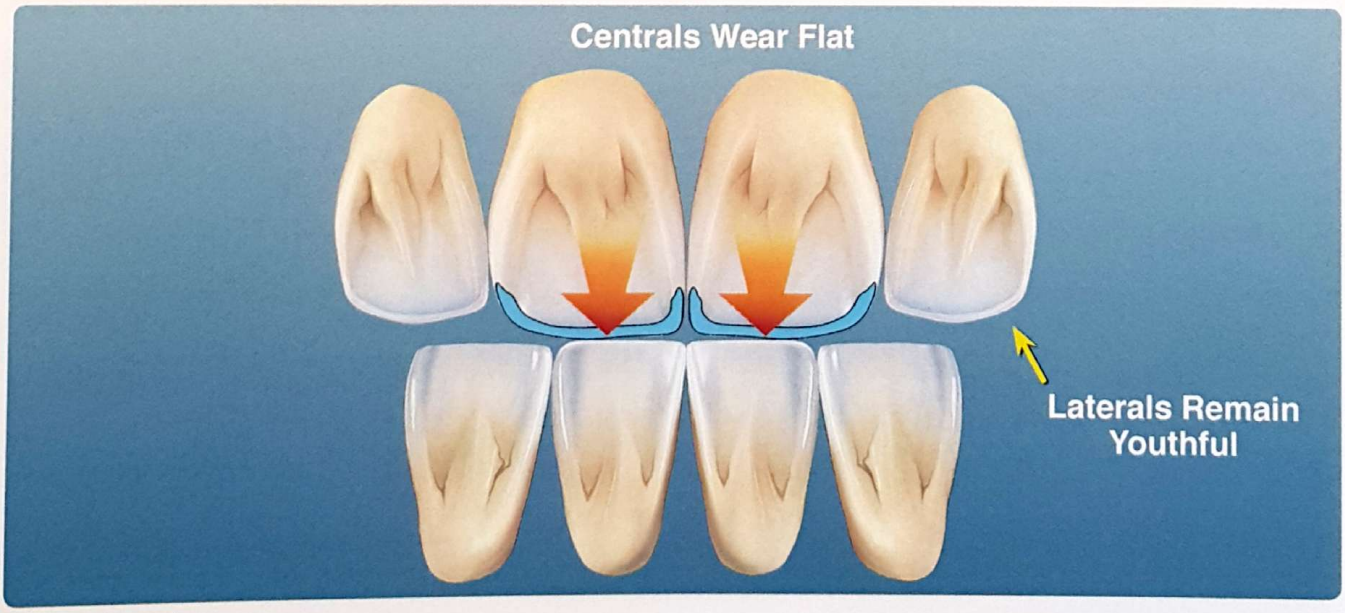


Fig. 3 | *lingual view*

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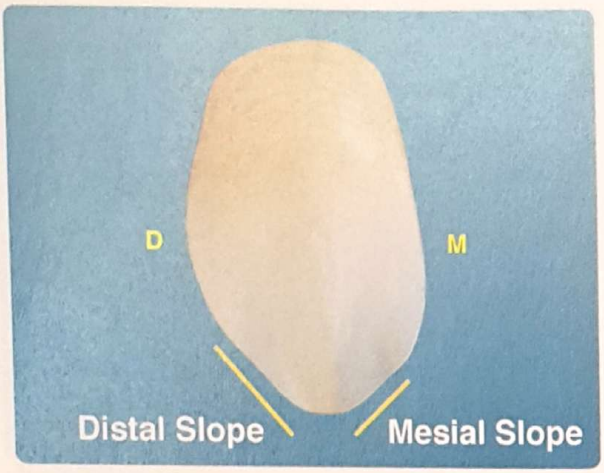


Fig. 1 | *cusp slopes*



Fig. 2 | *cuspid wear facets*

The incisal edge of a cuspid is shaped a little differently. It actually consists of two slopes which come together to form a rounded cusp. The mesial slope is shorter, and the distal slope is slightly longer, as shown in *Figure 1.*

Cuspids develop wear facets at their tips as a person gets older. This is due to abrasion by the opposing cuspid during lateral movement of the mandible, similar to the way the incisors are worn during protrusive movements. *(Fig. 2)*

Wear Facets and Exposed Dentin

It is common on centrals and cuspids for the enamel to be worn completely through the enamel cap, exposing the softer dentin underneath as shown in *Figure 3.*

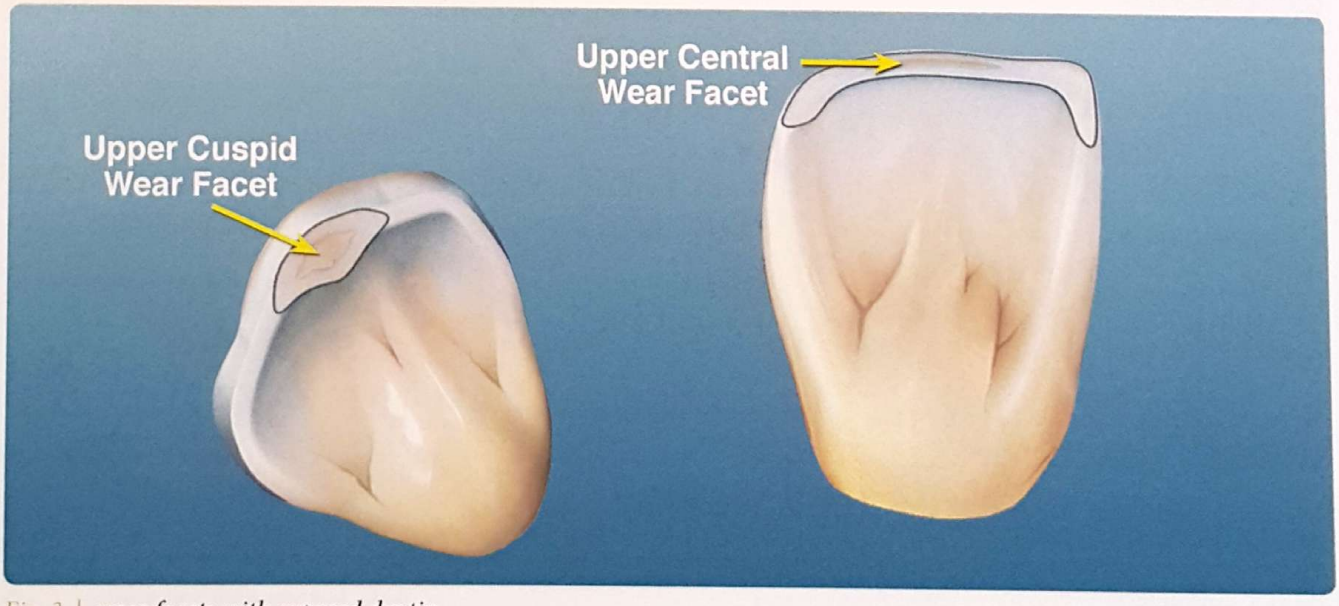


Fig. 3 | *wear facets with exposed dentin*

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It is important to know that wear facets are created over time throughout the entire life of the patient and become key reference points for determining just how the upper and lower teeth come together. *(Fig. 1)*

From the dental technician's point of view, the wear facets tell a story of how the upper and lower models fit together. *(Fig. 2)*

Figures 1 and 2 show all the anatomical features we have learned.



Fig. 1 | *wear facets develop over time*

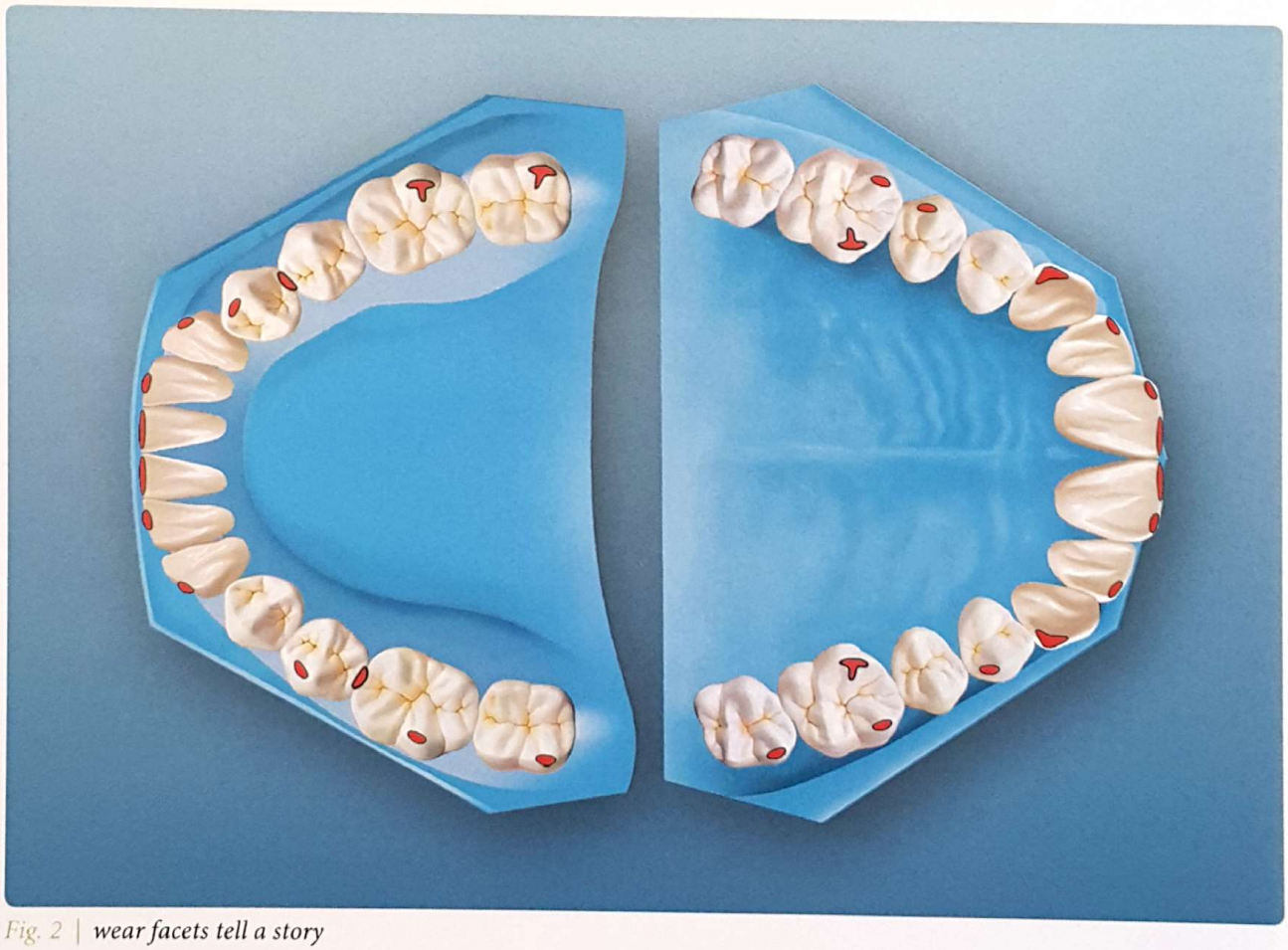


Fig. 2 | *wear facets tell a story*

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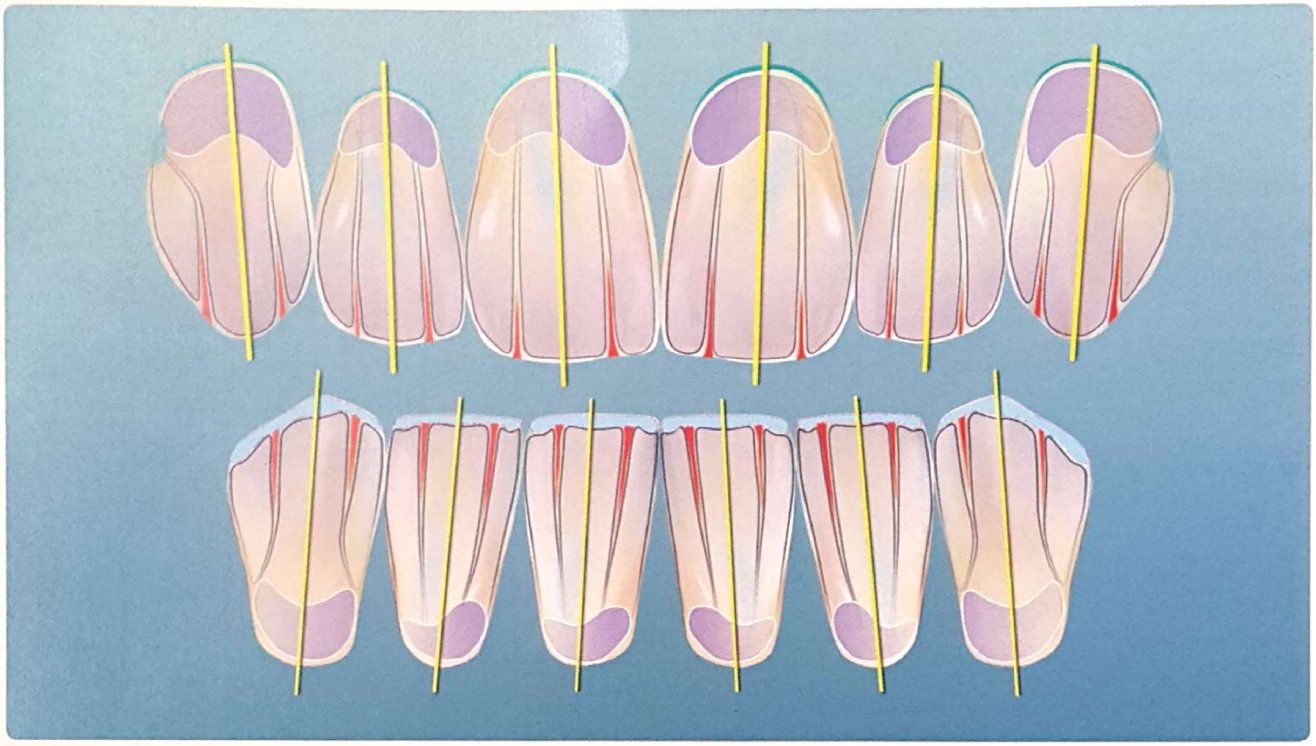


Fig. 1 | *labial anatomical features*

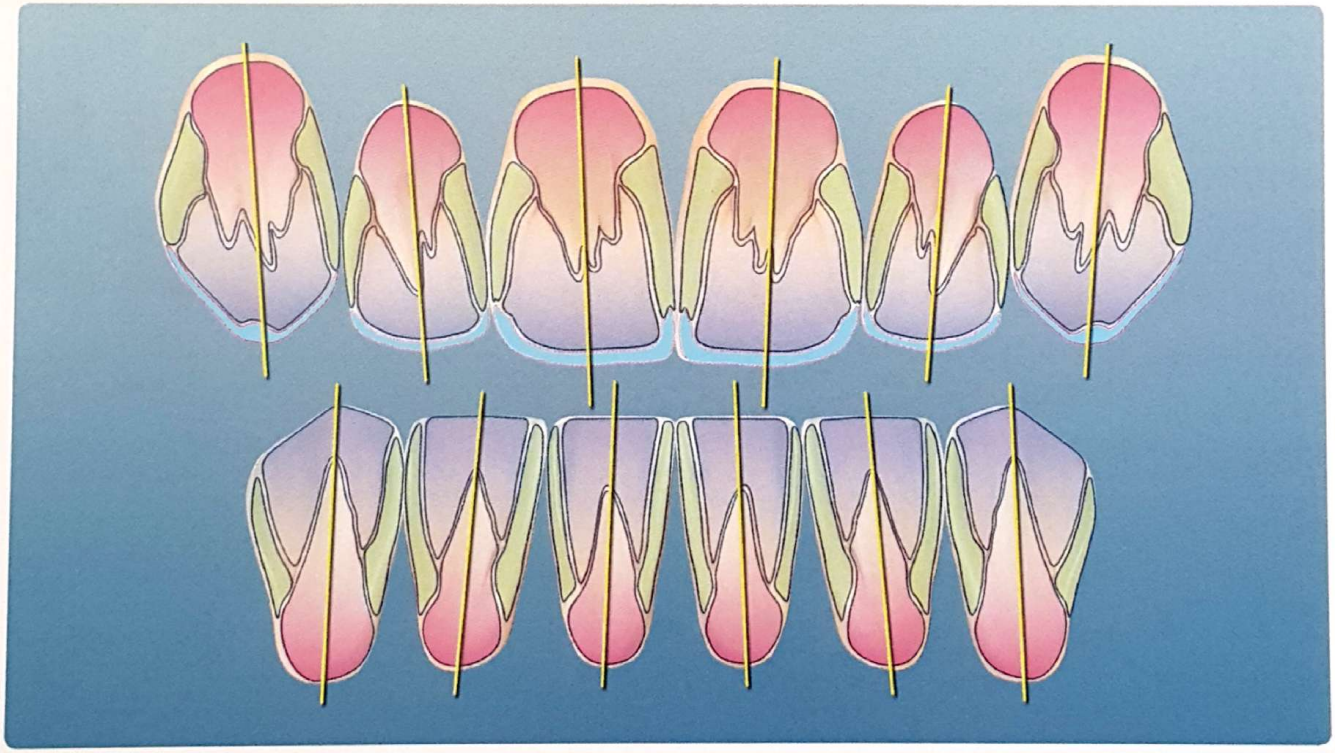
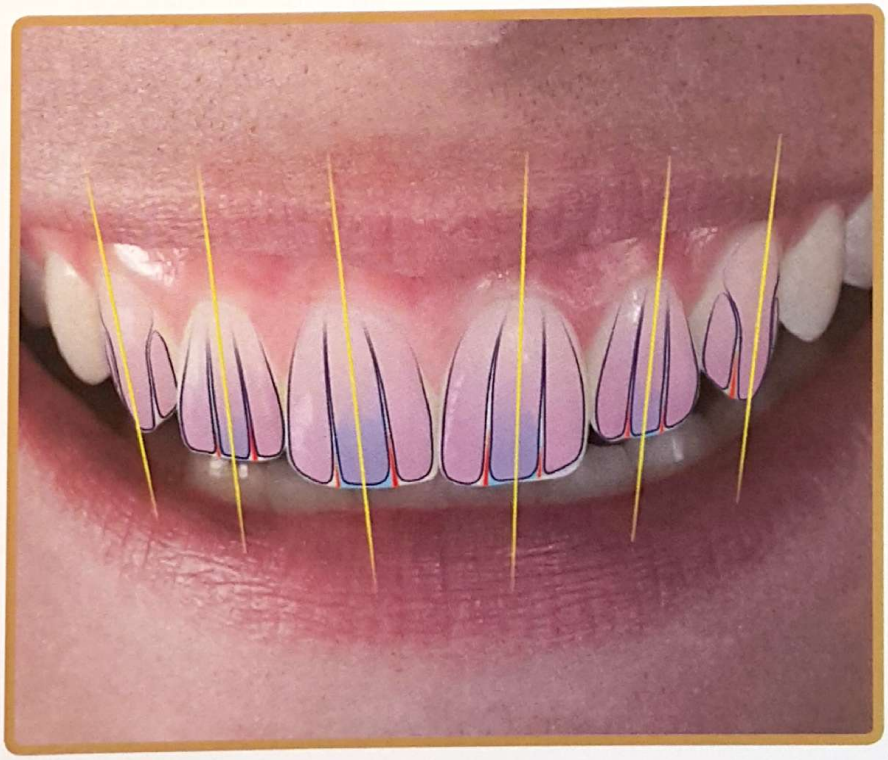


Fig. 2 | *lingual anatomical features*

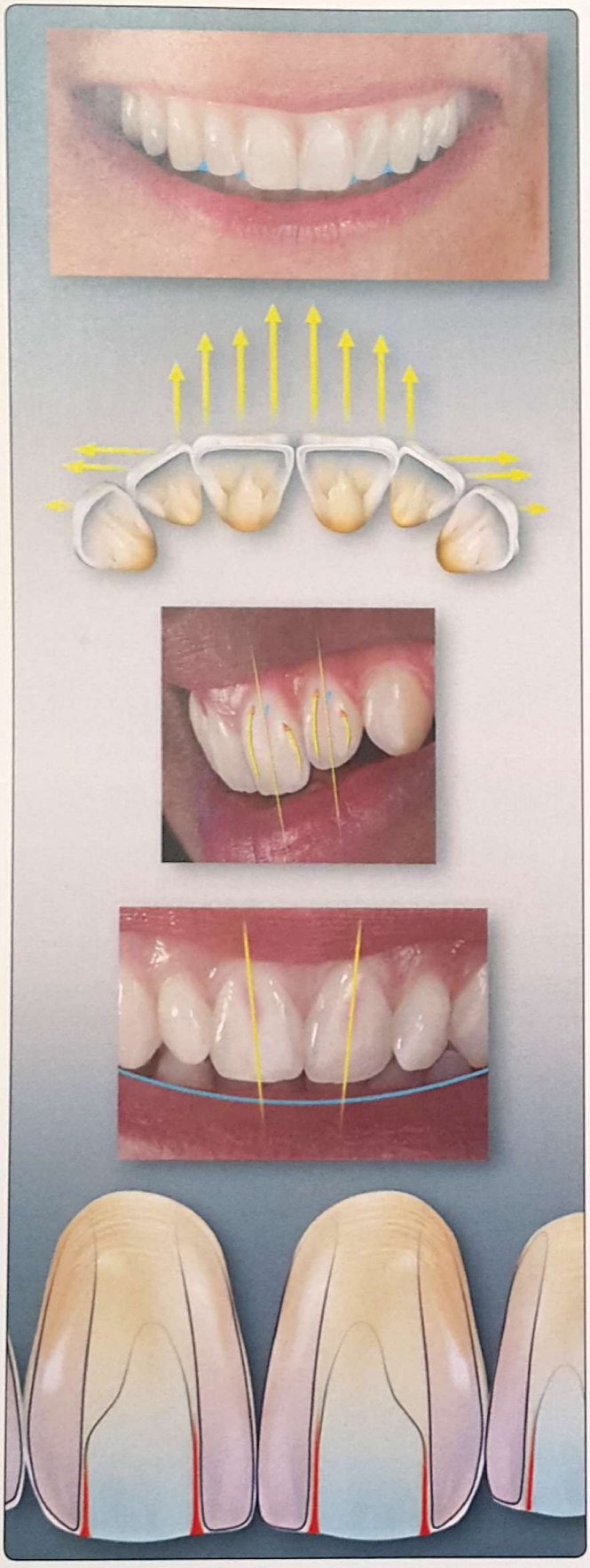
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Part Three

The Science of a Natural Smile



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The Ten Components of a Natural Smile

In this part, we'll look at the **ten fundamental components** of anterior esthetics and how they all come together in a natural smile. There are literally volumes of information written on the subject of anterior dental esthetics. The goal of this program is to introduce a simple, objective, practical way to effectively communicate all the necessary components of a natural smile.

We will examine each aspect of anterior esthetics that creates the essence of a natural smile. To do that, we will build on what we've learned about anterior anatomy and demonstrate a method for the rapid transfer of complex esthetic concepts. With that in mind, all of us on the dental delivery team will be able to use this understanding to prescribe and fabricate anterior restorations and to effectively communicate our knowledge of the fundamentals of cosmetic dentistry.

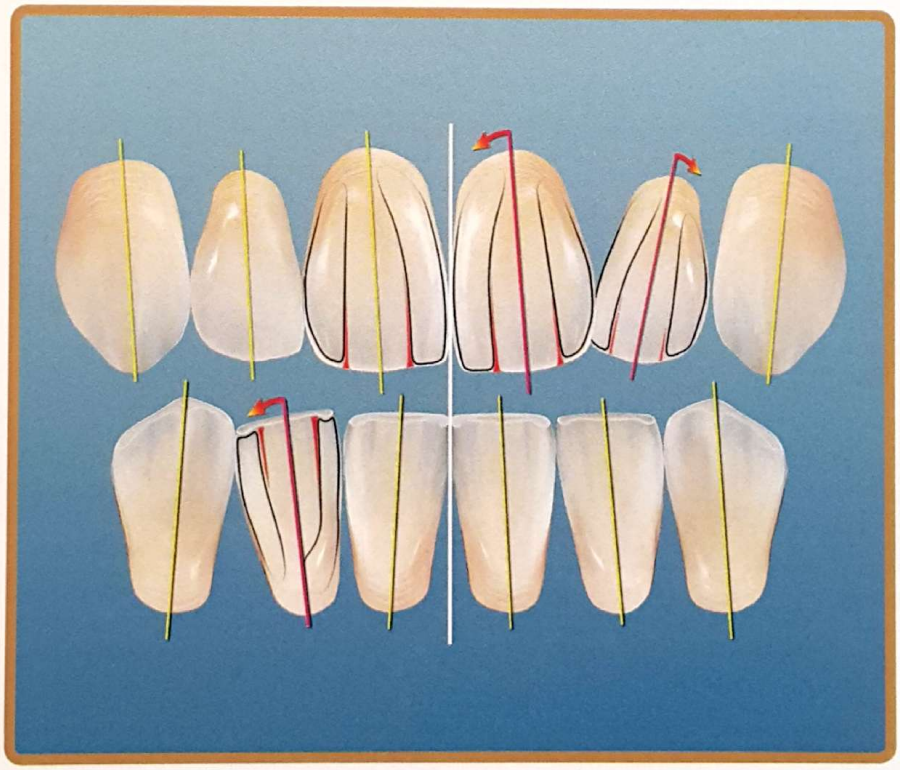
The esthetic concepts we need to study are:

1. The Long Axis
2. Vertical Transitional Line Angles
3. Primary Planes
4. Developmental Grooves and the Lobes
5. The "S" Curve
6. Embrasures, Proximal Contacts and the Interdental Papillae
7. The Nine Axes for Communicating Tooth Position
8. The Esthetic Composition of a Natural Smile
9. The Gingival Tissues and Esthetics
10. The Lips and the Smile Line

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Esthetic Component One

The Long Axis



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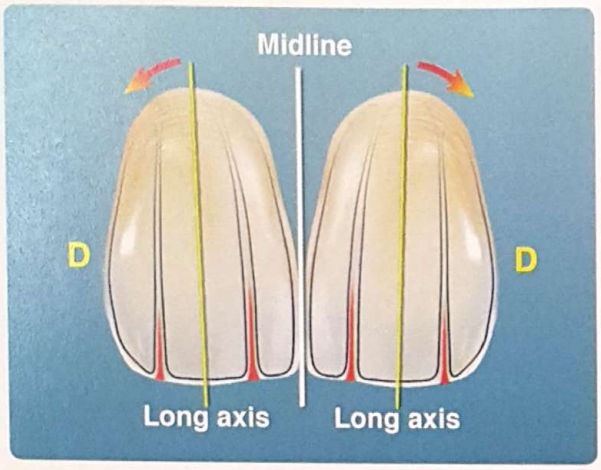


Fig. 1 | labial long axis alignment

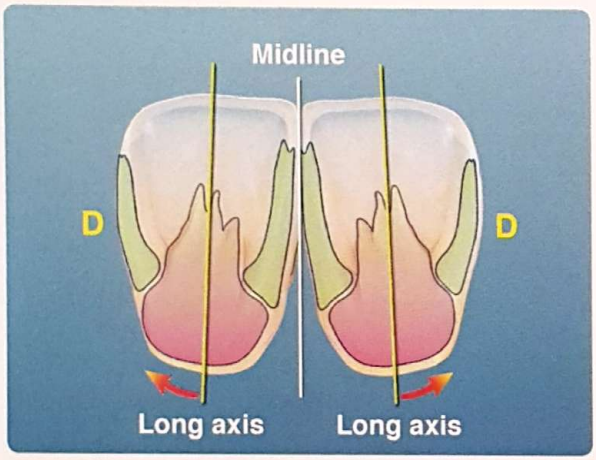


Fig. 2 | lingual long axis alignment

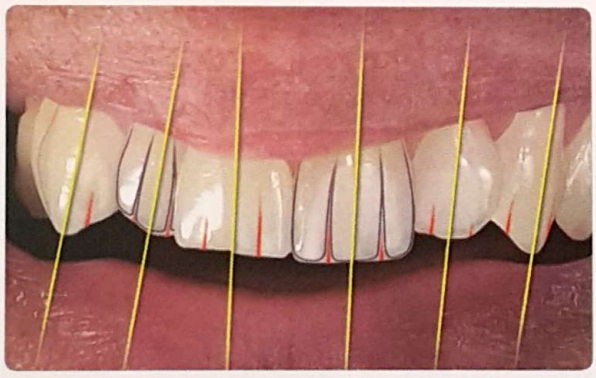


Fig. 3 | natural example

Up until now, we've studied the long axis and how it relates to the anatomical features. *(Figs. 1 and 2)* It is also important to understand that the **long axis can vary** from tooth to tooth, as you see in *Figures 3 and 4*. However, just like the leaning tower of Pisa, each tooth's **anatomical features follow and align with its long axis**.

The first fundamental component of anterior esthetics is the concept that a tooth's anatomical features will change with its long axis. The reason this is important is that when we change the long axis, we change the light reflective surfaces of the tooth and, therefore, change the esthetic composition of that tooth and how it is viewed next to the others.

Note: *As we stated in Part Two, the long axis is important when we communicate how teeth are arranged in the patient's smile. When the restorative dentist wants to modify or change the appearance of the smile, understanding the long axis gives us a way to communicate and modify the features to match his request.*



Fig. 4 | anatomy follows tooth axes

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Fig. 1 | *long axis anatomical alignments*

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Esthetic Component Two

Vertical Transitional Line Angles



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The second component of the natural smile is the **vertical transitional line angles** which delineate the transition from the labial surface at the mesial and distal lobes into the interproximal embrasures.

By now you can readily agree that there are an infinite number of shapes, forms and arrangements of natural teeth. We now need to look at how light reflects off these shapes, and in particular, the mesial and distal lobes, giving each tooth its shape and form.

It's the transitional line angles that create what appear to be bright, vertical lines of reflection on each anterior tooth. These line angles, created by the heights of contour of the mesial and distal lobes, mark the visual transition from the labial surface into each interproximal. *(Fig. 1)*

In *Figure 1*, the vertical light reflects from the mesial line angle of the lobe and clearly marks the transition of the labial surface to the interproximal. As you can see on the distal, the reflective surface of the transitional line angle is more rounded, curving with the distal lobe into the distal interproximal.

Moving these transitional line angles during fabrication or adjustment will either have the illusion of broadening the tooth and closing the interproximals *(Fig. 2)* or narrowing it and widening the interproximals. *(Fig. 3)*

This esthetic component is highly valuable in waxing, building and contouring porcelain, and in assisting the dentist in communicating the subtle variables they need to have understood.



Fig. 1 | *bright, vertical lines*

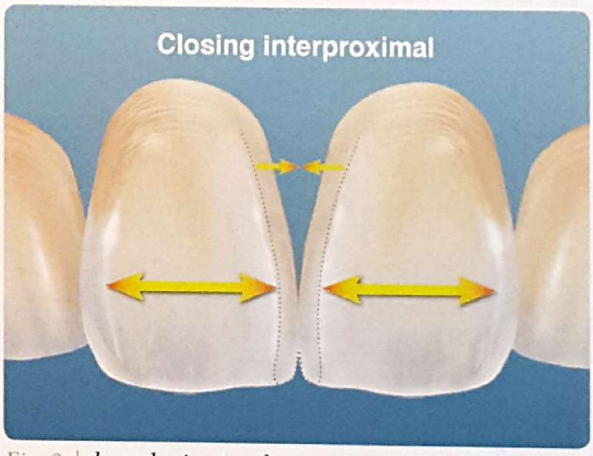


Fig. 2 | *broadening tooth*

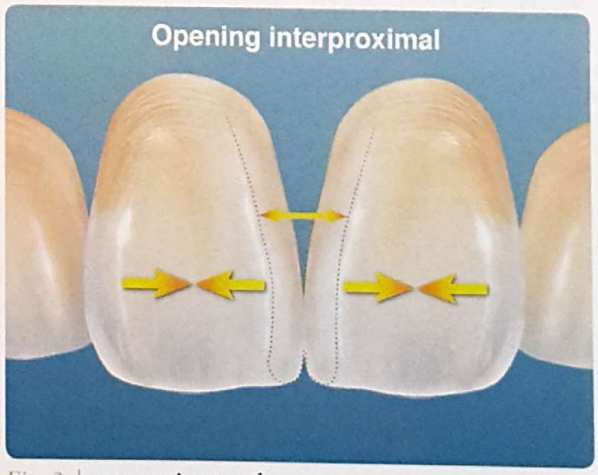


Fig. 3 | *narrowing tooth*

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The combination of:

1. The width of the primary planes;
2. The placement of the developmental grooves; and
3. The transitional line angles of the mesial and distal lobes

work in conjunction with one another. As you will see in esthetic components 3 and 4 this combination provides a stable reference for all feature modifications of the shape and form of natural teeth in this area.

In *Figures 1 and 2* you can see that the transitional line angles determine the shape of each interproximal. This is like a fine piece of art, where the reflective line angles visually frame each tooth, isolating and differentiating the labial and interproximal surfaces.

This gives the restorative team a way to communicate about each natural tooth surface. The dental technician can modify hese transitional line angles that contribute to the individuality of each tooth while maintaining control of the shape of the mesial and distal lobes.



Fig. 1 | *vertical transitional line angles frame each tooth*

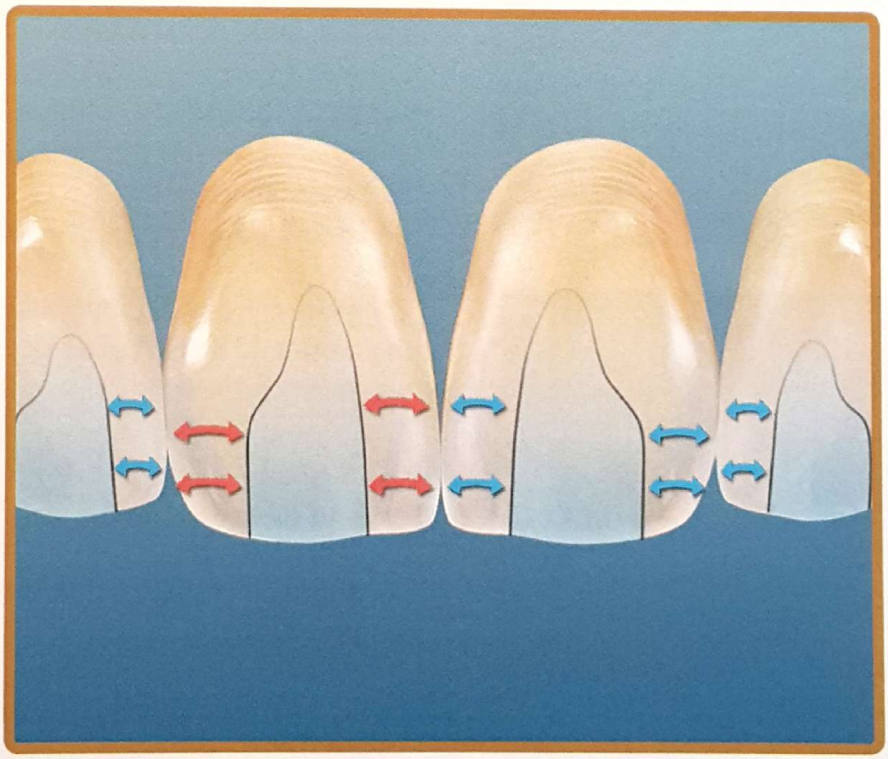


Fig. 2 | *vertical transitional line reflect the light*

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Esthetic Component Three

Primary Planes



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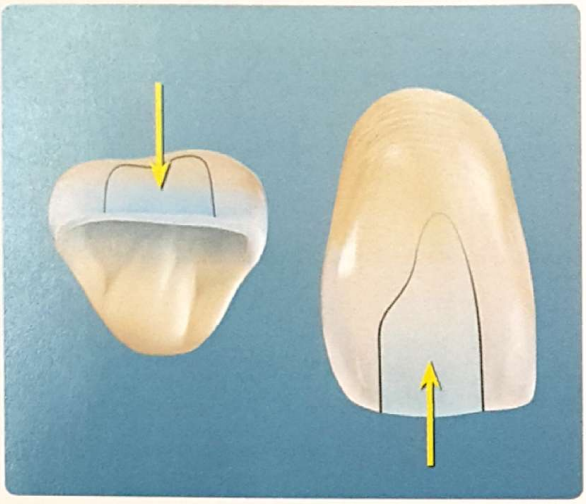


Fig. 1 | *the primary plane*

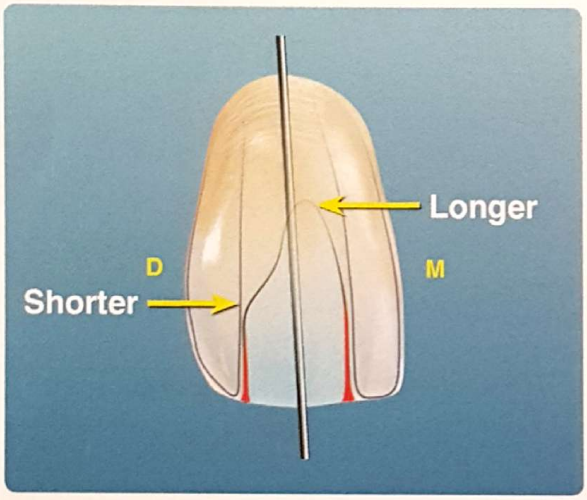


Fig. 2 | *aligned with long axis*

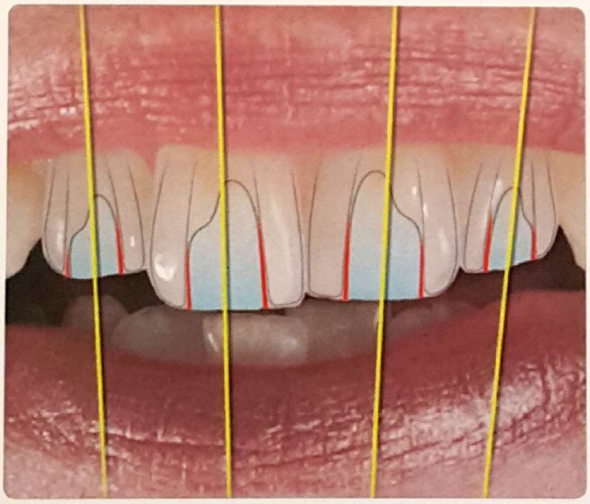


Fig. 3 | *primary planes vary with length*

The third fundamental component of anterior esthetics could be considered an unusual anatomical concept. You now have the information necessary to appreciate the subtle anatomical effect that we'll be discussing here.

This anatomical area is somewhat obscured within the labial features of the centrals and laterals. The component we're bringing to your attention is the **primary plane**. *(Fig. 1)*

These planes, when understood, become a key point of communicating modifications and corrections in single- and multiple-unit anterior restorations. It is significant enough that it could be considered the primary surface area that aligns the teeth, when controlled accurately, or distorts the long axis and the overall esthetic composition when done incorrectly. *(Fig. 2)*

When anatomical features consistently found in natural teeth such as lobes and developmental grooves are fully incorporated on the surface of the teeth, they tend to obscure this plane. Being aware of it, we can look through these features and make judgments we could not make unless we understood the primary plane.

The primary plane aligns with the long axis of the tooth and lies between the mesial and distal lobes. The mesial side of the plane extends well into the middle third, while the distal extends just through the incisal third. This can vary with the length of each tooth. *(Figs. 2 and 3)*

The position of the primary plane on any tooth ultimately determines the width of the mesial and distal lobes, and indicates the location of the developmental grooves. *(Fig. 1 next page)*

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The primary plane is a flat, slightly depressed area which has the effect of accentuating the mesial and distal lobes. The plane actually complements the illusion of the lobes framing each tooth. Knowing this will help you differentiate between incisors that are highly anatomical and those that are anatomically featureless.

The primary planes also reveal, in restorative cases, the symmetry, or the lack of symmetry, between each mesial and distal lobe from one side of the mouth to the other. *(Fig. 2)*

You can see in *Figure 3* that if we narrow the plane of the right central (red arrows), the mesial and distal lobes become larger in comparison to the left central. The right central appears somewhat distorted.

They key point here is that in a 4-unit anterior restoration, there are eight mesial and distal lobes. Any one of them being narrower or wider than the other can make the composition appear unnatural. As you see with the four upper and lower incisors, the width of each lobe is identical to the corresponding lobe on the other side of the mouth, giving the teeth their symmetry. *(Fig. 1 next page)*

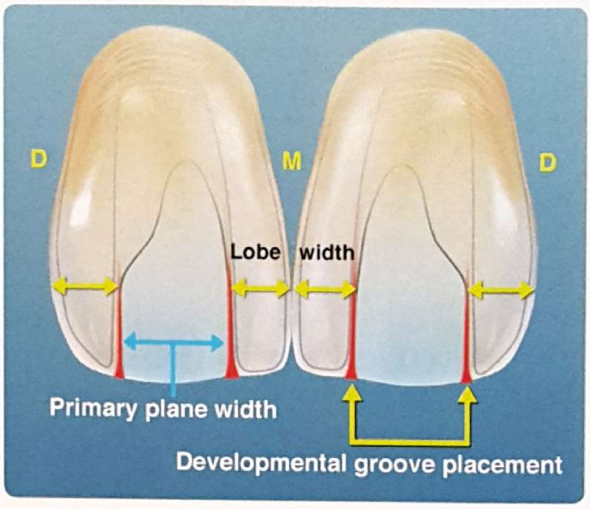


Fig. 1 | *planes dictate width of lobes*

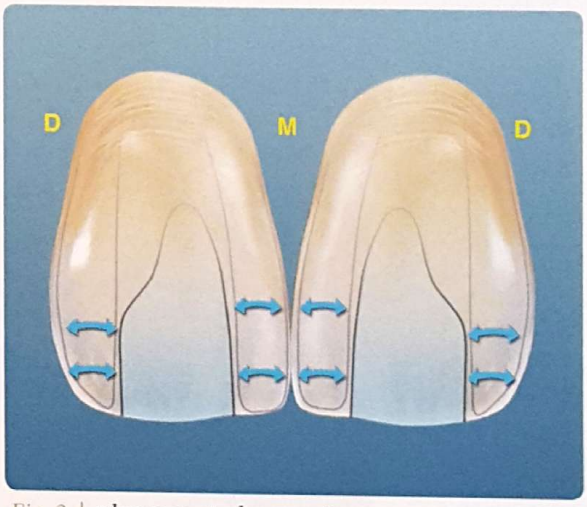


Fig. 2 | *planes control symmetry*

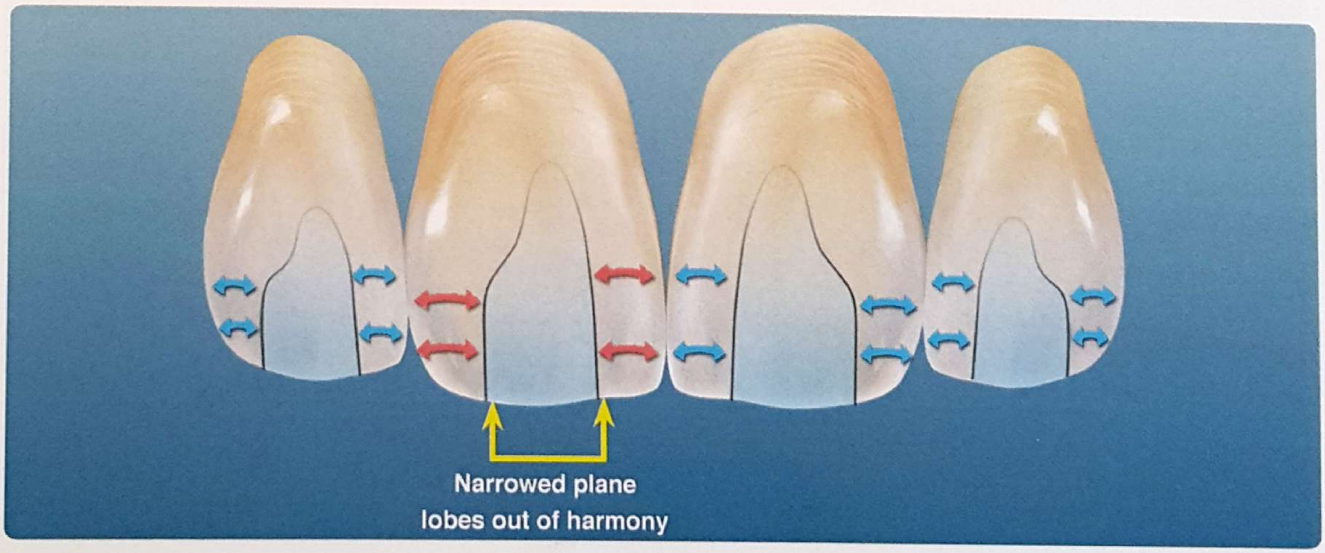


Fig. 3 | *mismatched primary planes destroy lobe symmetry*

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Fig. 1 | lobe symmetry

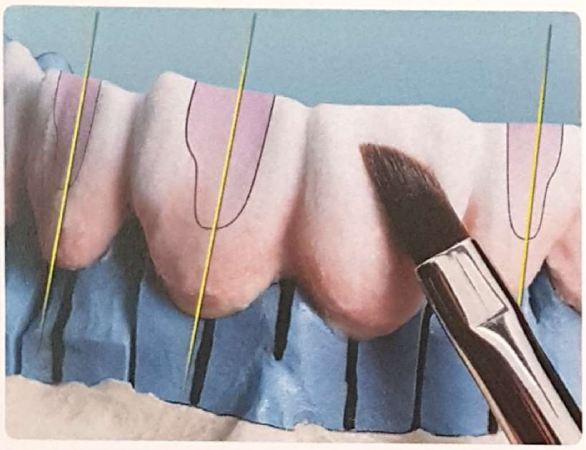


Fig. 2 | primary planes in porcelain

By widening or narrowing the anatomical surface of the primary plane, we can actually change the apparent size and shape of each tooth. When we understand this principle we can effectively communicate it and can manipulate wax, porcelain or CAD/CAM software. From a communication point of view, this information can be used as a stable reference in harmonizing all eight mesial and distal lobes under one symmetrical objective. Conversely, if a cosmetic restoration lacked symmetry, it could be used as a stable reference point for communicating the correction.

Note: *The outside parameter of each primary plane is an indicator of where the developmental grooves would be placed. We will cover that next.*

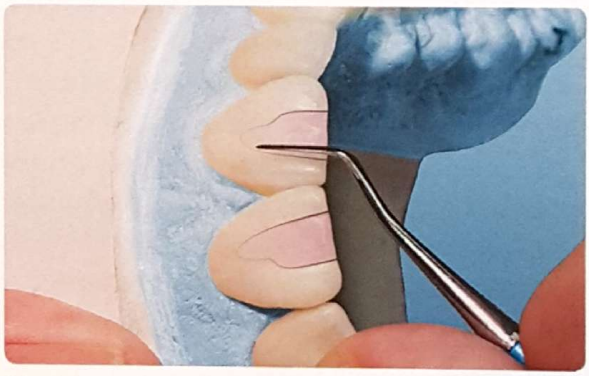


Fig. 3 | waxing primary planes



Fig. 4 | natural primary planes

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Esthetic Component Four

Developmental Grooves and the Lobes



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Fig. 1 | *developmental grooves*



Fig. 2 | *featureless anatomy*

The fourth component of the natural smile is the developmental grooves and how they relate to the prominence and size of the lobes. As we learned earlier, developmental grooves are formed as depressions where the mesial, central and distal lobes grew together. *(Fig. 1)*

You'll find that the shape and prominence of these lobes differ greatly from person to person.

The key differentiating factor which determines the prominence of the lobes is the length and depth of the developmental groove. In many teeth, the grooves are almost indistinguishable, where on others, they can be quite apparent. *(Figs. 2 and 3)*



Fig. 3 | *definite grooves*

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As we pointed out earlier, the mesial grooves on the centrals and laterals are long and the distals short. However, in the case of the cuspids, the mesial grooves are short and the distals long. *(Figs. 1 and 2)*

In some cases, we would be widening or narrowing the lobes by the placement of the grooves, which again would be guided by the outside parameters of the natural, primary plane we discussed earlier. *(Fig. 3)*

When we elongate a mesial developmental groove, it accentuates the length and prominence of the mesial lobe. If we were to make a distal developmental groove shorter and shallower, we would de-emphasize the distal lobe, making it appear to blend with the central lobe. *(Fig. 4)*

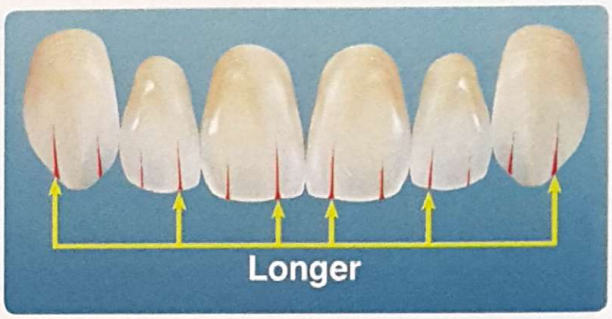


Fig. 1 | *longer mesial grooves*

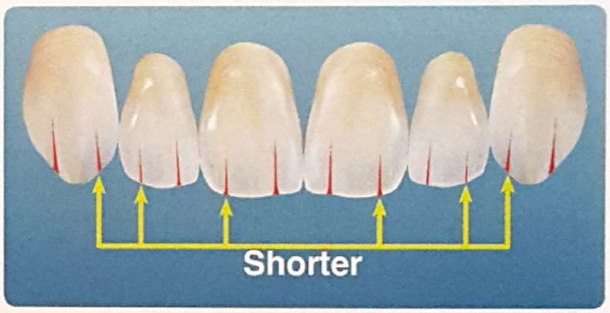


Fig. 2 | *shorter distal grooves*

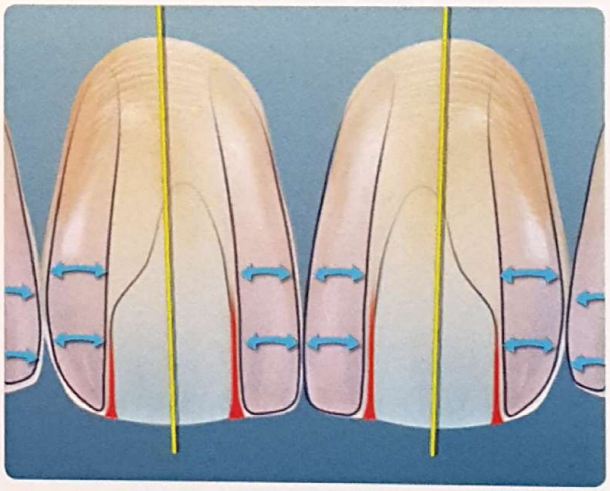


Fig. 3 | *grooves affect lobe width*

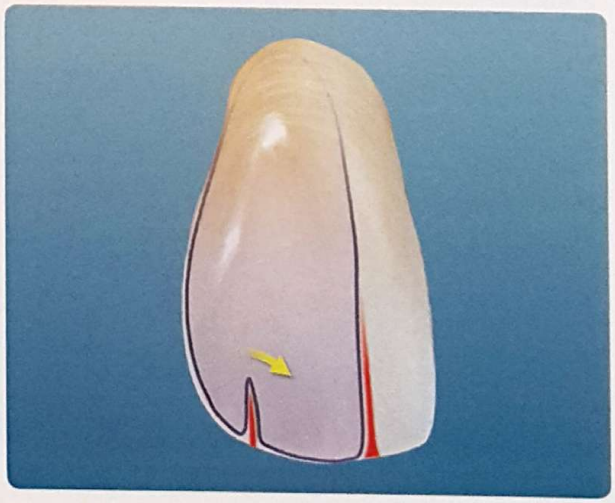


Fig. 4 | *short groove de-emphasizes lobe*

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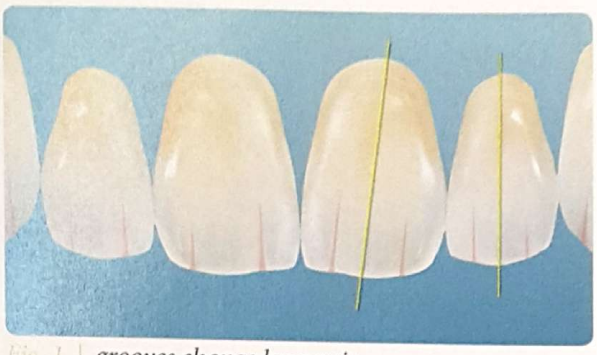


Fig. 1 | grooves change long axis

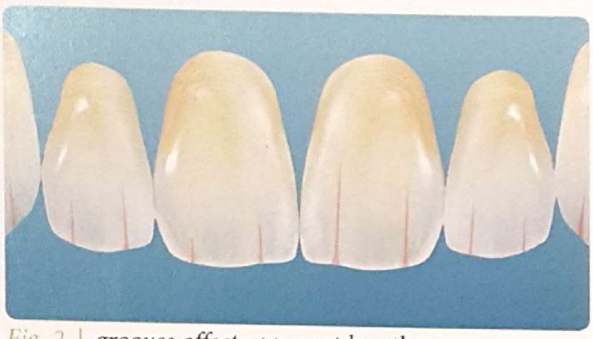


Fig. 2 | grooves affect apparent length



Fig. 3 | grooves affect youthfulness

Another key point for us to remember is that when duplicating the labial surface of natural teeth in anterior restorations, we may vary the length and depth of the developmental grooves, and when we do, we distinctly change the lobes and thereby modify the form and shape of the teeth.

The developmental grooves are the anatomical feature that provides a way for us to vary any anterior tooth's labial anatomy. For example:

1. To change the long axis of a tooth; *(Fig. 1)*
2. To elongate or shorten a tooth's appearance *(Fig. 2)*; or
3. To make a tooth appear more youthful looking. *(Fig. 3)*

Understanding this, we can specifically communicate alterations from virtually no anatomy to very robust looking teeth.



Fig. 4 | natural developmental grooves

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Esthetic Component Five

The "S" Curve



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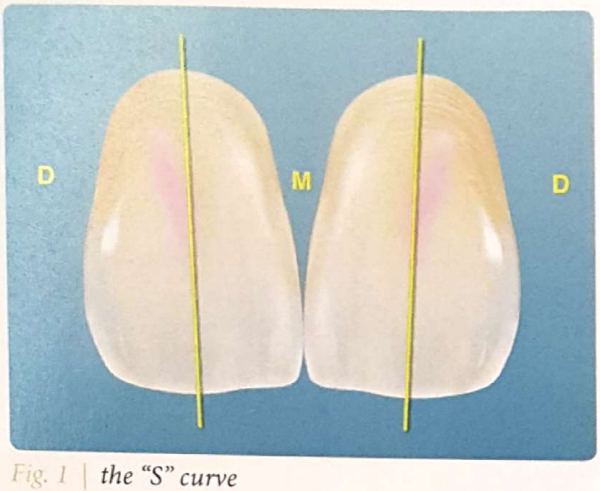


Fig. 1 | *the "S" curve*

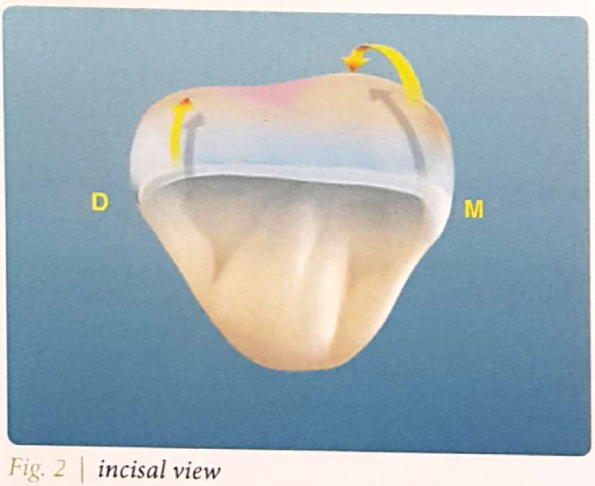


Fig. 2 | *incisal view*

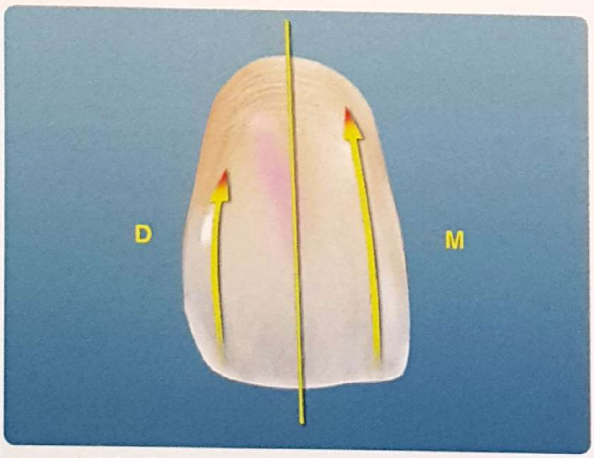


Fig. 3 | *labial view*

The next concept is the **"S" curve**, the fifth component of anterior esthetics. This one is fairly simple. It's a subtle, depressed area on the centrals and laterals that starts just distal to the long axis in the gingival third area, and curves in an elongated "S" or reverse "S" shape, into the base of the central lobe. *(Fig. 1)*

The "S" curve is similar to the primary plane in that it, too, is obscured and hidden within the labial features. Its shallow depression is actually formed by the lobes coming together in the middle and disto-gingival third.

Looking from the incisal edge, you can see in *Figure 2* how the curve, by being slightly depressed to the distal, enhances the length and boldness of the mesial lobe.

From the labial view, because it runs just distal to the long axis, it tends to elongate the mesial lobe, and at the same time, shortens the softer distal lobe, and further complements the long axis tilting slightly to the distal. *(Figs. 3 and 4)*

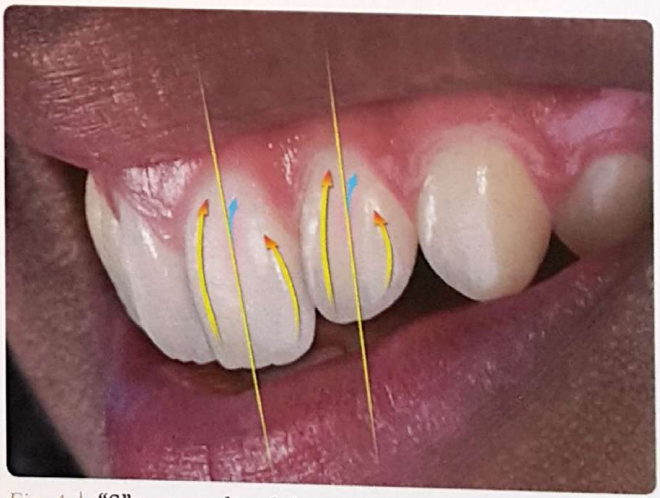


Fig. 4 | *"S" curves align lobes with axis*

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Notice how the "S" curve area influences the long axes on all incisors. In many centrals and laterals, this area is almost undetectable, so you don't want to exaggerate it. It is very subtle. *(Fig. 1, 2, and 3)*

When controlling the four incisors, you will find that this area alone, understood and placed correctly in waxing, building and contouring, harmonizes all four long axes, because its slight depression reinforces all the heights of contour.

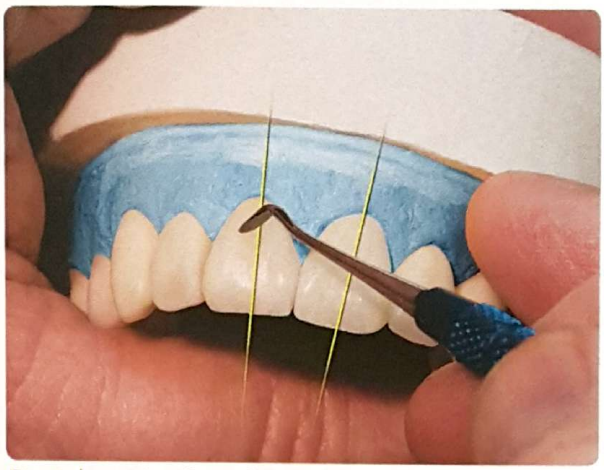


Fig. 1 | *waxing for esthetics*

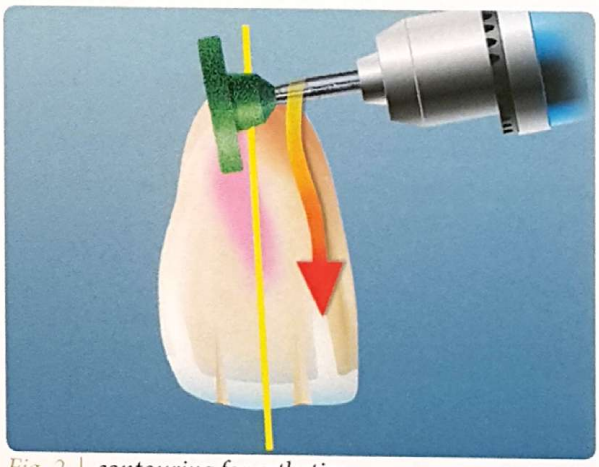


Fig. 2 | *contouring for esthetics*

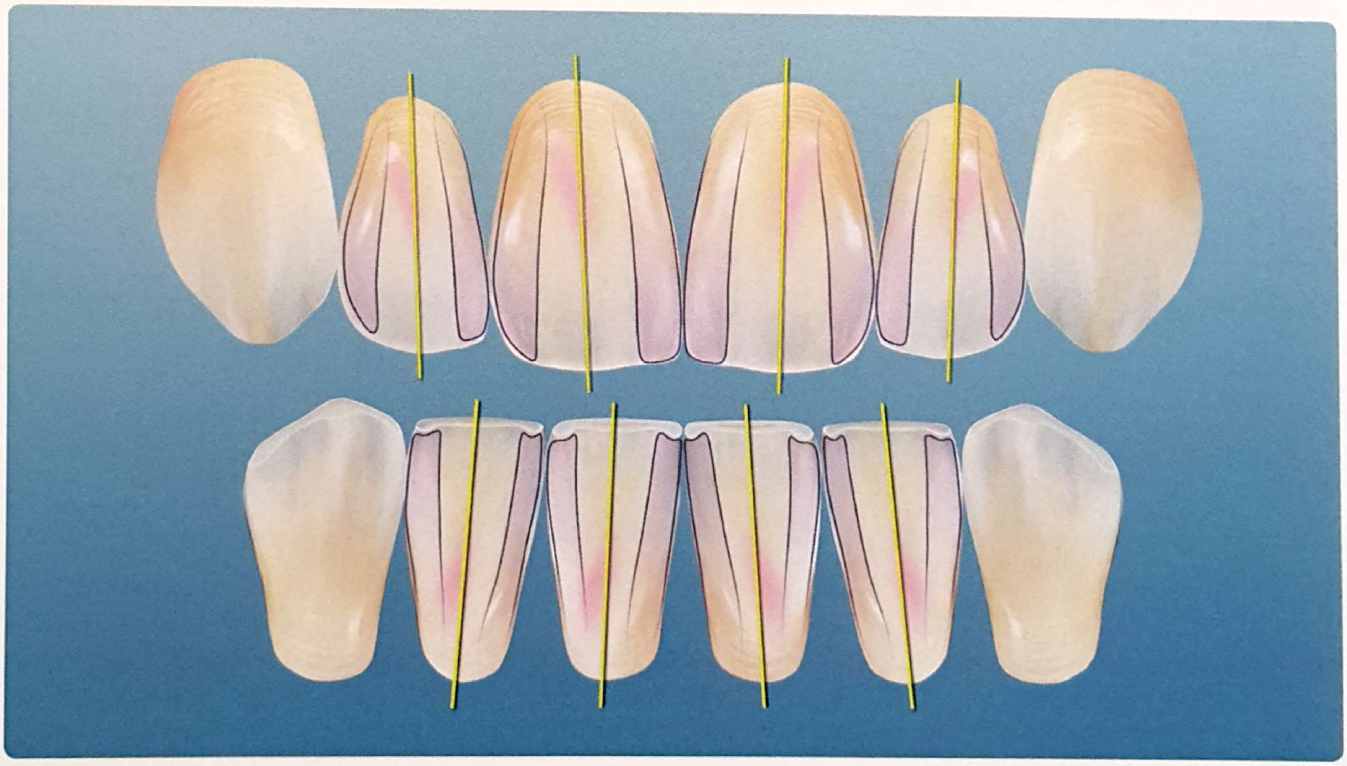


Fig. 3 | *upper and lower "S" curves*

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Esthetic Component Six

Embrasures, Proximal Contacts and the Interdental Papillae



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It is the rule that adjacent teeth do not touch at their incisal edges. These incisal interproximal spaces are called **embrasures**, which are the sixth component of a natural smile. *(Fig. 2)*

As you look at the six anterior teeth in these natural smiles, notice the dark shadows of the oral cavity accentuating the triangular spaces at the incisal edges. These spaces are the embrasures, which enhance the individuality found in a natural smile. *(Figs. 1 and 3)*



Fig. 1 | *embrasures*



Fig. 2 | *incisal embrasures*



Fig. 3 | *embrasures*

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Fig. 1 | upper central embrasure



Fig. 2 | upper lateral embrasure

Incisal Embrasures

There are subtle variations in the incisal embrasures, as you see in *Figure 1*, between the centrals, laterals and cuspids. Notice the **central embrasure** at the midline. The centrals contact just above the incisal edge, leaving a small embrasure.

Between the central and the lateral, the distal of the central is rounded, as is the mesial incisal edge of the lateral. The teeth contact at the middle third, allowing the embrasure to be deeper and wider, and therefore more open. *(Fig. 1)*

Where the cuspid meets the lateral, the rounded distal of the lateral and the mesial form of the cuspid, make the interproximal embrasure deeper and wider as the teeth contact near the middle third. *(Fig. 2)*

On the six upper anterior teeth, the embrasures create the natural individuality of each tooth. *(Fig. 3)*



Fig. 3 | incisal embrasures and contact position

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Notice that when the teeth are more rounded and youthful, the embrasures and contacts are more open and closer to the gingiva, resulting in even more individuality and youthfulness. *(Figs. 1 and 3)*

Conversely, in an elderly person, where there has been significant abrasion of the incisal edges, we see almost no embrasures. You can see how embrasures are important as a point of communication for enhanced esthetics in waxing, building or porcelain contouring. *(Figs. 2 and 4)*

With this concept in mind, you can see how when constructing laminates or full porcelain restorations, we can focus on the embrasures and proximal contacts to help determine the individuality of each tooth in a smile.



Fig. 1 | youthful embrasures



Fig. 2 | elderly embrasures



Fig. 3 | youthful embrasures



Fig. 4 | incisal abrasion elderly embrasures

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Fig. 1 | *gingival embrasures*

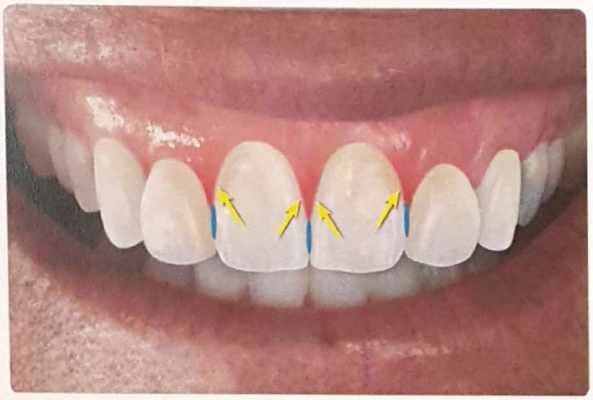


Fig. 2 | *long contacts and closed embrasures*



Fig. 3 | *bone resorption*



Fig. 4 | *black spaces, inflamed tissue*

Gingival Embrasures

Equally important are the gingival interproximal embrasures, the "V"-shaped openings gingival to the proximal contacts that provide the space for the interdental papillae. *(Fig. 1)*

When the contact areas of a restoration are elongated toward the tissue, or when overbuilt and made too square, the gingival embrasures become too closed, impinging on the tissue. *(Fig. 2)*

When this happens, the nerve and blood flow is restricted, creating unhealthy periodontal conditions. The tissue recedes, and eventually, even the underlying bone may begin to resorb. *(Fig. 3)*

As this happens, unsightly black spaces are created between the teeth, detracting from the natural smile. *(Figs. 4 and 5)*



Fig. 5 | *natural example*

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Proximal Contacts

Another aspect relating to embrasures is the location of the proximal contacts of the anterior teeth. *(Fig. 1)* The mesial contact of the central is slightly elongated and more toward the incisal. *(Fig. 2-A)* The distal contact is higher due to the soft, rounded edge of the central. *(Figs. 2-B)*

The mesial contact of the lateral is more gingival than that of the central. *(Fig 2-C)* The distal contact of the lateral is almost at the middle third. *(Figs. 2-D)*

The mesial contact of the cuspid is in the middle third, further opening the embrasure. *(Fig. 2-E)*

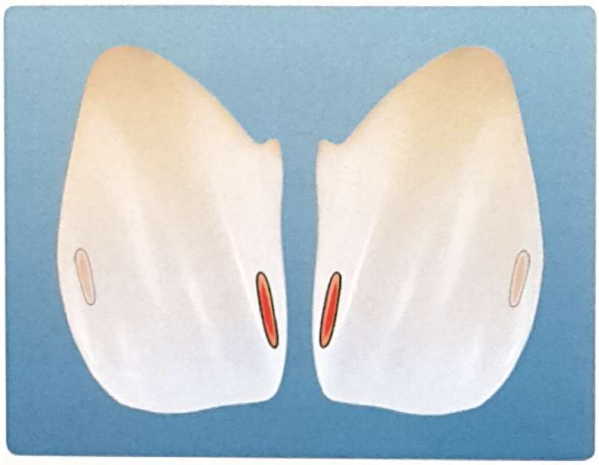


Fig. 1 | central mesial and distal contacts

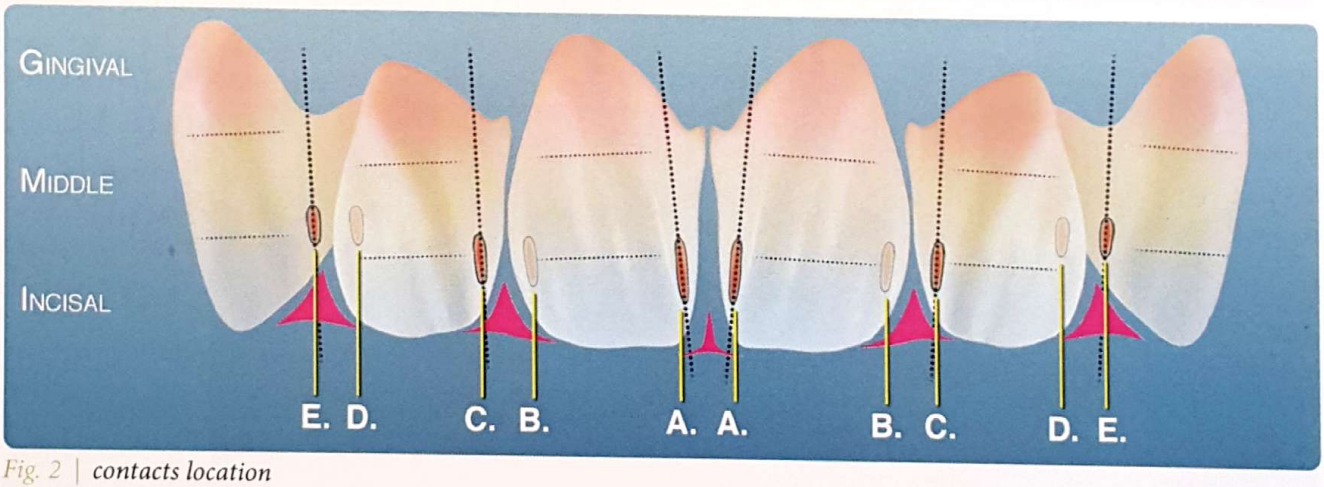


Fig. 2 | contacts location

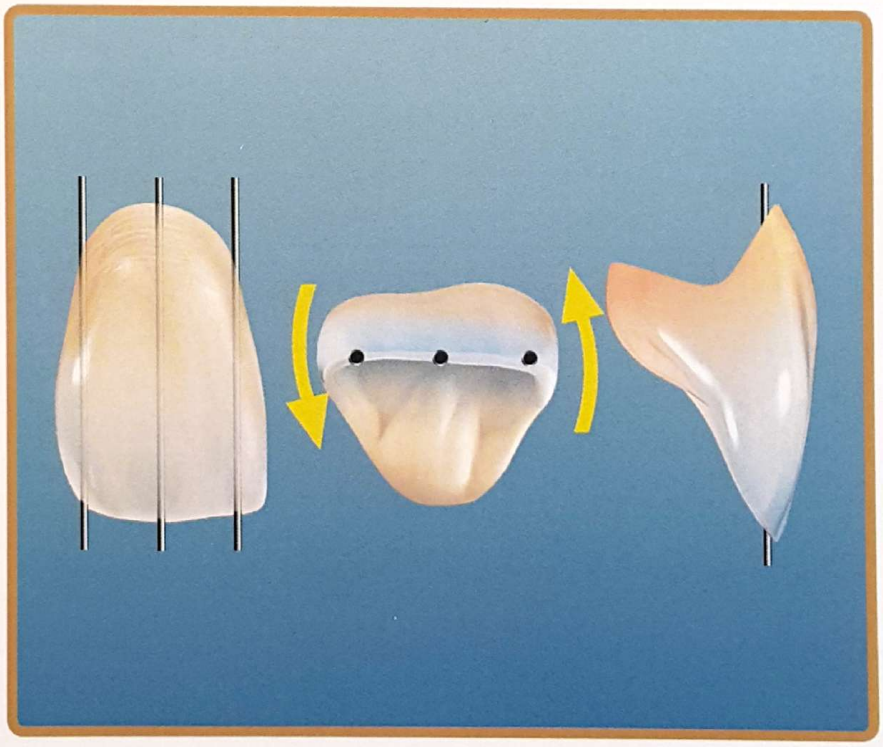


Fig. 3 | natural contacts, incisal and gingival embrasures

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Esthetic Component Seven

The Nine Axes for Communicating Tooth Position



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Now we need to have an easy way to **communicate** how teeth are positioned on their axes. For example, in **case planning**, model marking, denture try in, or correcting a tooth's position in a precise way. A patient's teeth can be rotated in different positions. Having such a method, we can eliminate much of the potential error in communication. *(Figs. 1, 2 and 3)*

The **seventh** component of anterior esthetics is the **nine rotational axes** of a tooth. In addition to the long axis, covered previously, there are **nine separate axes** of rotation we need to understand. We will use these nine axes to communicate the rotational position of each tooth in any smile. *(Fig. 1 next page)*

An axis is like an imaginary rod running through a tooth about which the tooth could be rotated. *(Fig. 4)* There are an infinite number of ways we could rotate one tooth in relationship to another. As a practical matter, this would be too complex and unrealistic to communicate. So we only use nine axes of rotation to communicate each tooth's position in a smile.



Fig. 1 | *denture teeth axes*

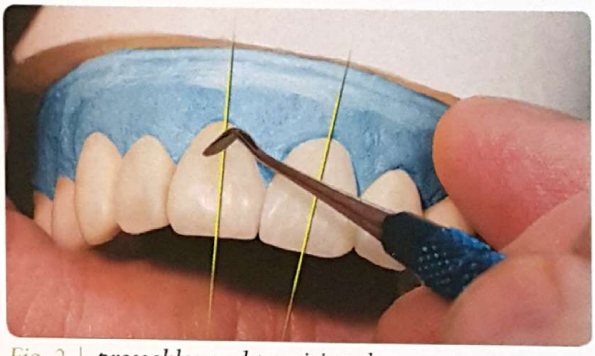


Fig. 2 | *pressables and provisionals*



Fig. 3 | *ceramics*



Fig. 4 | *examples of axes on rotated teeth*

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There are **three vertical axes**, **three mesio-distal axes**, and **three labio-lingual axes** that we need to understand. (*Figs. 1 - 3*)

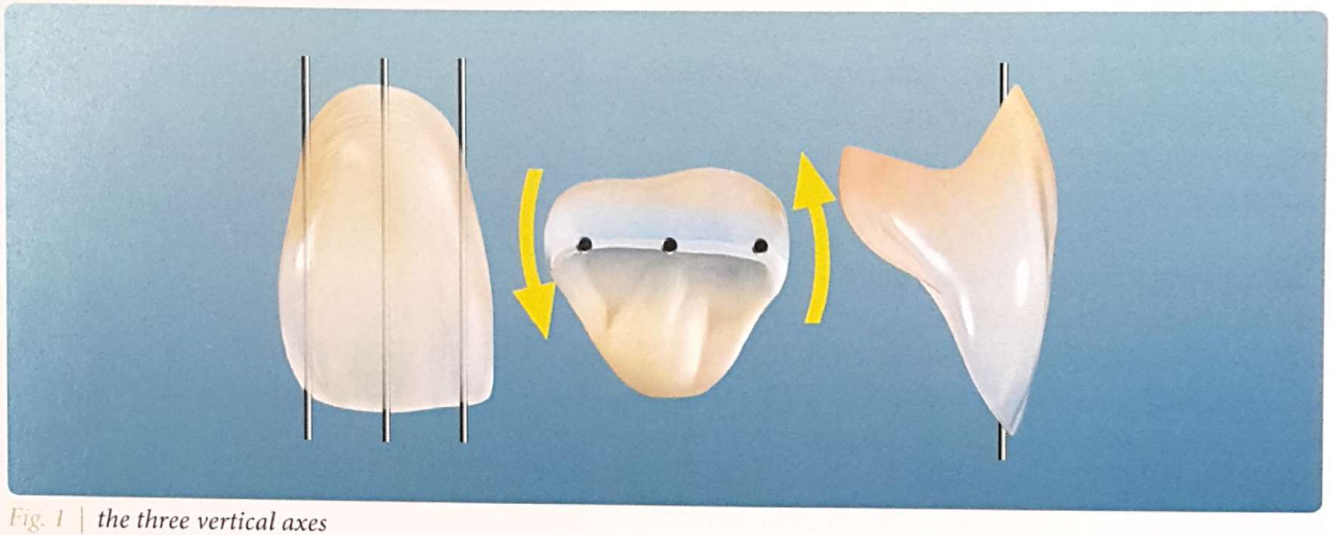


Fig. 1 | *the three vertical axes*

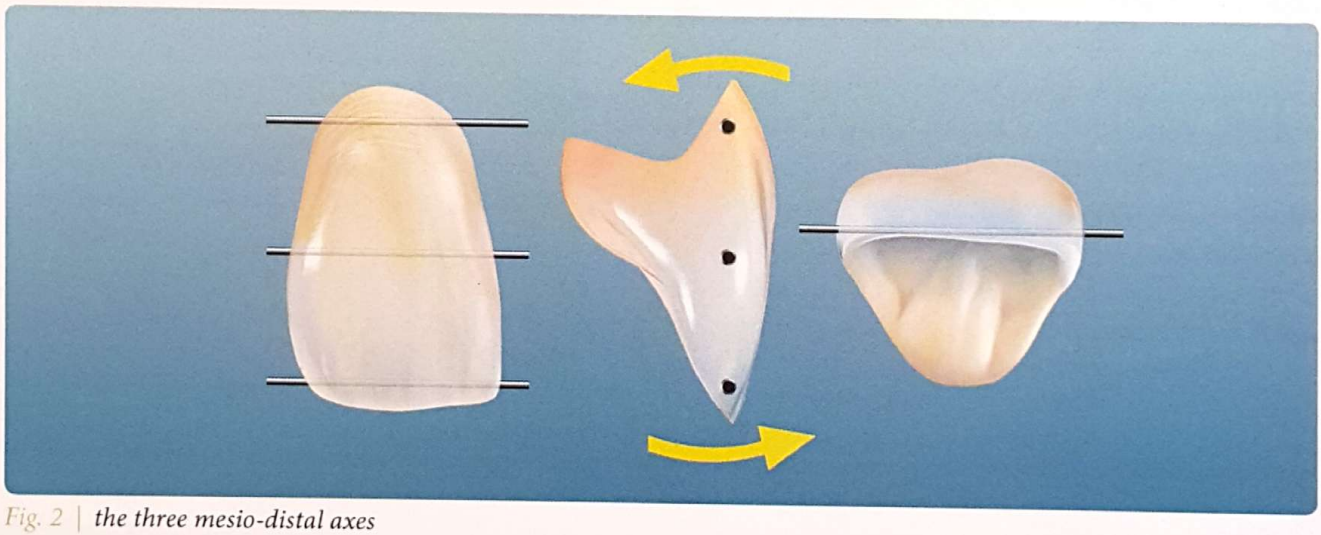


Fig. 2 | *the three mesio-distal axes*

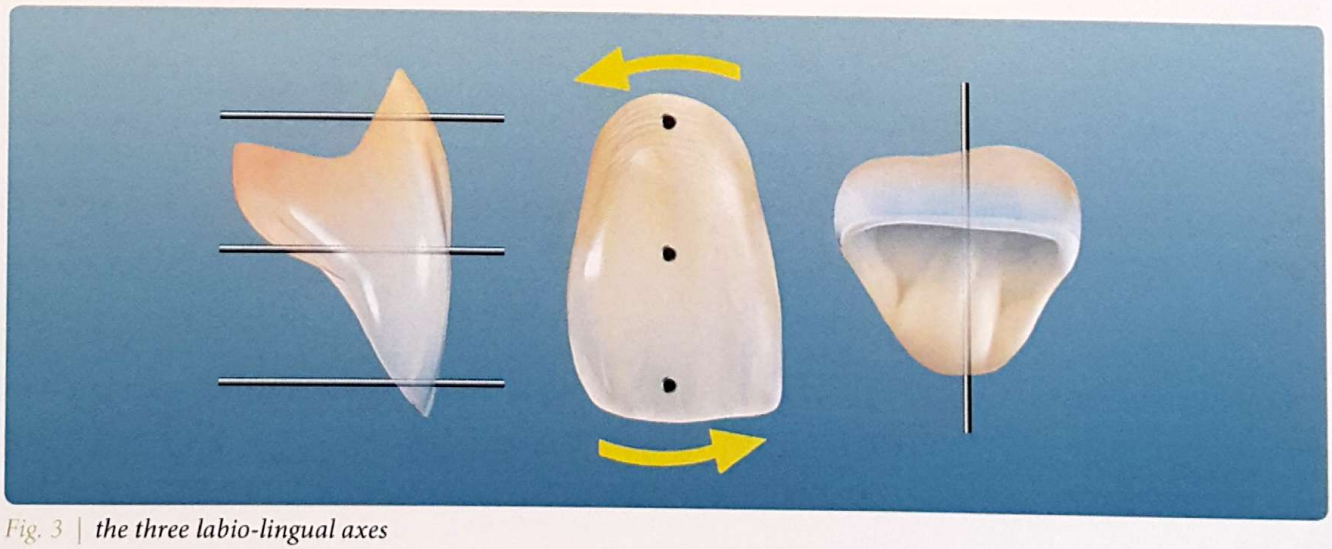


Fig. 3 | *the three labio-lingual axes*

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The Three Vertical Axes

The three vertical axes run vertically through the tooth from the incisal to the root. They are the **mesial vertical**, the **central vertical**, and the **distal vertical** axes.

When a tooth is rotated on the **mesial vertical axis**, it looks like a door that has been turned on its hinges. The mesial of the tooth remains in place, while the distal is turned out to the labial, or in to the lingual. *(Figs. 1 and 4)*

The tooth could also be rotated on its **distal vertical axis** like a door hinged on the other side. In this case, the distal would remain fixed, and the mesial would be turned out or in. *(Figs. 2 and 5)*

When it is rotated on the **central vertical axis**, it's more like a revolving door. If the mesial was turned in, of course the distal would have to be out. If the distal was in, the mesial would be out. *(Fig. 3)*

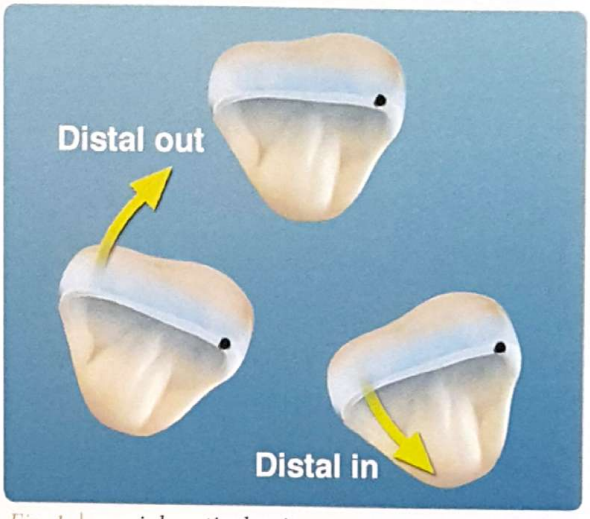


Fig. 1 | *mesial vertical axis*

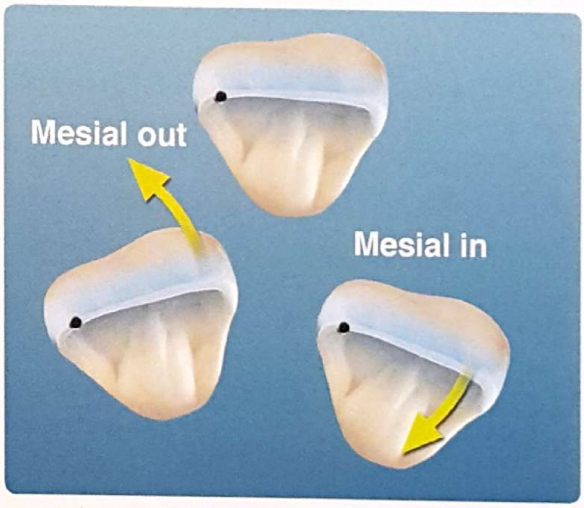


Fig. 2 | *distal vertical axis*

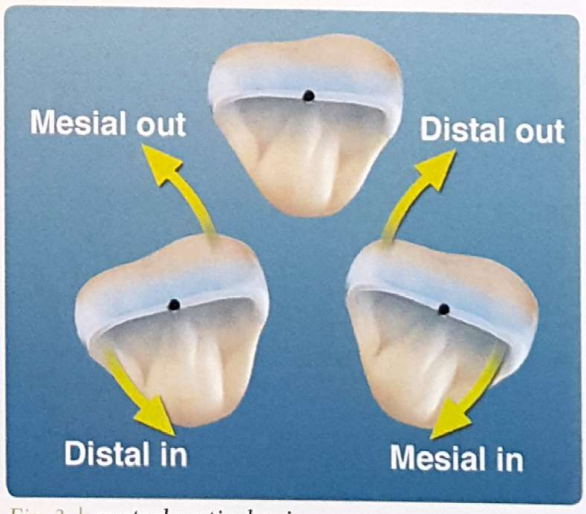


Fig. 3 | *central vertical axis*



Fig. 4 | *mesial vertical axis, distal in*



Fig. 5 | *distal vertical axis, mesial in*

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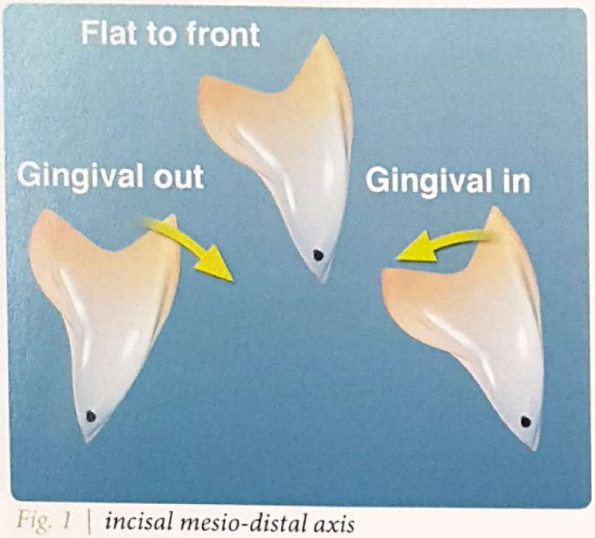


Fig. 1 | *incisal mesio-distal axis*

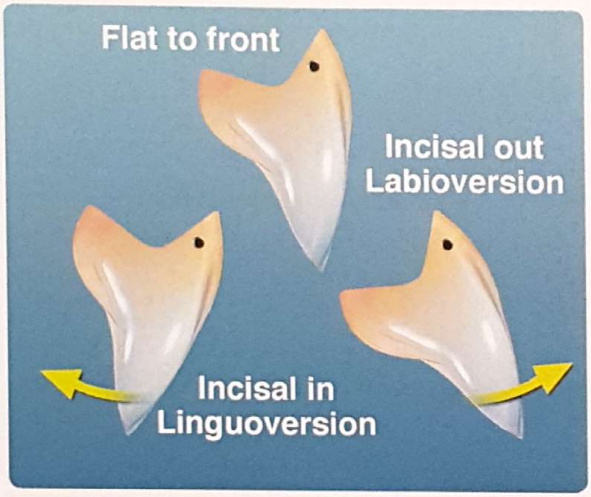


Fig. 2 | *gingival mesio-distal axis*

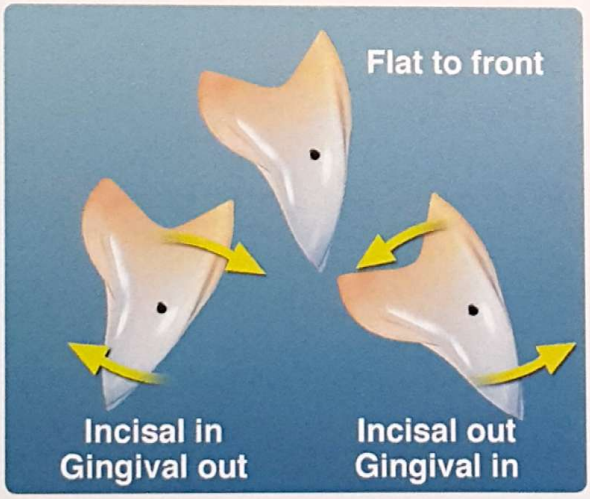


Fig. 3 | *central mesio-distal axis*

The Three Mesio-Distal Axes

The three **mesio-distal axes** run horizontally through the tooth from mesial to distal. They are the **incisal mesio-distal**, **central mesio-distal**, and **gingival mesio-distal** axes.

When a tooth is rotated on its **incisal mesio-distal axis** the incisal edge remains fixed, however, the gingival would move either labially or lingually. *(Fig. 1)*

On the **gingival mesio-distal axis**, the gingival would remain in place, but the incisal could be moved lingually. There's a special term for this position, which is called **linguoversion**. The incisal could also be turned labially, in what we call **labioversion**. *(Figs. 2, 4 and 5)*

On the **central mesio-distal axis**, you would either find the incisal depressed and the gingival out, or you would find the gingival depressed and the incisal out. *(Fig. 3)*



Fig. 4 | *gingival mesio-distal axis, incisal out*



Fig. 5 | *gingival mesio-distal axis, incisal in*

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The Three Labio-Lingual Axes

The three labio-lingual axes run through the tooth from labial to lingual. They are the **incisal labio-lingual**, **central labio-lingual**, and **gingival labio-lingual** axes.

The tooth could be rotated on **incisal labio-lingual axis**. The incisal edge would be fixed. However, the gingival would rotate either to the mesial or to the distal. *(Fig. 1)*

The **gingival labio-lingual axis** fixes the gingival in place. The incisal is rotated either to the mesial or the distal. *(Fig. 2)*

The tooth could also be rotated around the **central labio-lingual axis**. If the incisal edge is turned to the mesial, the gingival will be to the distal. Likewise, if the incisal is to the distal, the gingival will be to the mesial. *(Fig. 3)*

Finally, it's important to note that all six anterior teeth in a natural smile would in some way or another have a position in accordance with these nine axes of rotation, providing all of us a way to discern each tooth's position in the composition of any smile.

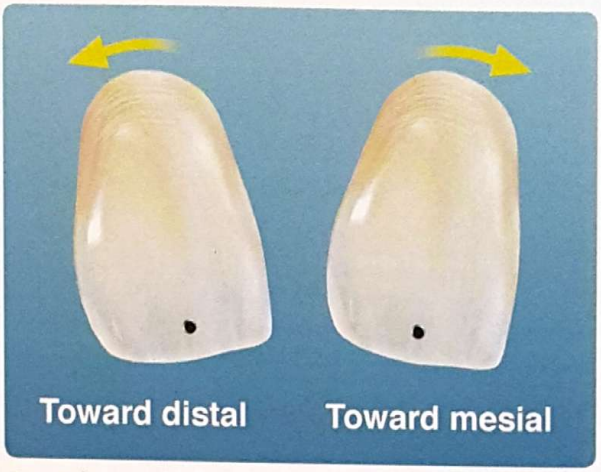


Fig. 1 | *incisal labio-lingual axis*

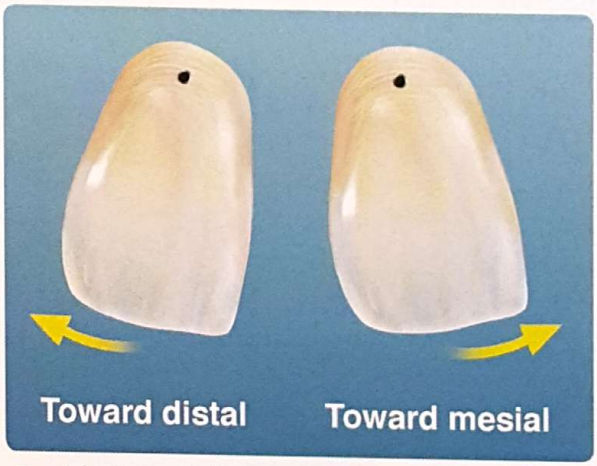


Fig. 2 | *gingival labio-lingual axis*

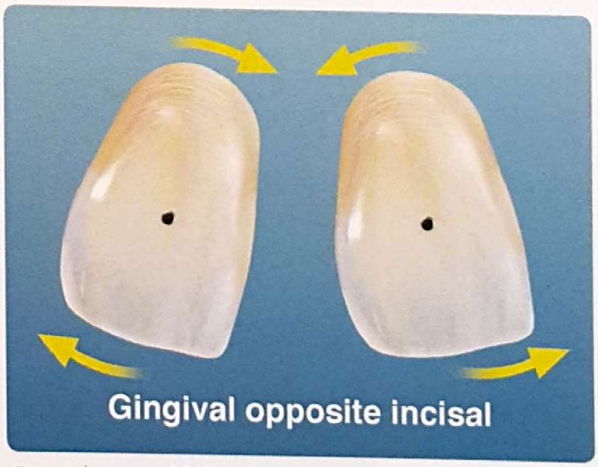


Fig. 3 | *central labio-lingual axis*

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Fig. 1

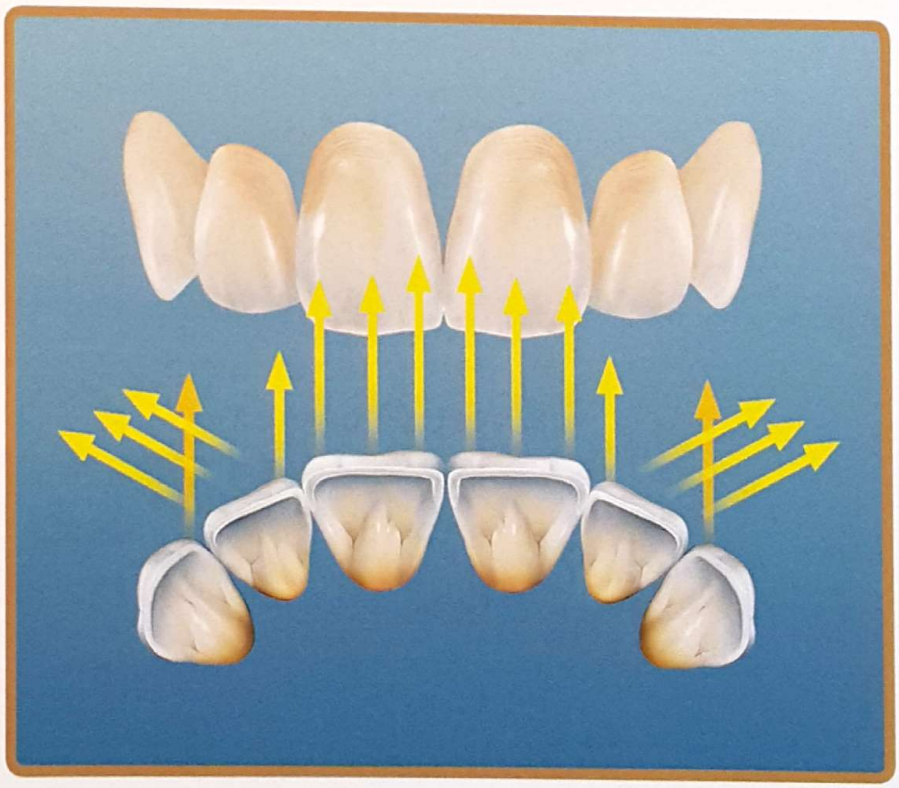
These nine rotational axes become a stable reference point for communicating tooth position.

In conclusion, when applying these principles to anterior waxing, ceramics, denture setups, orthodontia, temporization, implant placement and in CAD/CAM design, correct assessment and action can more easily take place.

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Esthetic Component Eight

The Esthetic Composition of a Natural Smile



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Fig. 1 | *the basic esthetic composition*



Fig. 2 | *the strong esthetic composition*



Fig. 3 | *the soft esthetic composition*

In this section, we'll examine the eighth component of a natural smile, the **three esthetic tooth arrangements** that we find most reoccurring in natural, pleasing smiles. *(Figs. 1 - 3 and next page Figs. 1 - 3)*

You can test the premise of this section yourself by observing those smiles around you at social events, watching television or examining photographs in magazines. You'll also notice smiles where the teeth don't fit into these three esthetic compositions and, in that case, we think you will agree they are not as pleasing to look at.

As you concentrate on these three variations of a natural smile, your objective should be to differentiate and communicate the tooth arrangement in any smile.

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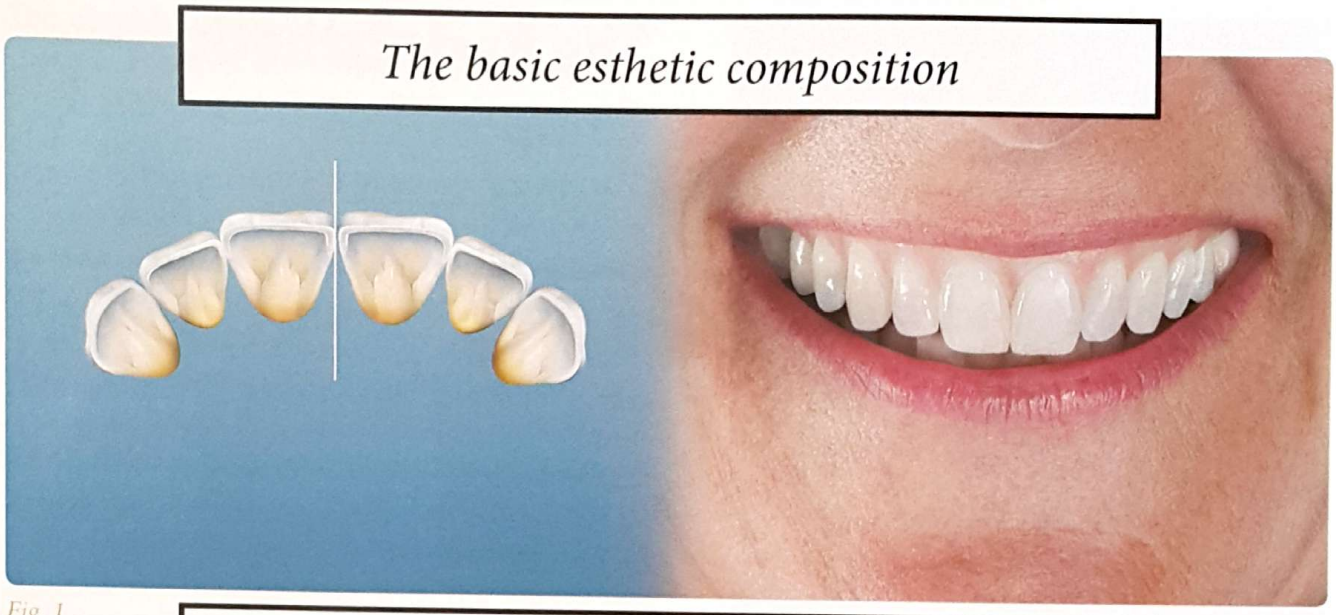


Fig. 1



Fig. 2



Fig. 3

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Fig. 1 | centrals flat to the front

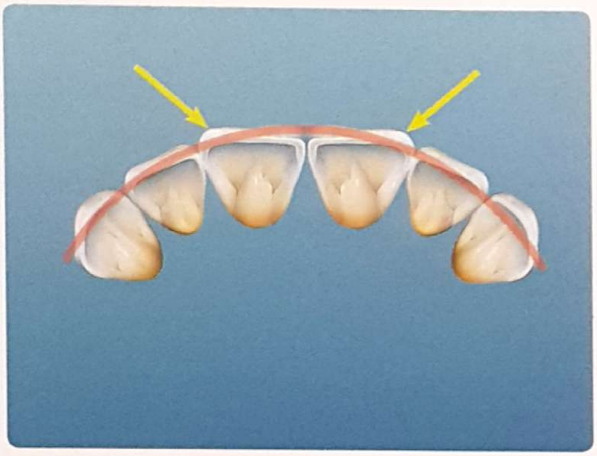


Fig. 2 | the curve of the arch

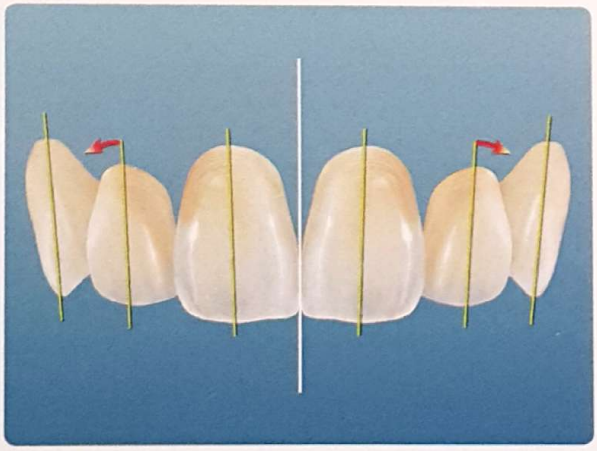


Fig. 3 | the long axes

The Basic Esthetic Composition

The first arrangement is a basic esthetic composition which is found in the majority of natural-looking smiles. We'll start with the centrals.

The two upper centrals are found centered on the midline, facing flat to the front of the mouth and vertical in profile. You will find that in most pleasing, natural smiles, the centrals will be flat to the front. Their long axes will be vertical or tilted slightly toward the distal. *(Fig. 1)*

The laterals will follow the curve of the maxillary arch. The distal of each central appears rotated out from the laterals a little, due to the centrals being flat to the front. *(Fig. 2)*

The laterals will be shorter than the centrals, the amount depending on the abrasion of the centrals and the person's age. Notice that the long axes of the laterals in this case tilt slightly to the distal. *(Fig. 3 and 4)*



Fig. 4 | basic composition

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The cuspids, like the laterals, are found in the curve of the arch and would be about the same length as the laterals, following the upward curve of the smile. The long axes of the cuspids are vertical in buccal profile, or tilted just slightly to the distal. *(Fig. 1)*

Notice that the cuspids are also rotated out approximately 3 to 5 degrees on the incisal mesio-distal axis, emphasizing their prominence at the gingival. *(Fig. 2)*

The mesials of the cuspids are turned out on the central vertical axis. Notice that their disto-labial surfaces are in alignment with the buccal surfaces of the posterior teeth. *(Fig. 3)*

Imagine standing in front of the patient with this esthetic composition. As you recall, each central has three lobes. So, because the centrals are flat to the front, there would be six lobes reflecting light back to the viewer.

The laterals, on the other hand, are rotated on their central vertical axes to match the curve of the arch, and in this case, the light reflection would tend to fall away, softening their appearance and, at the same time, distinguishing them from the centrals. The mesials of the cuspids are slightly exposed, reflecting light to the front and accentuating their axes, which draws the eye into the smile. *(Fig. 4)*



Fig. 1 | *cuspid length*



Fig. 2 | *gingivals out 3° to 5°*

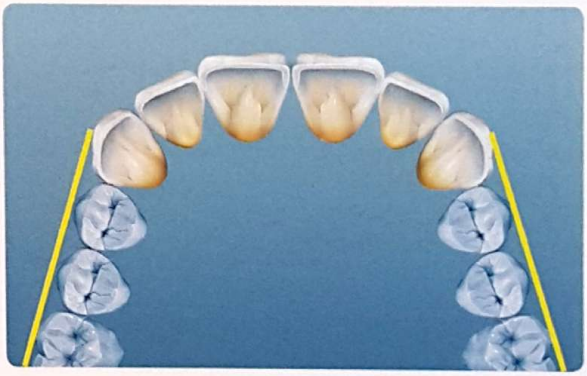


Fig. 3 | *mesials out, distals in*

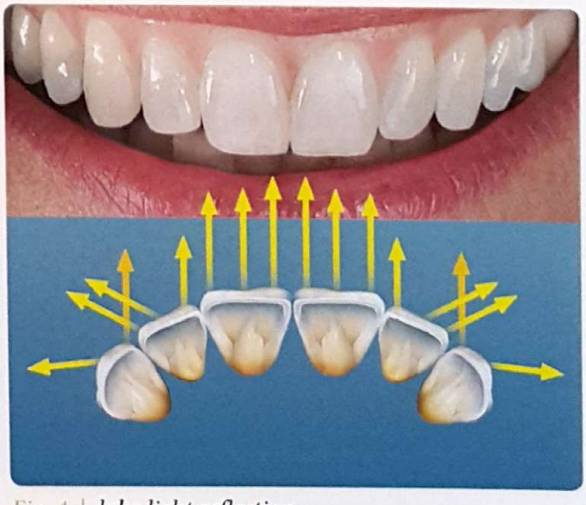


Fig. 4 | *lobe light reflection*

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Fig. 1 | strong composition



Fig. 2 | incisal view



Fig. 3 | labial view

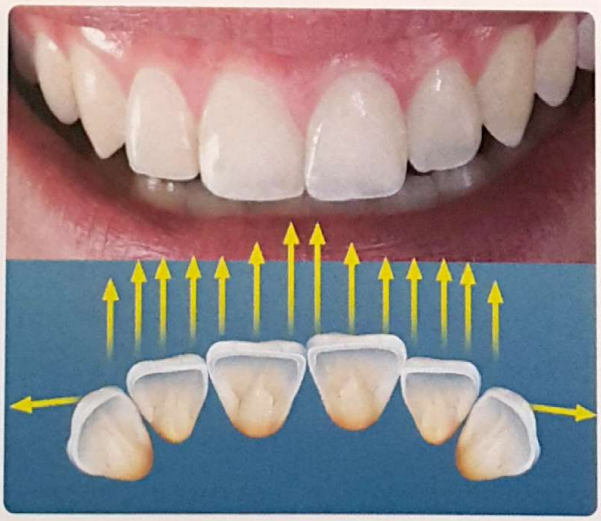


Fig. 4 | light reflects straight back

The Strong Esthetic Composition

Since it is the light reflection of an esthetic composition that dictates what the eye sees, you can see that more light reflection would bring more attention to the teeth, making them appear stronger and more vigorous. *(Fig. 1)*

Like in the basic smile, we find the centrals at the midline and flat to the front. Many times in nature, one central will be slightly offset from the other. *(Fig. 2)*

As in the basic composition, the laterals will be found in the curve of the arch, and shorter than the centrals. However, in this case, the long axes will be vertical, as opposed slanting toward the distal. In many cases, we'll find one or both laterals turned in on their distal vertical axes, flat to the front, and slightly depressed from the centrals. *(Figs. 2 and 3)*

The cuspids will be the same as in the basic composition.

In this esthetic composition, the light reflection, as the arrows show, can appear quite aggressive, due to the 14 lobes reflecting so much light back to the viewer. *(Fig. 4)*

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The Soft Esthetic Composition

You often see soft, delicate natural smiles, which are very appealing. Once again, you'll find the centrals positioned flat to the front. *(Fig. 1)*

In the case of the laterals, they will appear rotated on their central vertical axes, mesial out, distal in, and, ever so slightly, they may lap over the distal of the centrals. At the same time, the gingivals appear depressed in on their incisal mesio-distal axes. *(Fig. 2)*

In this instance, the laterals are shorter than the centrals. This increases the curve of the smile and creates a more youthful appearance.

One lateral may appear to be rotated on its incisal labio-lingual axis, with its gingival toward the mesial, creating a natural, asymmetric look, one lateral from the other.

Because the gingival of the laterals are slightly depressed, and because the cuspids have an inclination of up to 5 degrees, the amount of the cuspids exposed makes them more apparent. This accentuates their long axes, drawing your eye into the soft, delicate smile. *(Fig. 3)*

As before, with all six anterior teeth together in this composition, the light would vary accordingly, creating what could be perceived a softer, more delicate smile. *(Fig. 4)*



Fig. 1 | *soft esthetic composition*



Fig. 2 | *laterals rotated out*



Fig. 3 | *cuspids out 5°*

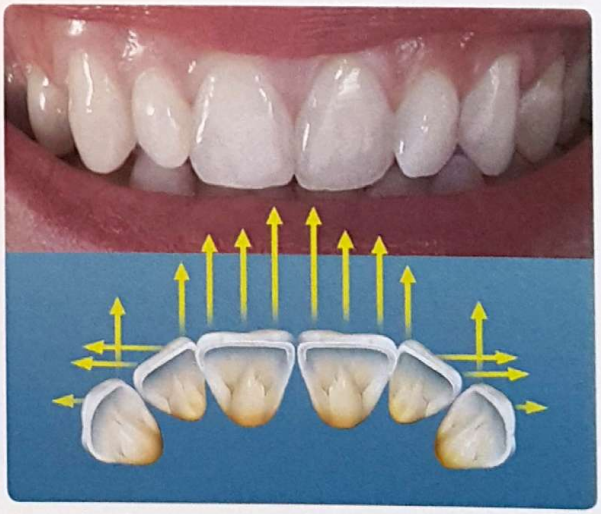


Fig. 4 | *soft composition light reflection*

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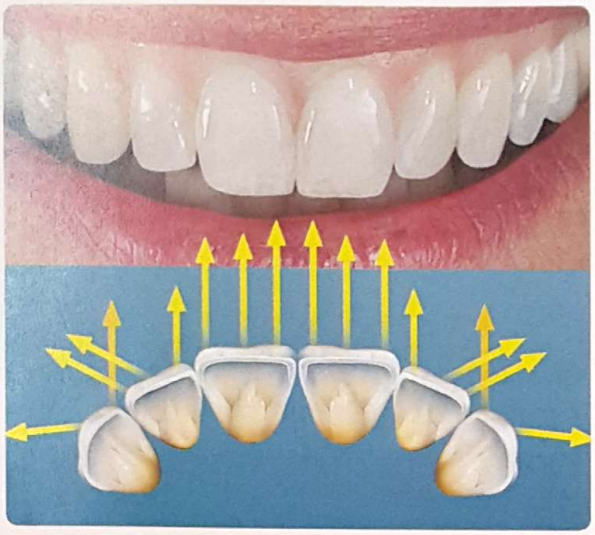


Fig. 1 | the basic esthetic composition

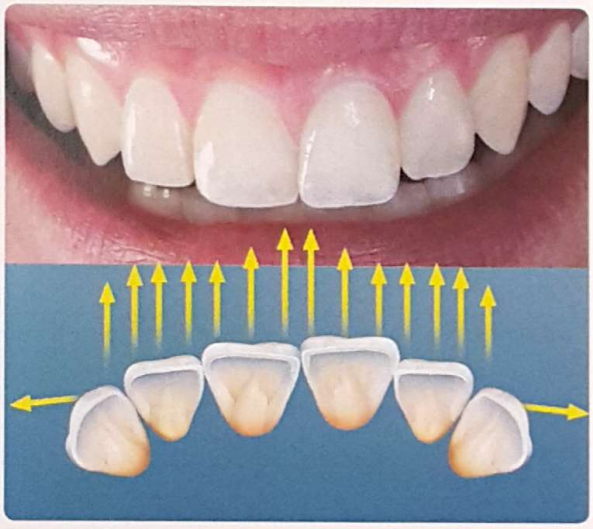


Fig. 2 | the strong esthetic composition

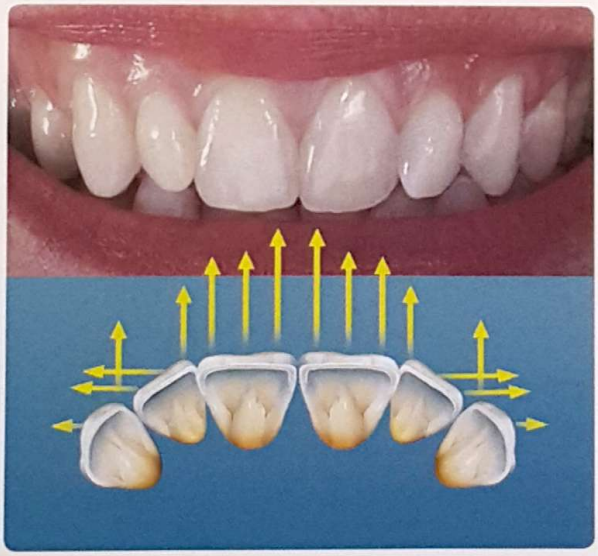


Fig. 3 | the soft esthetic composition

You can see in all three esthetic compositions that it's the laterals that change the personality of the smile. We know that for ourselves, because in viewing all the different variety of smiles in life, it's almost always the inclinations and rotations of the laterals that have the largest effect on what we perceive in a person's smile.

These three esthetic compositions represent a basis of all the variety you could see in natural smiles, as they would all be variations of one or the other, extreme one way, or less in another.

In summary, these esthetic compositions become a standard, stable reference that we can use as a basis to describe and communicate any smile composition. They also provide a reference for modification in ceramic frameworks, anterior waxing, anterior porcelain building and contouring, denture setups, orthodontia, temporization, implant placement, laminates and in CAD/CAM design.

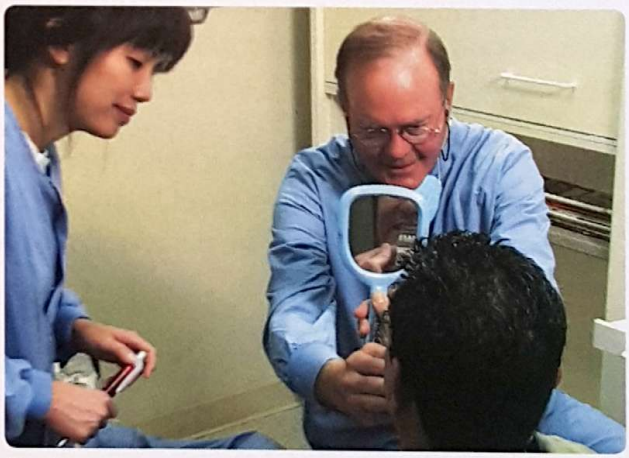
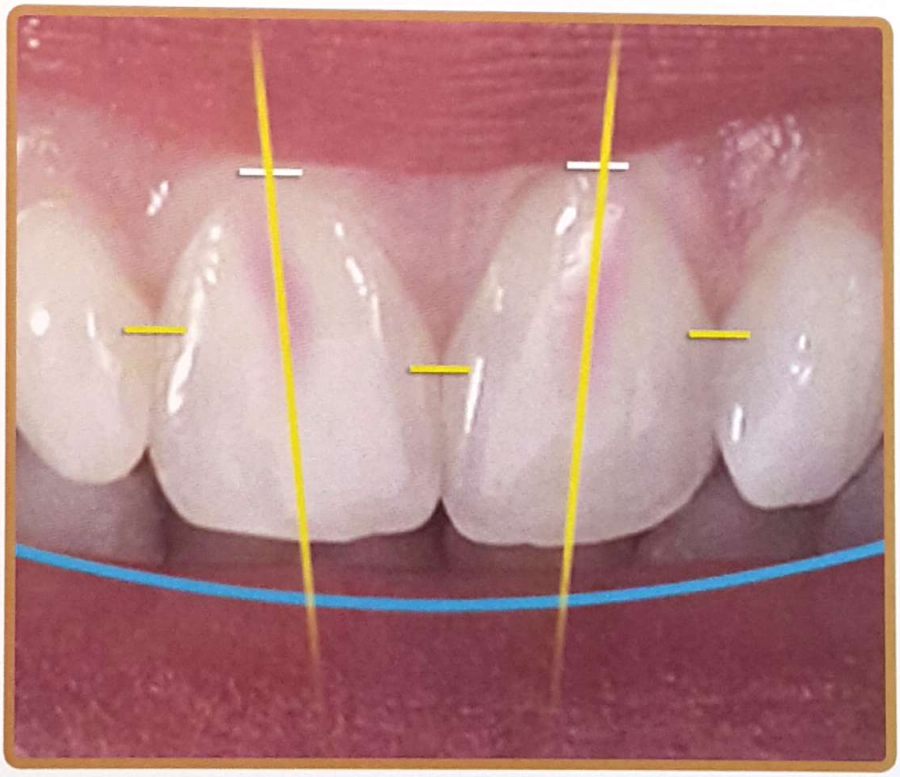


Fig. 4

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Esthetic Component Nine

The Gingival Tissues and Esthetics



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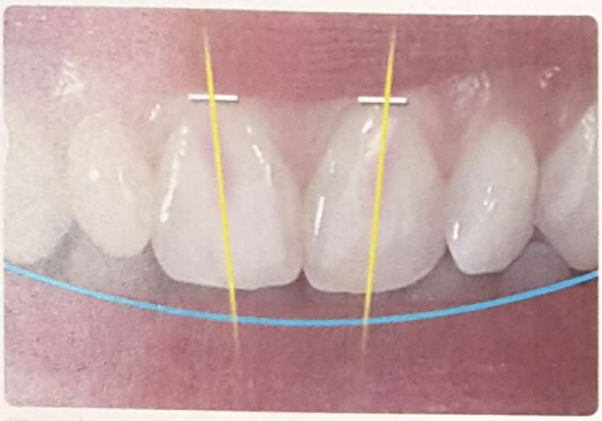


Fig. 1 | gingival collar height

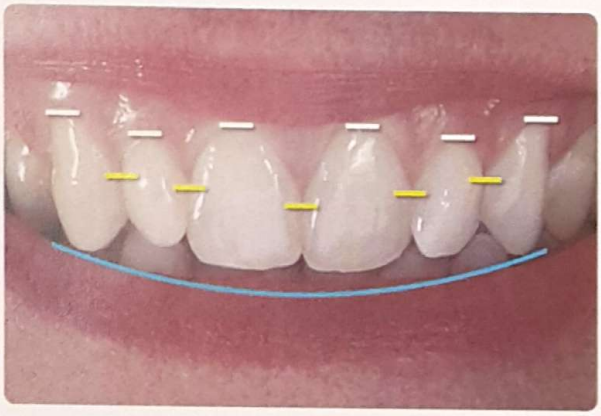


Fig. 2 | tissue heights and papilla length

The ninth esthetic component is recognizing how the soft tissues of the gingiva and the lips affect the smile. First, lets look at the gingival tissue and how it is formed around each of the upper anterior teeth.

Notice that the height of the **gingival collars** of the centrals are at the same height *(white dot)*, with a slight upward curve to the distal, just as we saw with the long axis and the "S" curve. *(Fig. 1)*

On the laterals, the gingival collar is lower. On the cuspids, the gingival height is higher than that of the centrals, complementing the curve of a natural smile. *(Fig. 2)*

Another aspect of the gingival tissues is the length of the interdental papillae. As you see in *Figure 2*, the central papilla is the longest. Between the central and the lateral it is slightly shorter, and between the lateral and the cuspid it is even shorter, again reinforcing the upward curve of the smile. *(Fig. 3)*

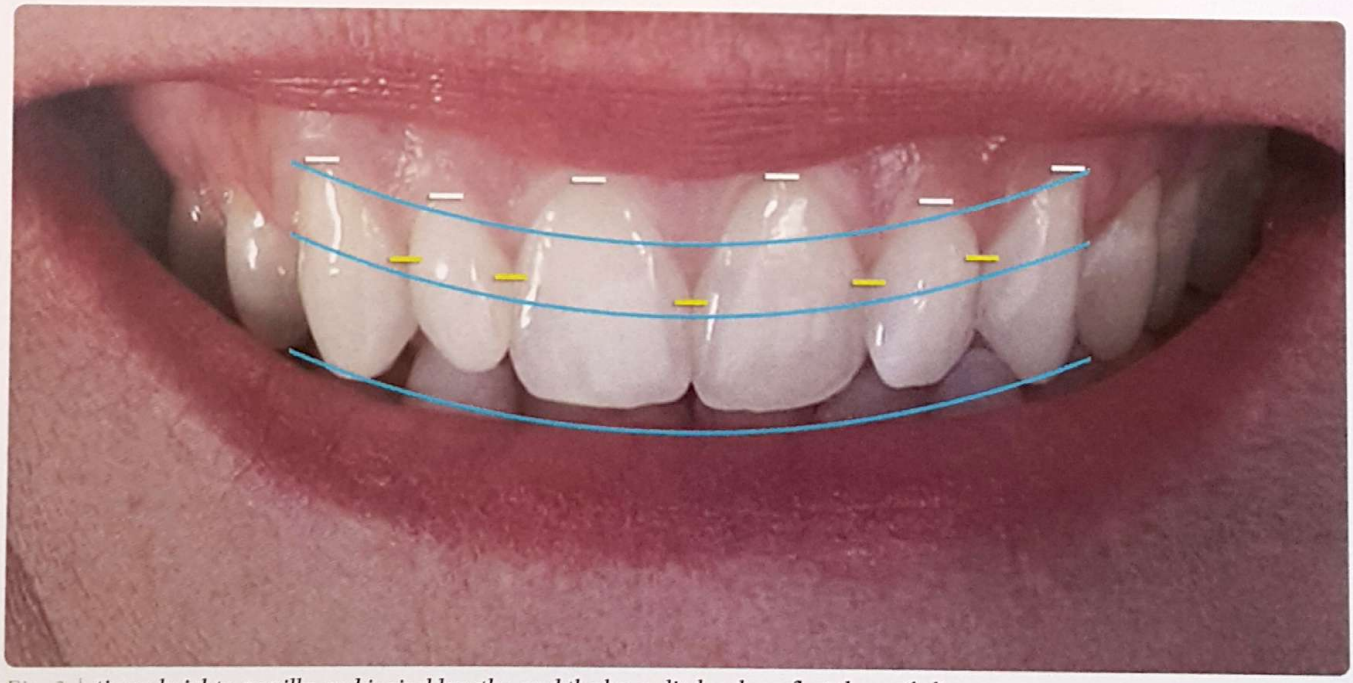


Fig. 3 | tissue heights, papilla and incisal lengths, and the lower lip border reflect the smile line

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Soft Tissue Recontouring

This patient's gingival tissue covers too much of her right lateral, distracting from the overall esthetic composition. The doctor may wish to contour the soft tissue to increase the clinical crown length. *(Fig. 1)*

The dentist can recontour the tissue, dramatically improving the look of the smile. *(Fig. 3)*

Figure 2 shows an extreme example, where the tissue covers too much of all the anterior teeth. Recontouring the soft tissue dramatically improves the overall esthetic appearance. *(Fig. 4)*

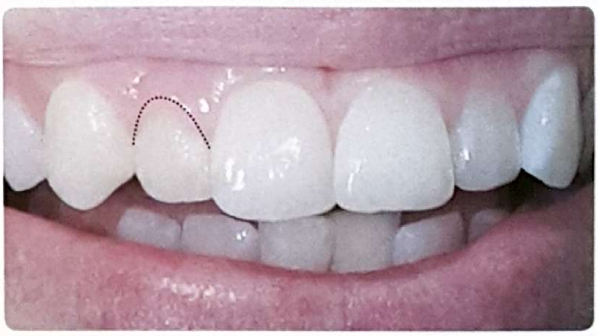


Fig. 1 | overextended gingiva

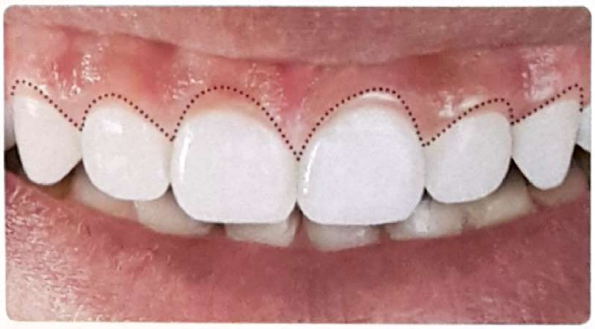


Fig. 2 | overextended gingiva



Fig. 3 | single unit soft tissue esthetic recontouring



Fig. 4 | six unit soft tissue esthetic recontouring

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Esthetic Component Ten

The Smile Line and Buccal Corridors



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The tenth esthetic component, and the last one to discuss, is how the teeth relate to the lips in a natural smile. As you see in *Figure 1*, the lower lip in a natural smile curves up to the corners of the mouth. You can see how the incisal edges of the upper teeth follow the same curve. This is called the **smile line**.

Notice how the height of the gingival crests, and the length of the interdental papillae, harmonize with the smile line as in component 9.

The height of the upper lip in a grin is just at the necks of the upper centrals, creating what we call the **high lip line**. *(Fig. 2)*

When the lip is at rest, it comes down, covering all but the incisal edges of the centrals. This is called the **low lip line**. In the elderly, the low lip line could cover most or all of the centrals. *(Fig. 3)*

The triangular space between the cheek and the buccal surfaces of the posterior teeth is the called the **buccal corridor**. It is normal among men and women of all ages. *(Fig. 4)*



Fig. 1 | *the smile line*

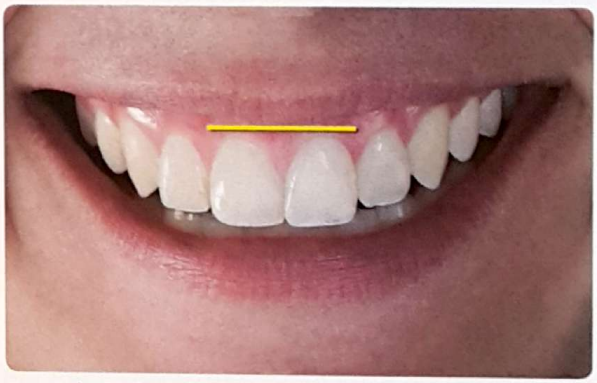


Fig. 2 | *the high lip line*

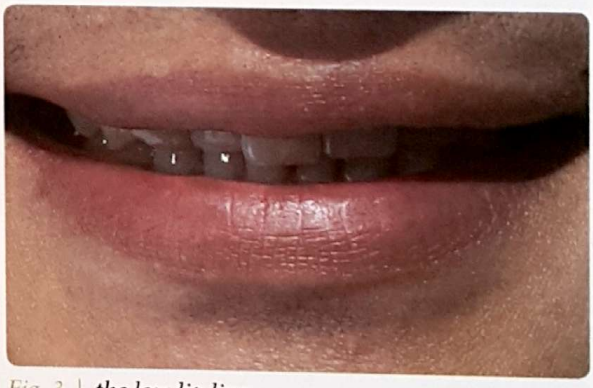


Fig. 3 | *the low lip line*

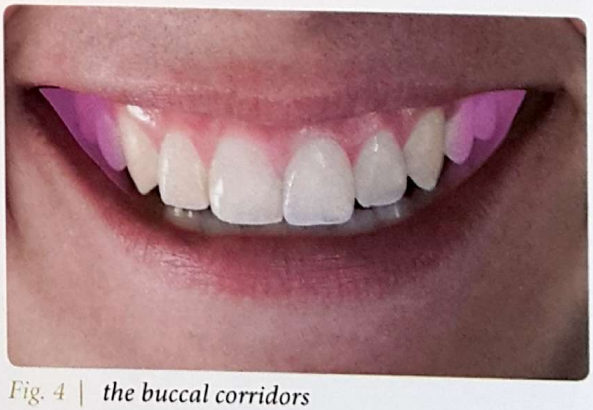


Fig. 4 | *the buccal corridors*

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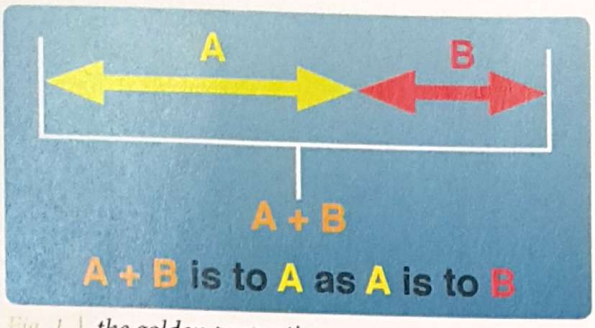


Fig. 1 | *the golden proportion*

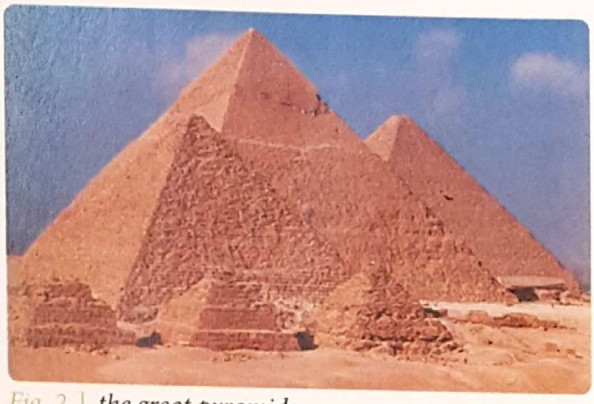


Fig. 2 | *the great pyramids*

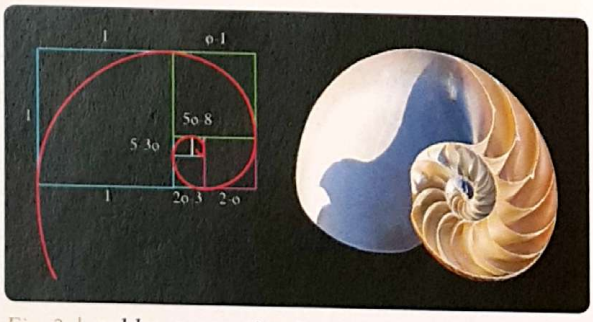


Fig. 3 | *golden proportion in nature*

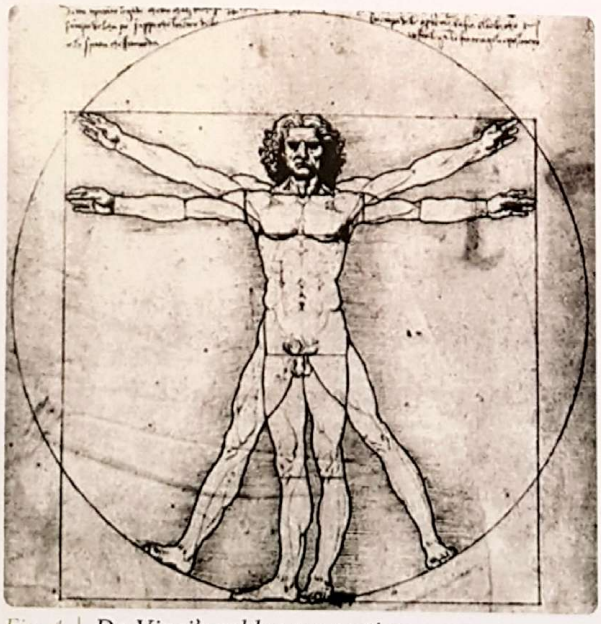


Fig. 4 | *Da Vinci's golden proportion*

The Rule of Golden Proportion

A common method for comparing **relative** tooth size is the **Rule of Golden Proportion**. The rule has been applied since the time of the greek mathematician Pythagoras in 550 BC, and is based on a mathematical principle called *phi*, which establishes a ratio between objects wherein the total size of both objects relates to the larger object the same way the larger object relates to the smaller. *(Fig. 1)*

The Golden Proportion has lots of application in mathematics, architecture and nature. *(Figs. 2 and 3)* Leonardo da Vinci, among others, applied this principle of Golden Proportion in illustrating the proportions of the human body, as well as architecture, in his art. *(Figs. 4 and 5)*



Fig. 5 | *the last supper*

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Mathematically, the Golden Proportion states that the laterals are about 61.8% the size of the centrals. This can make the laterals appear quite small, and may not be appropriate in some cases. *(Fig. 1)*

Dr. Russell Wheeler described in *Dental Anatomy, Physiology and Occlusion*, and Dr. Henry A. Linek in his *Tooth Carving Manual*, a lateral would be about 77% the size of a central, which, in some patients, would make the laterals appear too large. *(Fig. 2)*

There has been much published on the merits of Golden Proportion in dentistry, both pro and con. It has been argued that the rule cannot be applied to every person mathematically. However, the Golden Proportion does provide a way to determine one tooth's size relative to another when restoring the anterior teeth.

In reality, you could use the **rule-of-thumb** that the laterals are approximately **2/3 the size of the centrals.** *(Fig. 3)*

The cuspid creates the turn of the arch and the prominence of its central lobe determines how much it is seen in a smile. The Rule of Golden Proportion can be applied to cuspids in this manner. The cuspids appear to be approximately 2/3 the size of the laterals, when viewed from the front. However, this can vary with the curve of the arch. *(Fig. 4)*

Note: The Golden Proportion is a visual reference only. The restorative dentist would have the final opinion on tooth form and size for each patient.

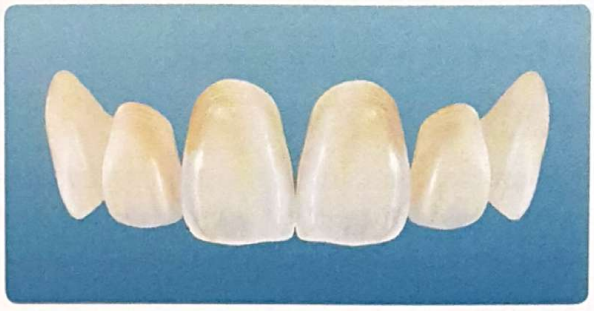


Fig. 1 | *laterals at 61.8% of centrals*



Fig. 2 | *laterals at 77% of centrals*



Fig. 3 | *laterals at 2/3 of centrals*



Fig. 4 | *cuspids at 2/3 of laterals*

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Tooth Color and Fabrication

Of course, color and fabrication procedures play a key role in anterior esthetics and would be considered significant to the esthetics of a natural smile.

PTC covers color and fabrication extensively in our Skill Learning Systems. *(Fig. 1)*

Note: *for further information contact PTC at www.ptcdental.com, e-mail ptc@ptcdental.com.*

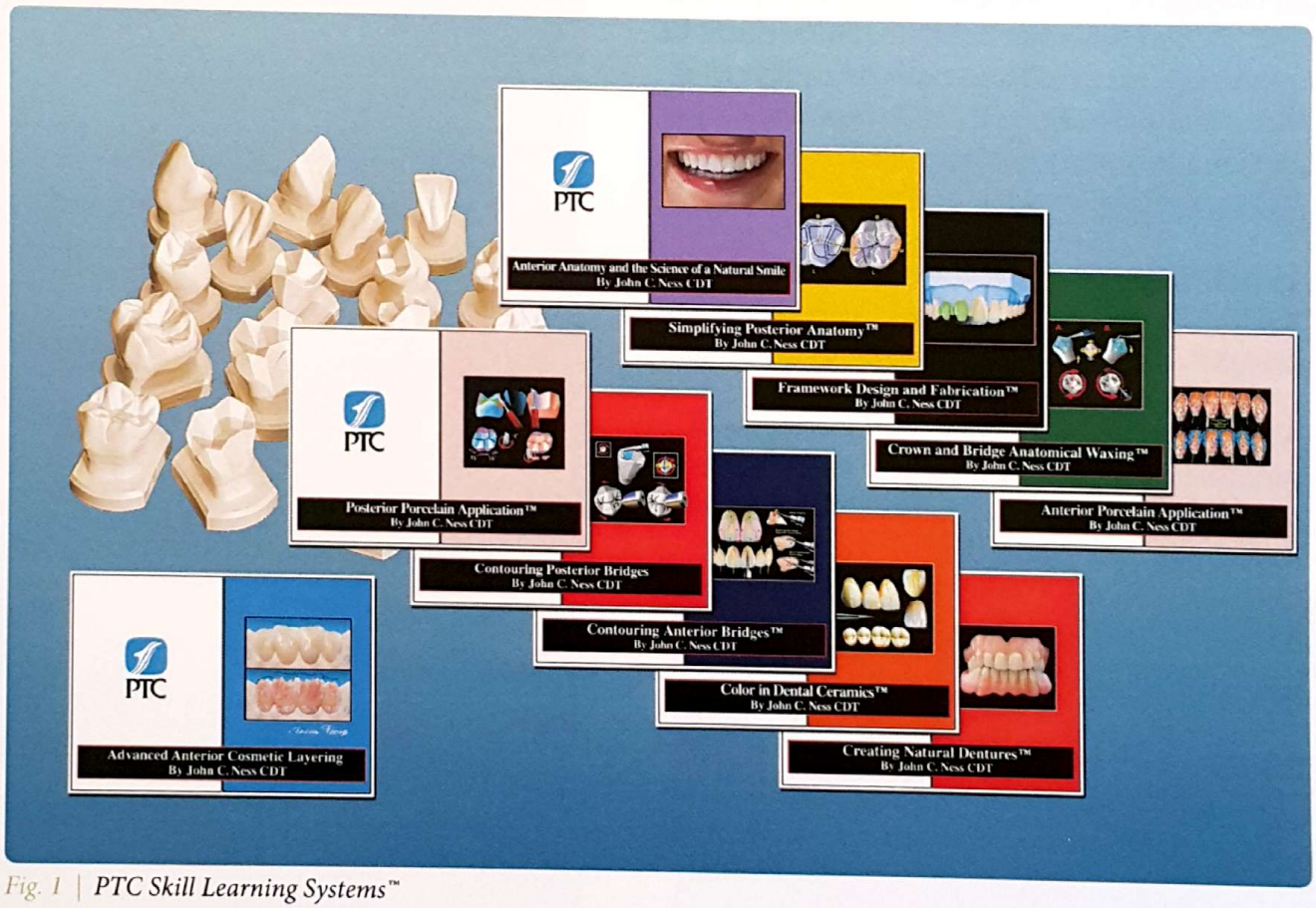


Fig. 1 | *PTC Skill Learning Systems™*

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Anterior Drawing Guide

Imagine the oral cavity divided into four quadrants by the midline (the middle of a person's face) and the occlusal plane. The horizontal line separates the uppers from the lowers, and the vertical line separates the centrals. *(Fig. 1)*

The first step in creating an anterior smile is to divide the space according to the golden proportion. The laterals should be 2/3 the width of the centrals, and the cuspids should be slightly narrower than the centrals. *(Fig. 1)*

Next, establish the long axes, making them converge toward the incisal. *(Fig. 2)*

Begin shaping the teeth with the mesio-gingival embrasures (the mesial triangles). Notice in *Figure 2* how opening the mesial triangles helps establish the long axes.

Finish the smile by opening the remaining embrasures. *(Fig. 3)*

Adjust the teeth to their final length and draw in the anatomical features. *(Fig. 4)*

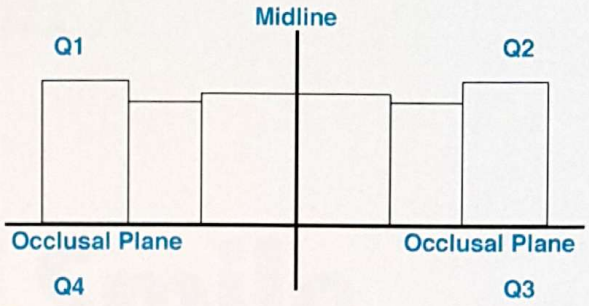


Fig. 1 | frame of reference

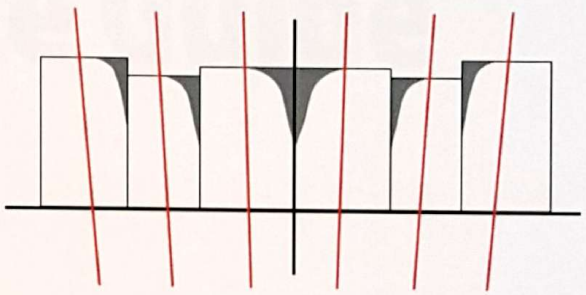


Fig. 2 | long axes and mesial triangles

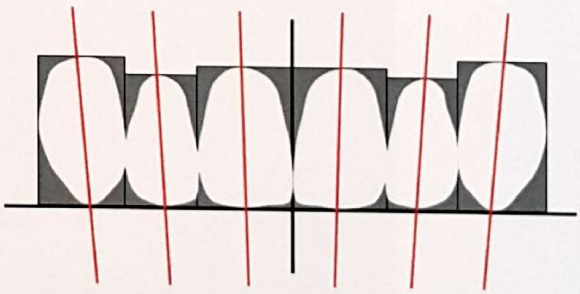


Fig. 3 | open embrasures

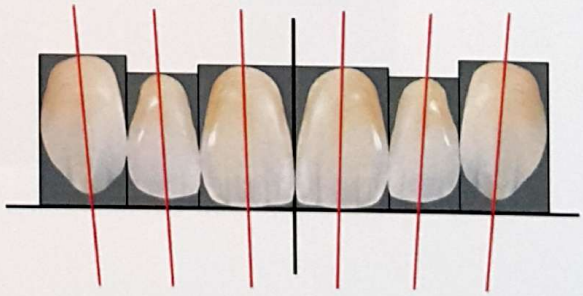
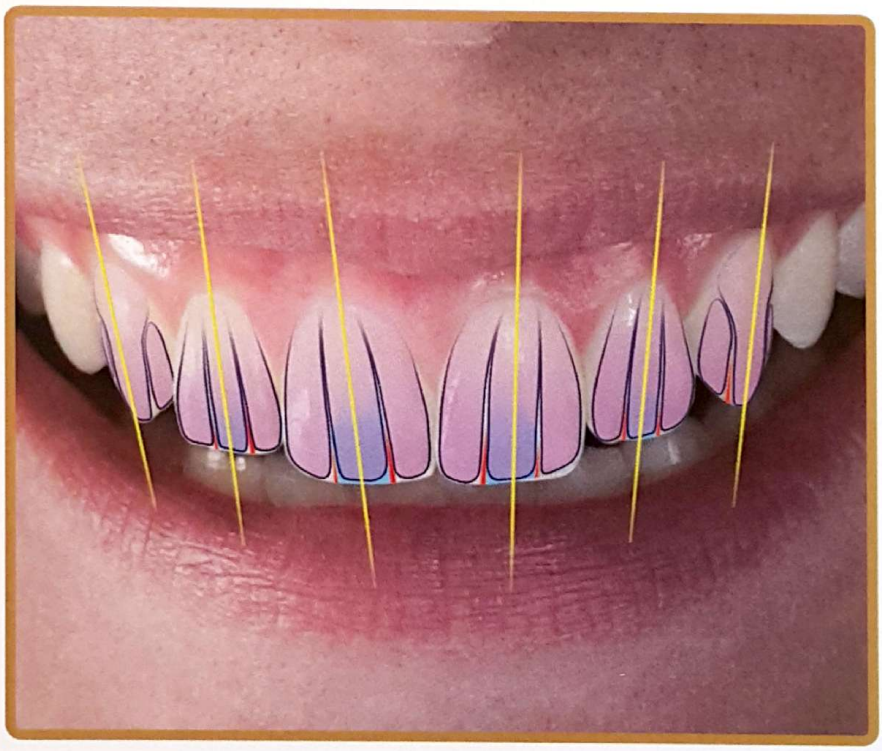


Fig. 4 | properly proportioned bridge

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Appendix A

Natural Smile Reference Guide



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Natural Smile Reference: Long Axis

Use these natural smiles as a reference for the design and fabrication of anterior restorations.

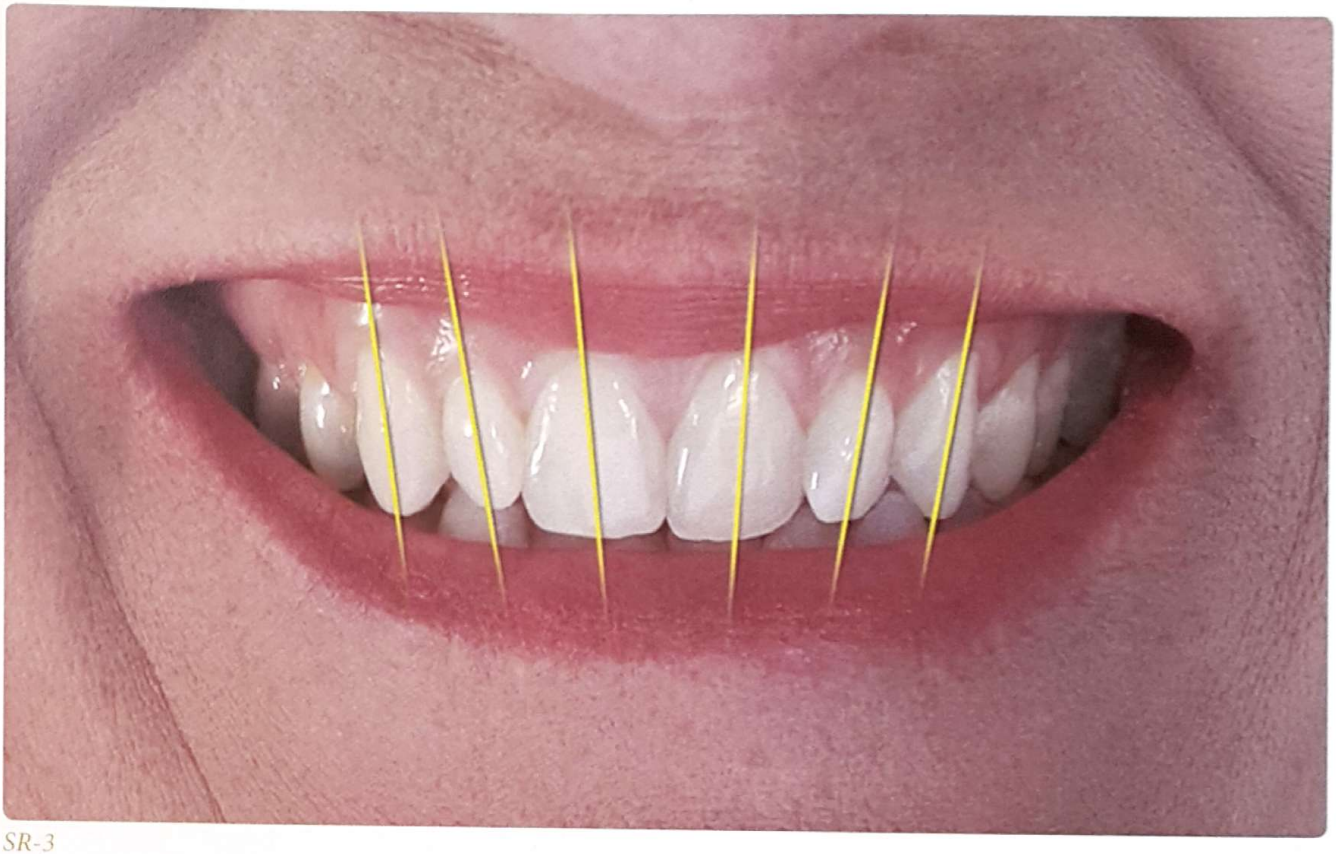


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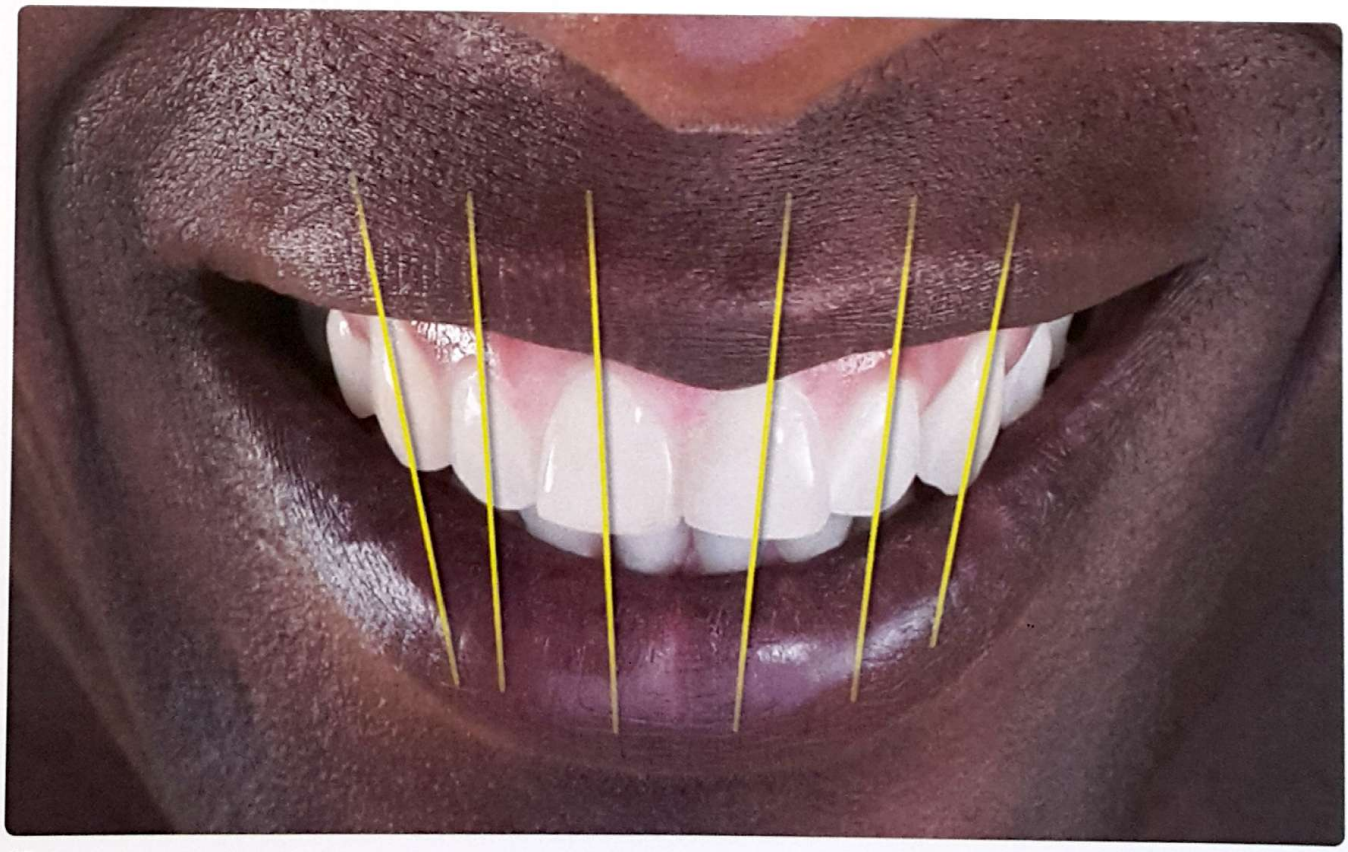


SR-2

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SR-3



SR-4

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Natural Smile Reference: Transitional Line Angles

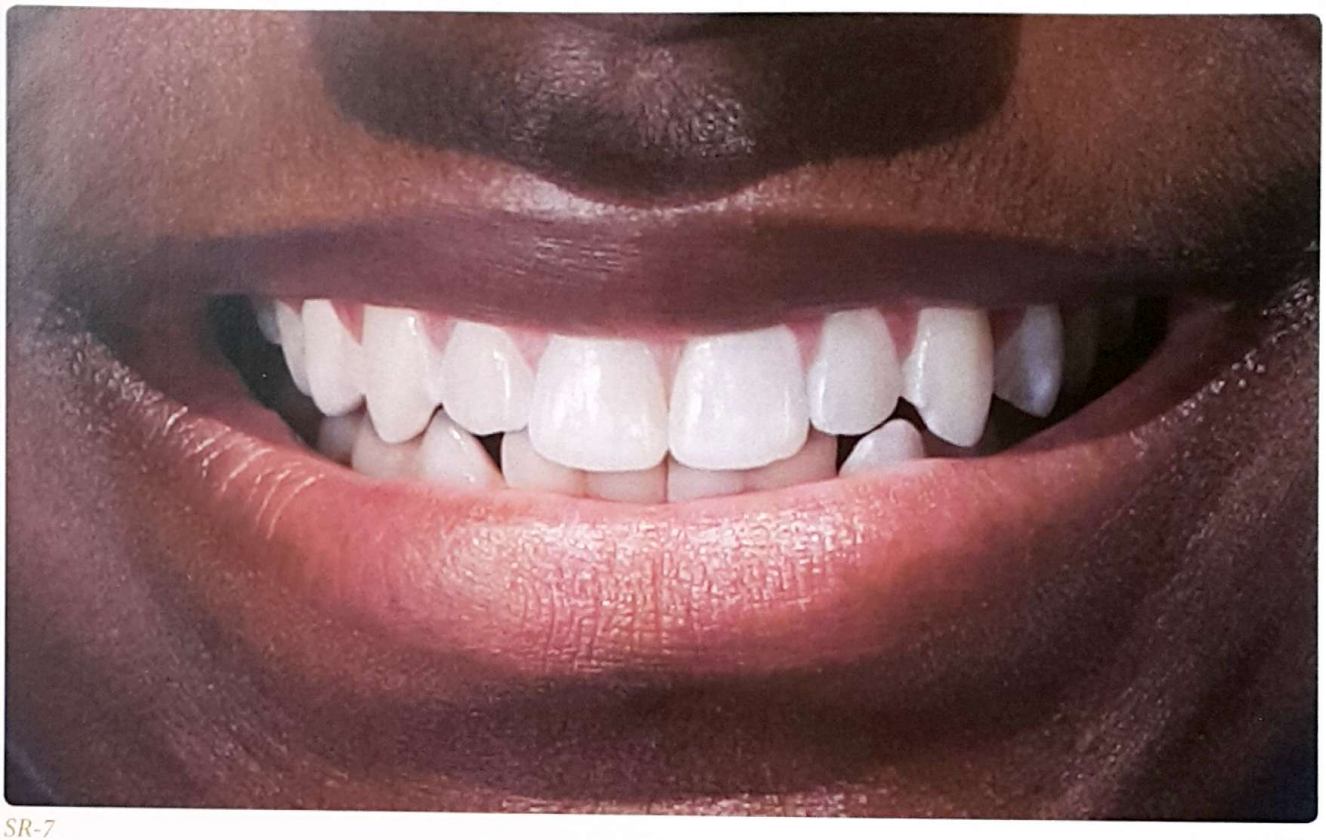


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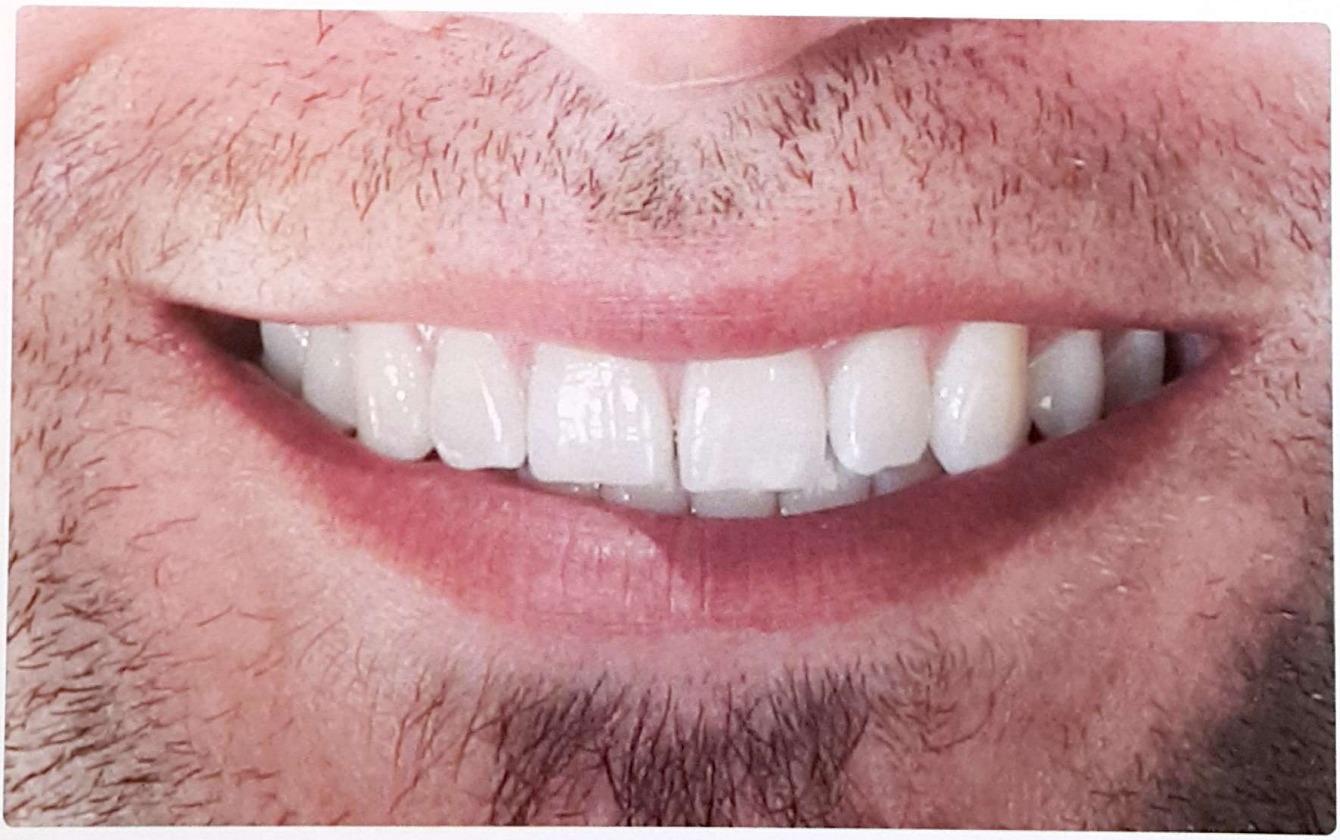


SR-6

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SR-7



SR-8

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Natural Smile Reference: Primary Planes



SR-9



SR-10

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SR-11



SR-12

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Natural Smile Reference: Lobes



SR-13

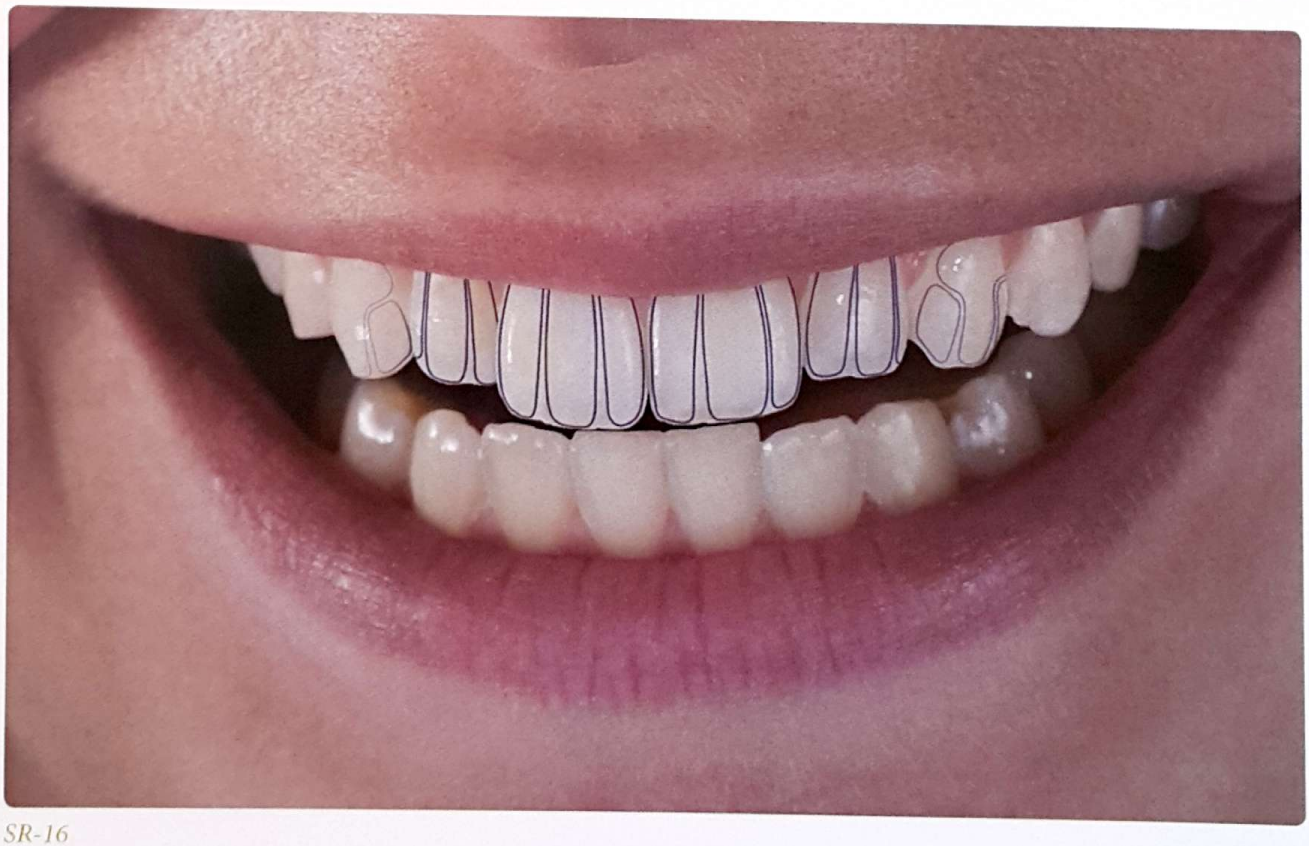


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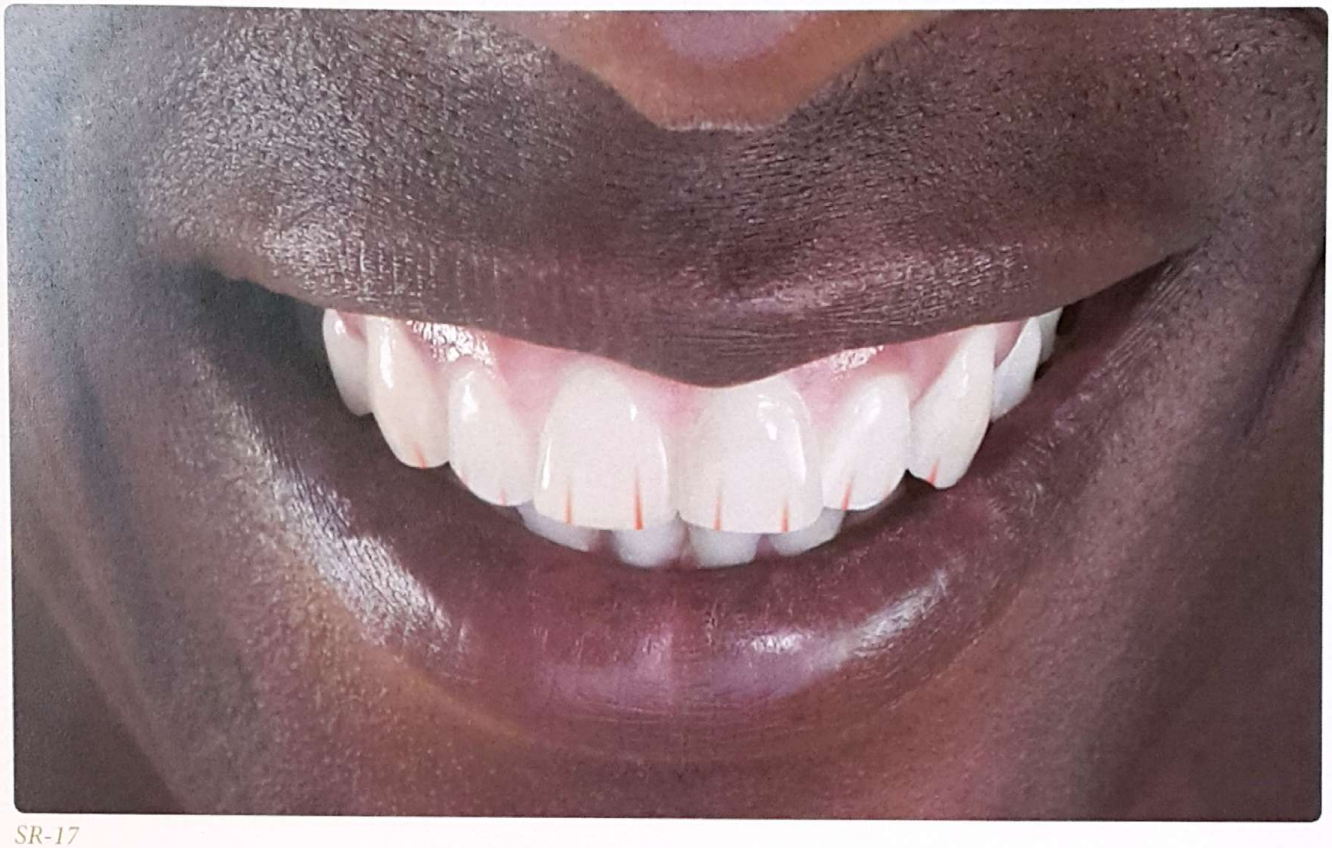
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SR-16

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Natural Smile Reference: Developmental Grooves



SR-17



SR-18

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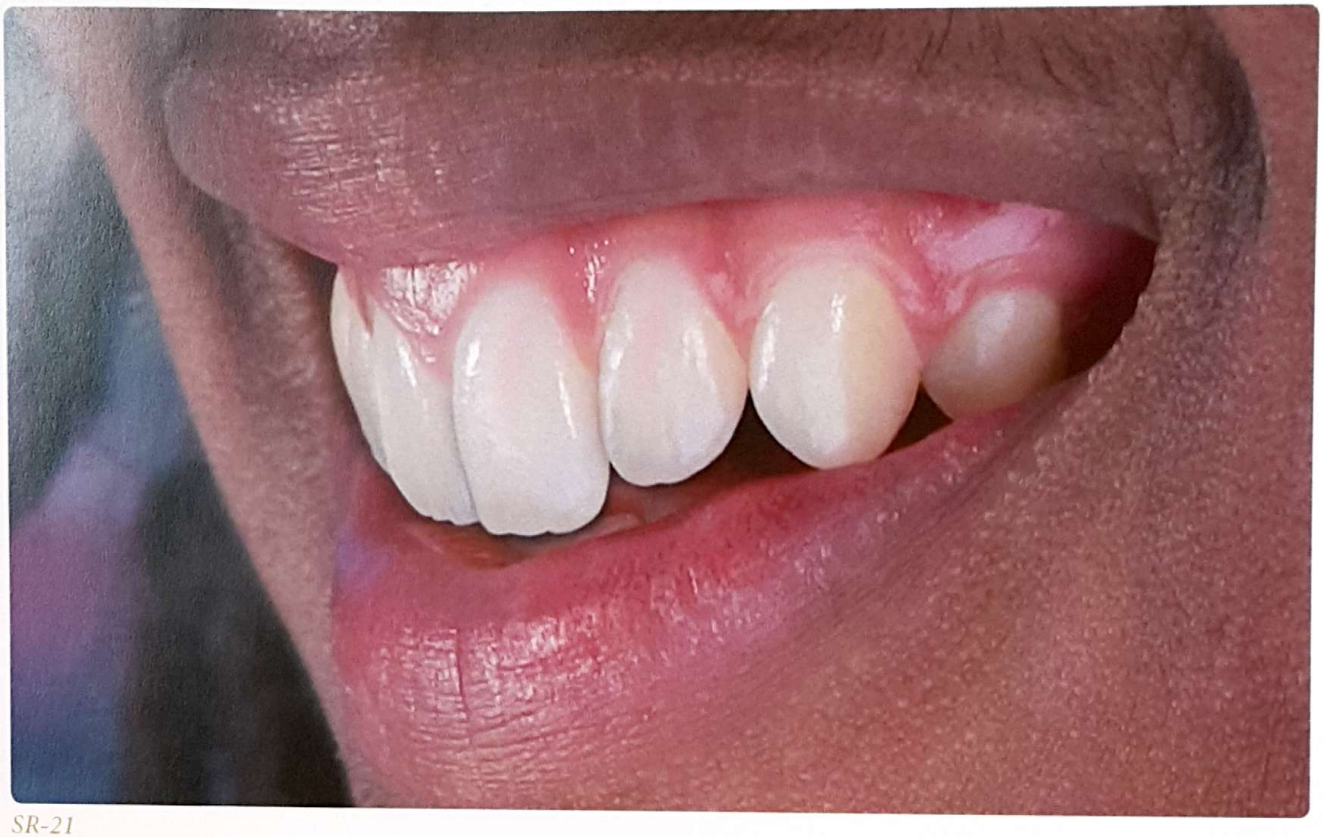
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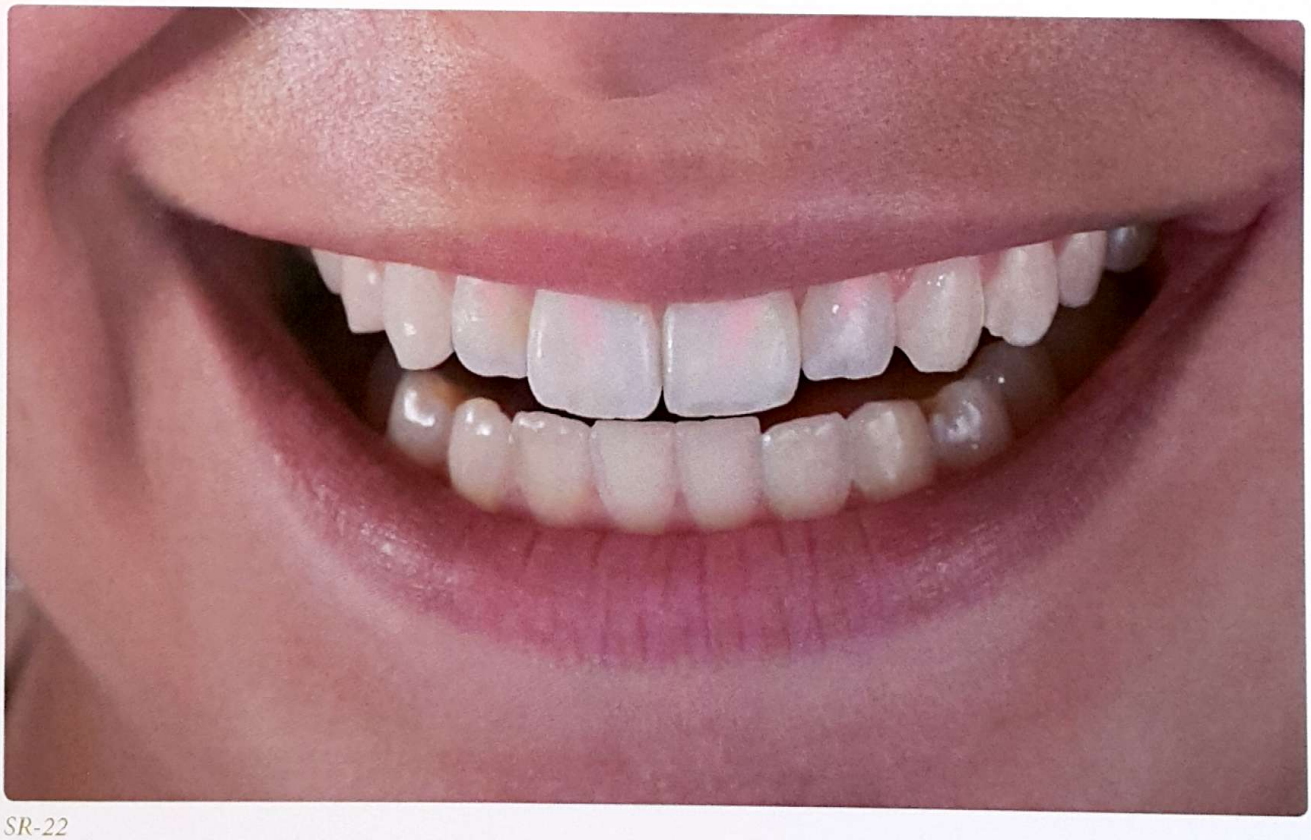
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Natural Smile Reference: The "S" Curve



SR-21



SR-22

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SR-23



SR-24

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Natural Smile Reference: Embrasures

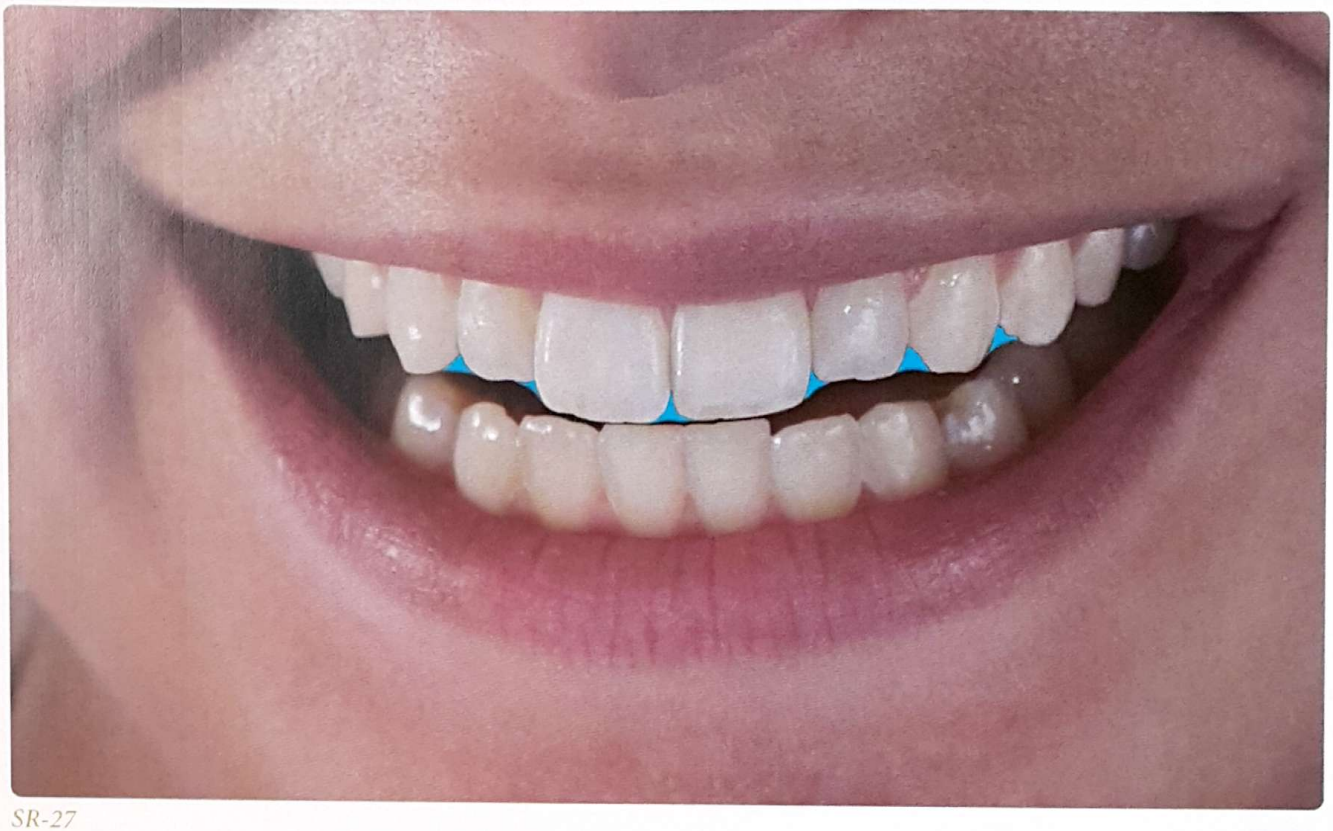


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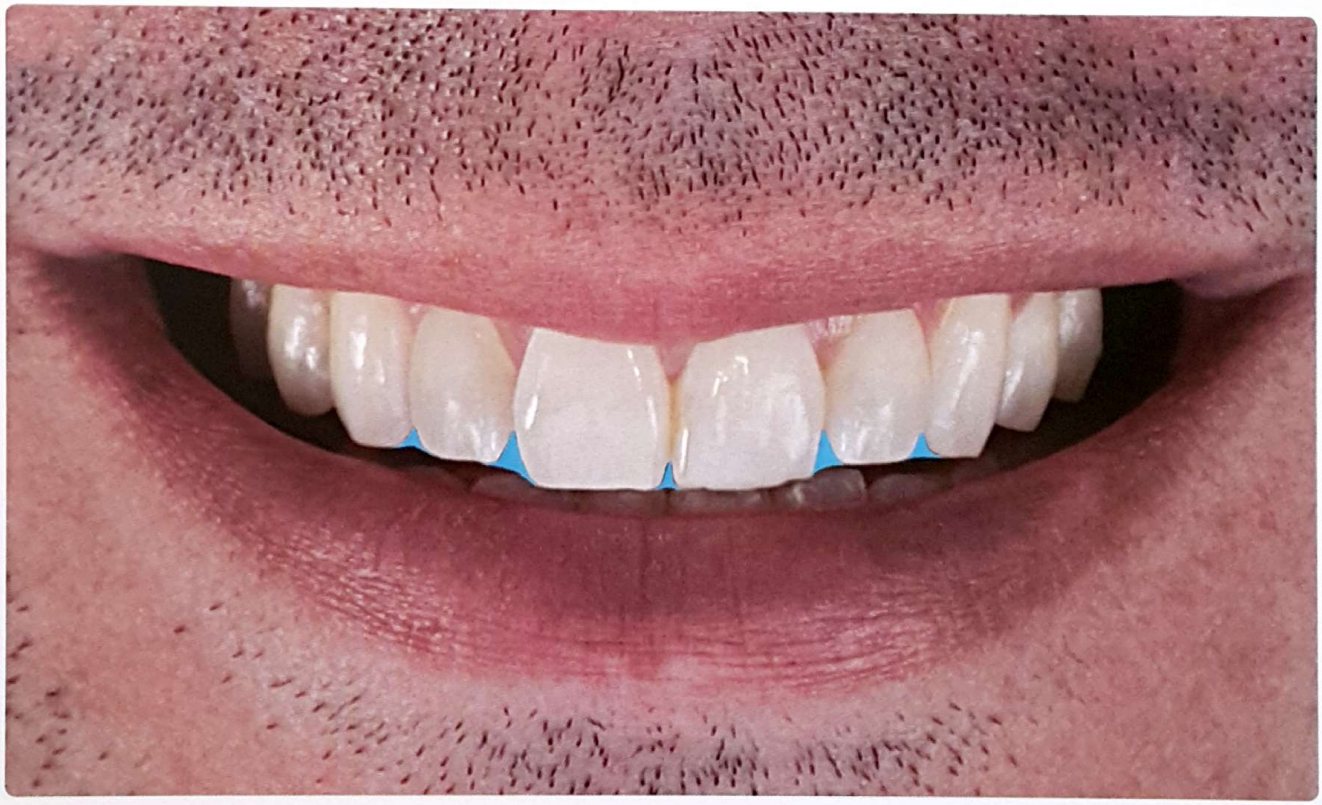


SR-26

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SR-27



SR-28

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Natural Smile Reference: Contacts

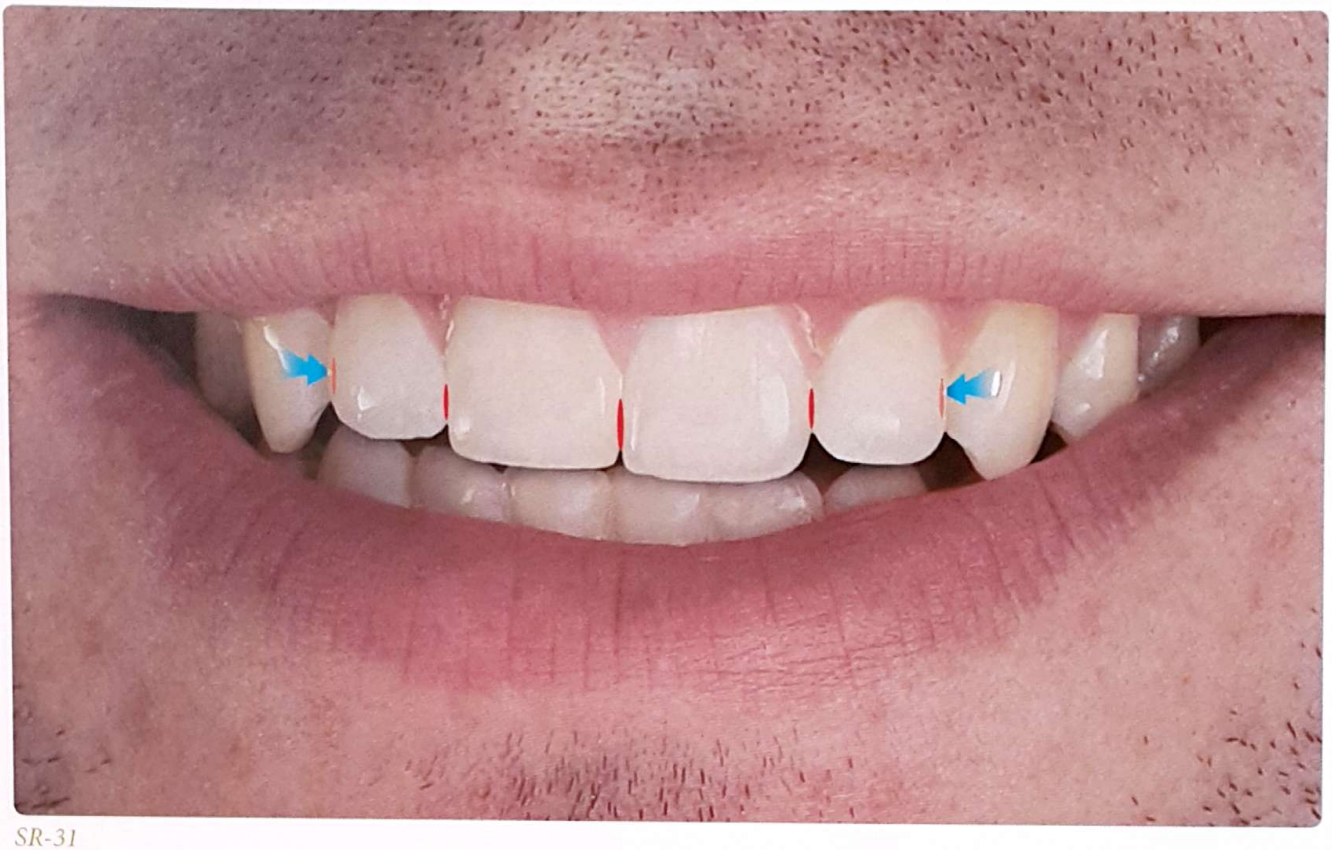


SR-29



SR-30

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SR-31



SR-32

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Natural Smile Reference: Tooth Rotational Axes

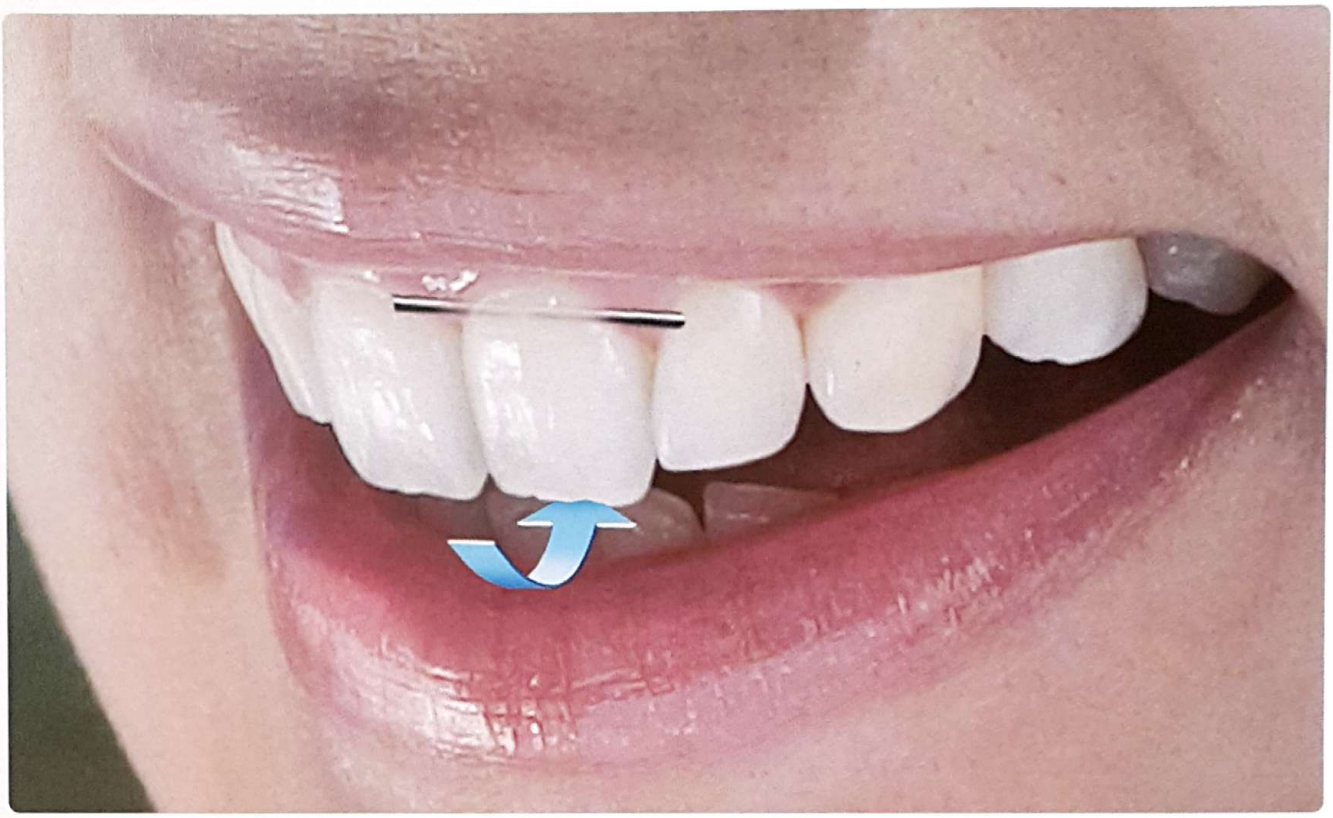


SR-33



SR-34

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SR-35



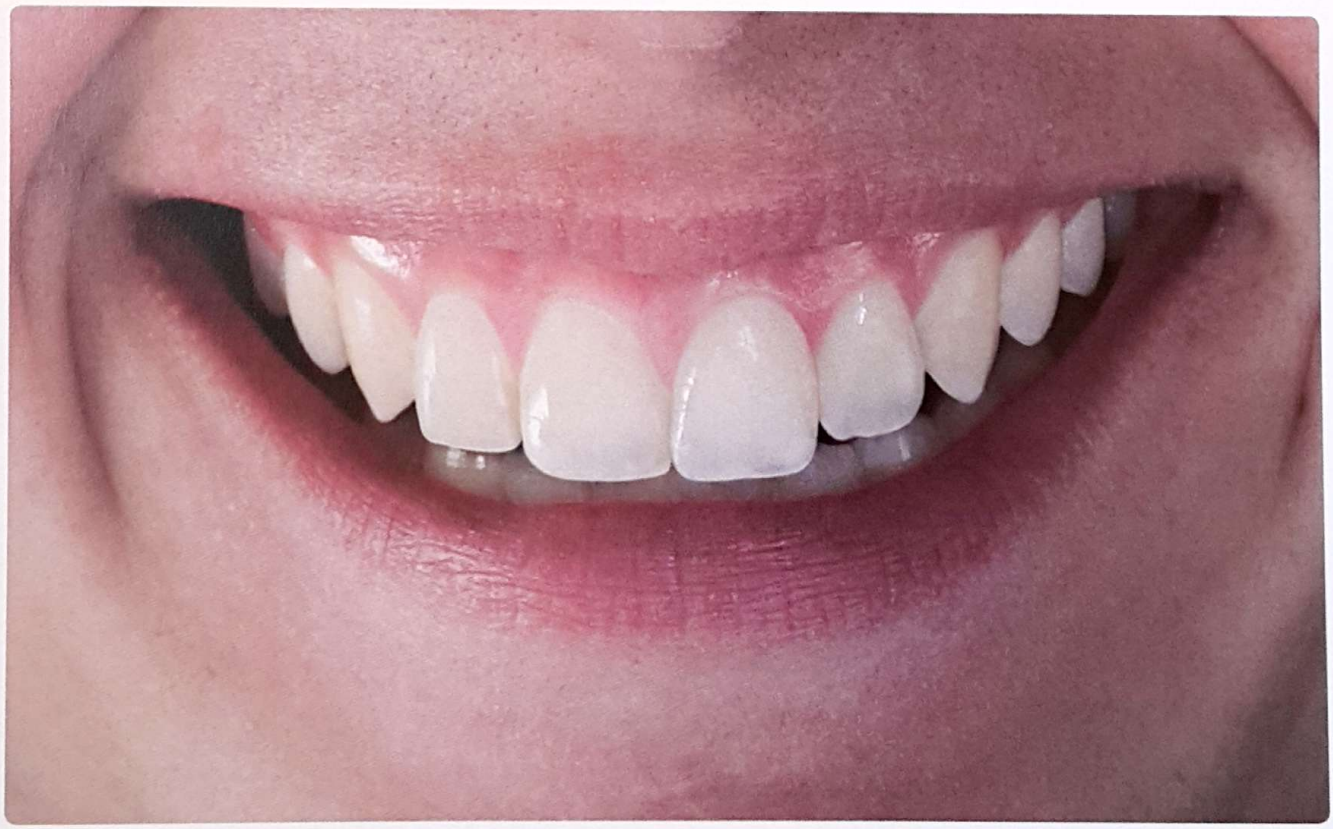
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Natural Smile Reference: Three Esthetic Compositions



SR-37 | *basic esthetic composition*



SR-38 | *strong esthetic composition*

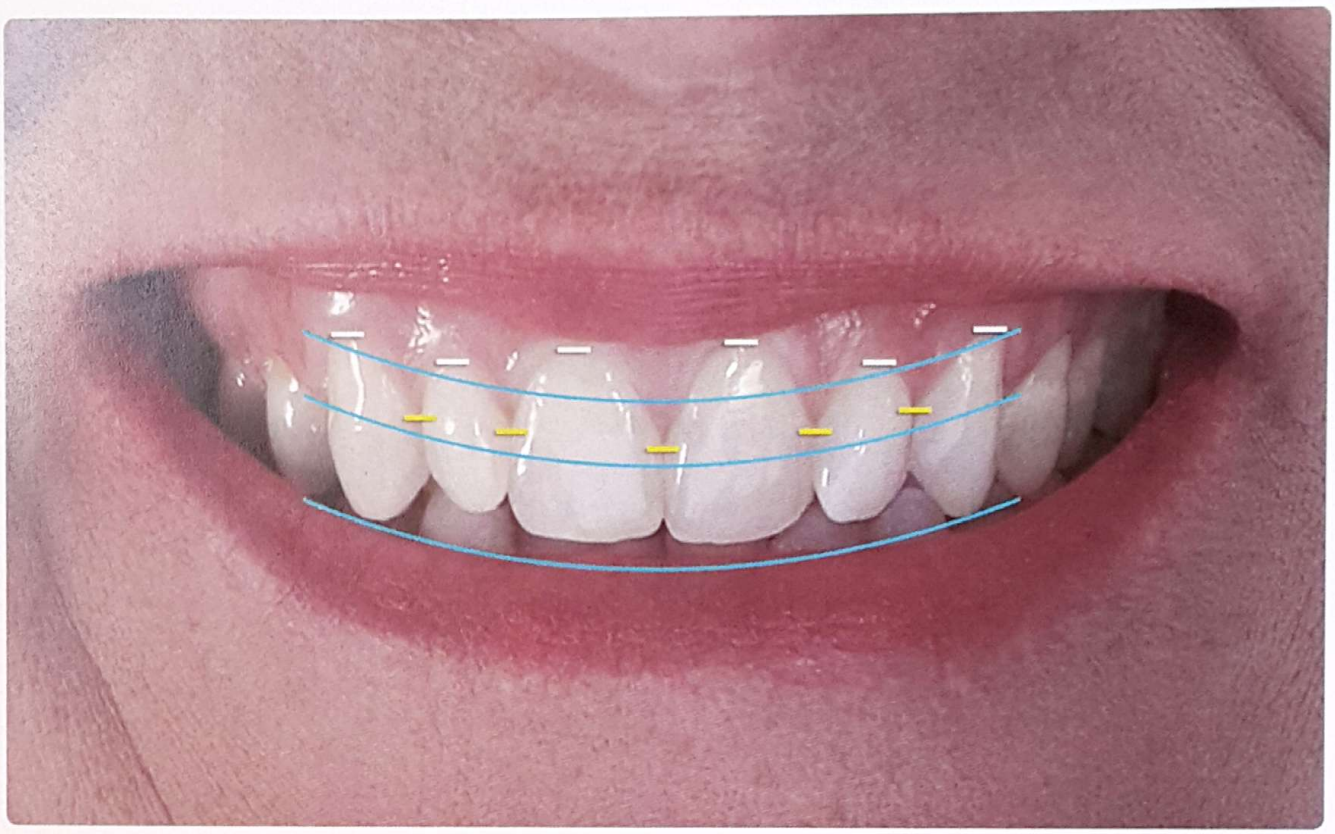
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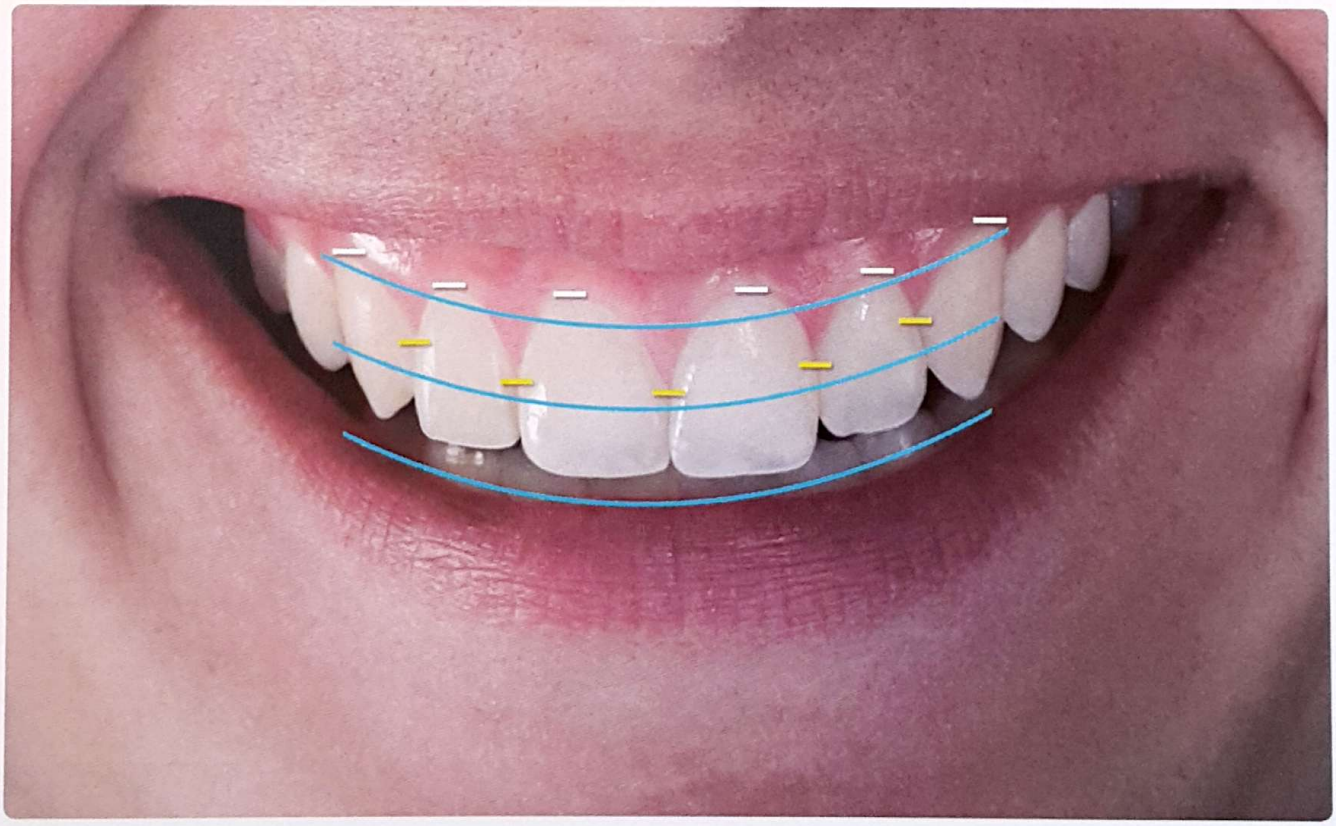
SR-39 | *soft esthetic composition*

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Natural Smile Reference: Gingival Tissues



SR-40

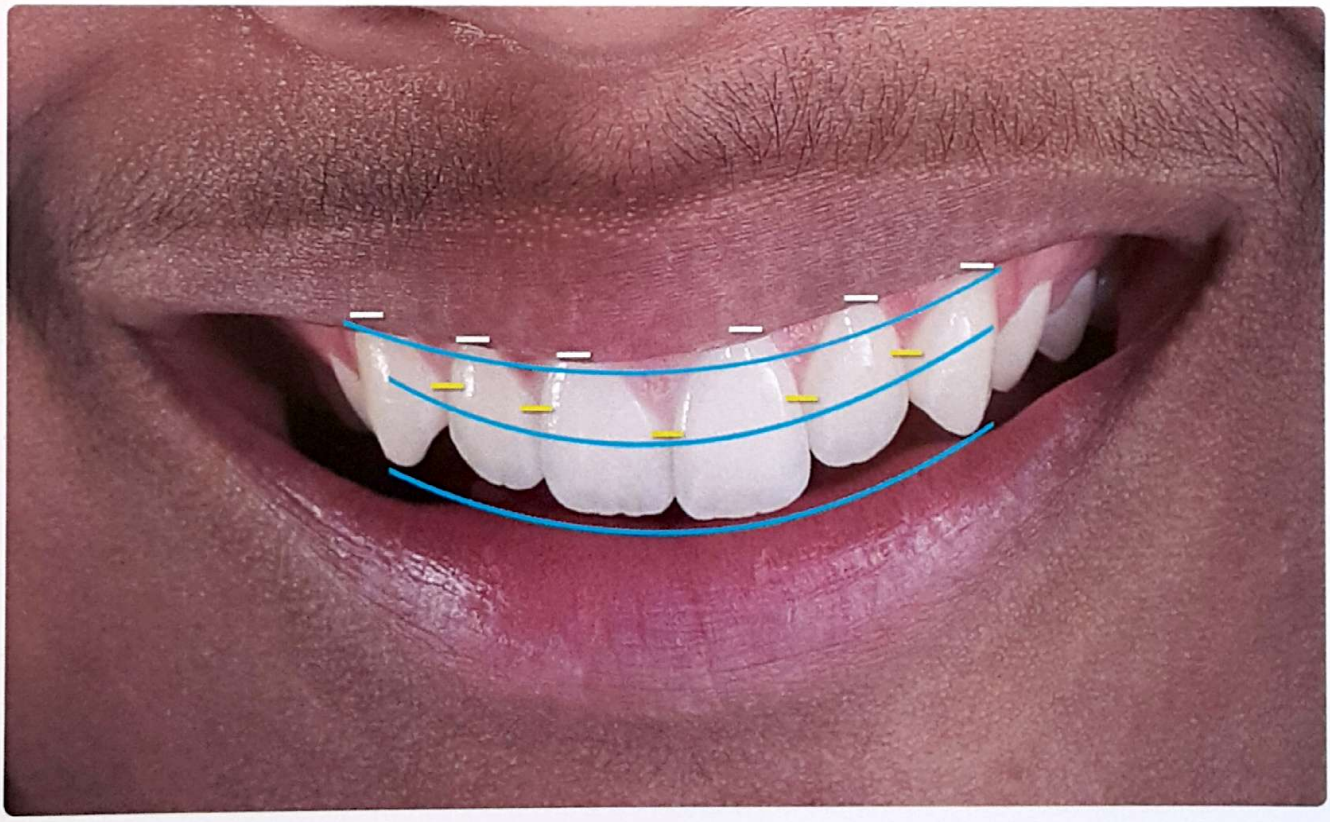


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SR-42



SR-43

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Natural Smile Reference: Smile Line and Buccal Corridor



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SR-45

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SR-46

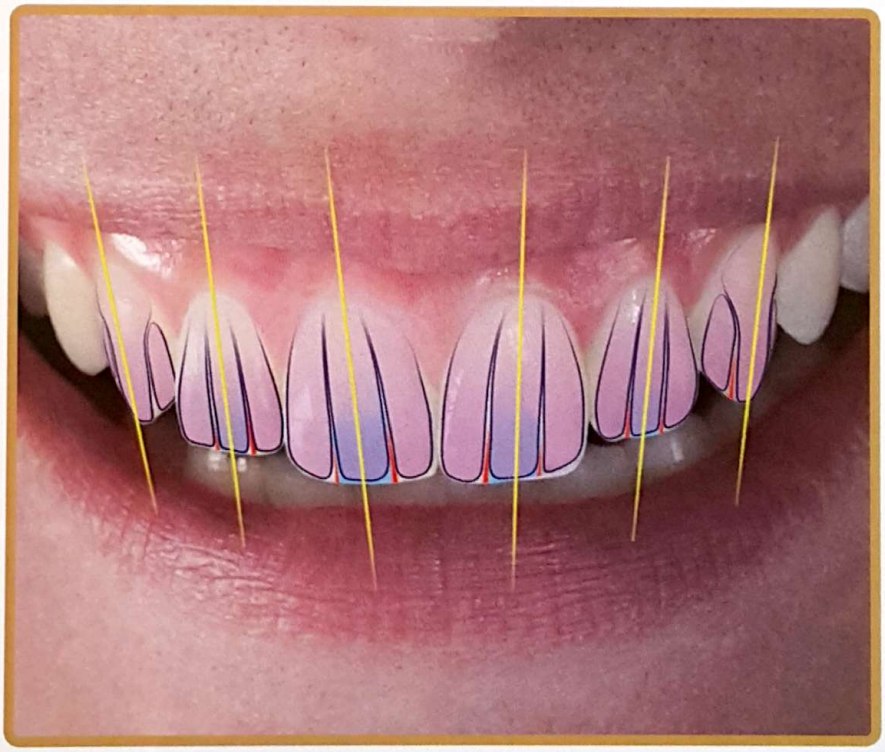


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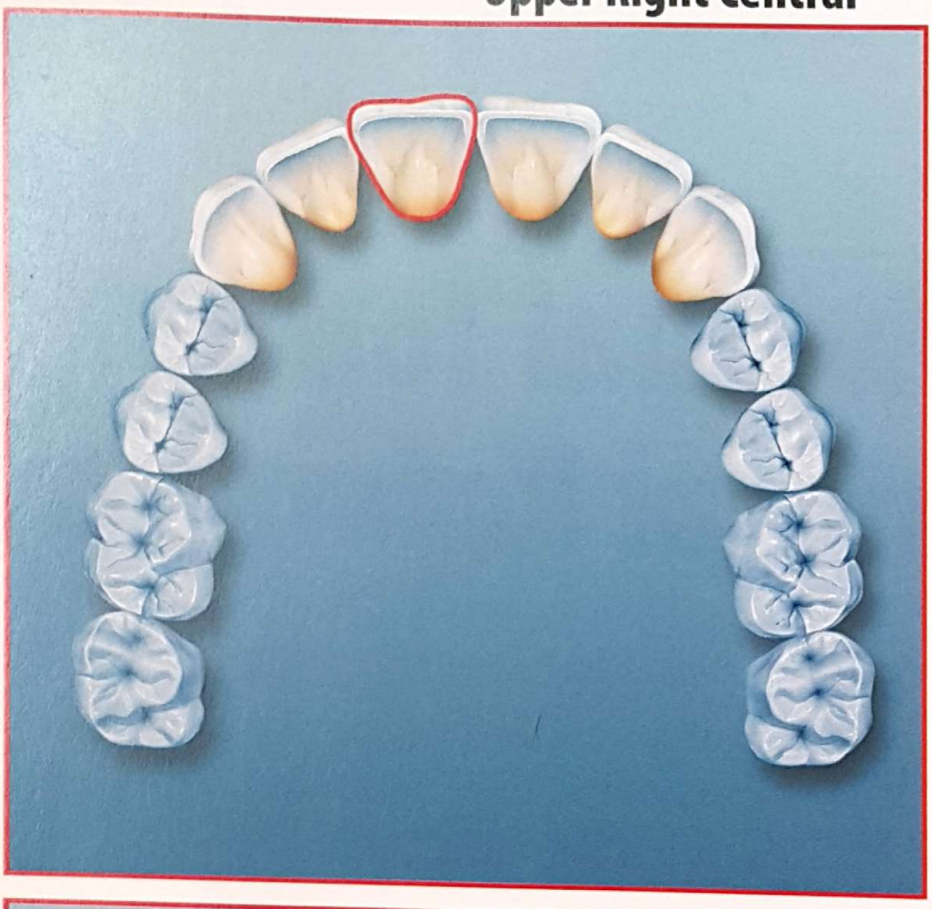
Appendix B

Individual Tooth Anatomical Reference

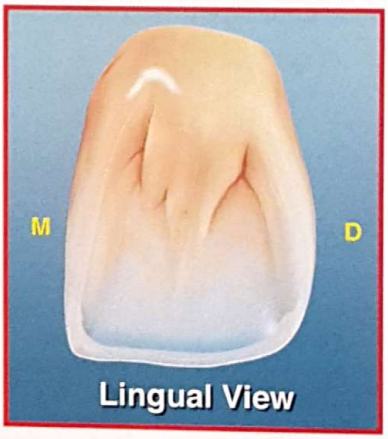


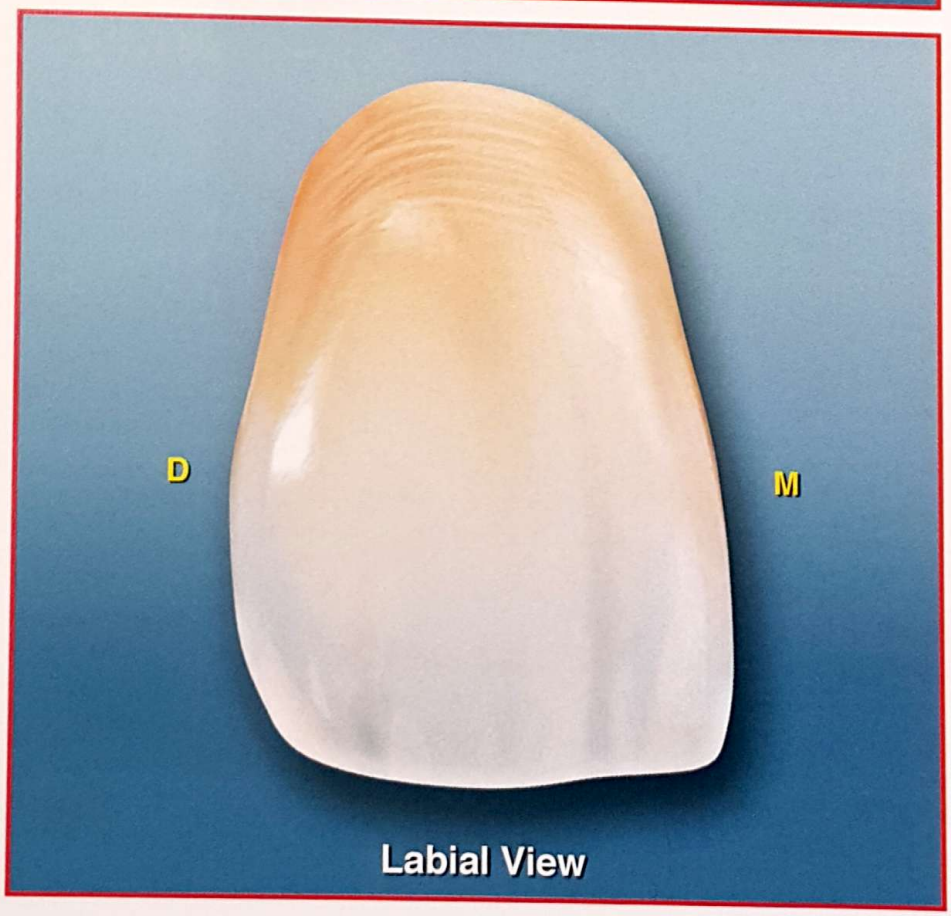
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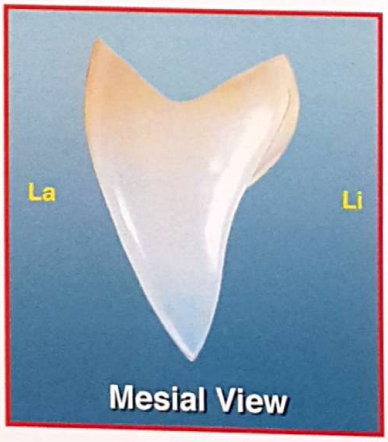
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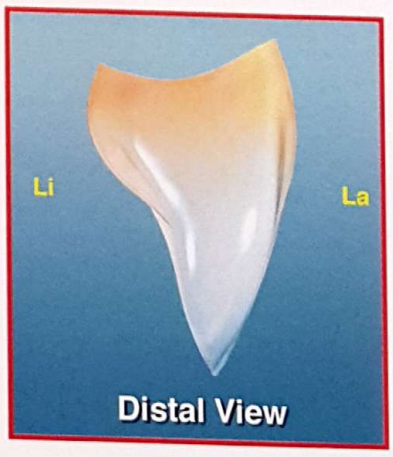








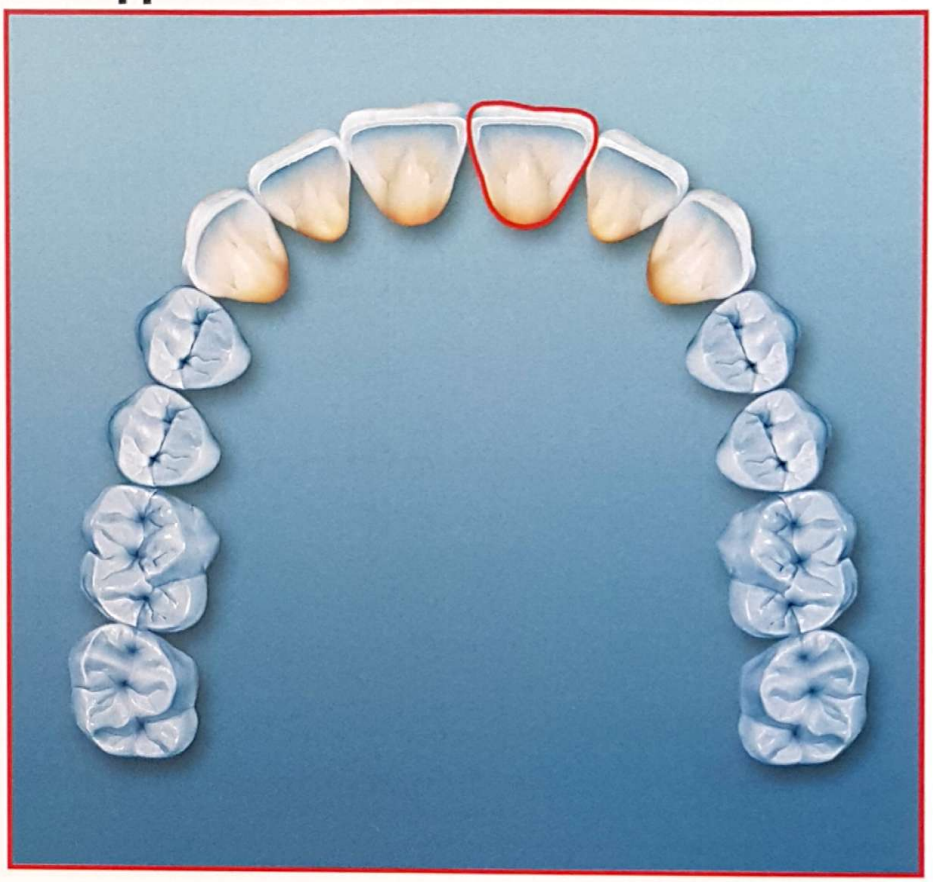


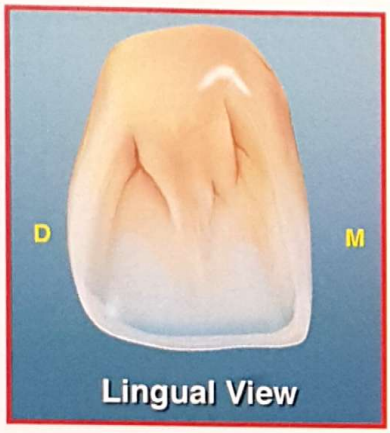


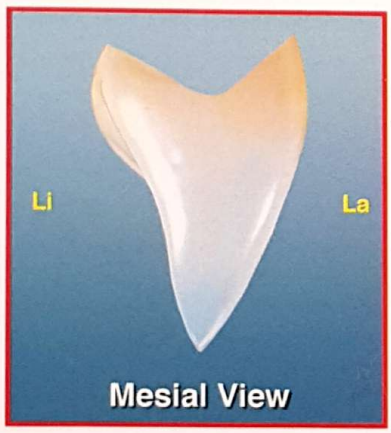
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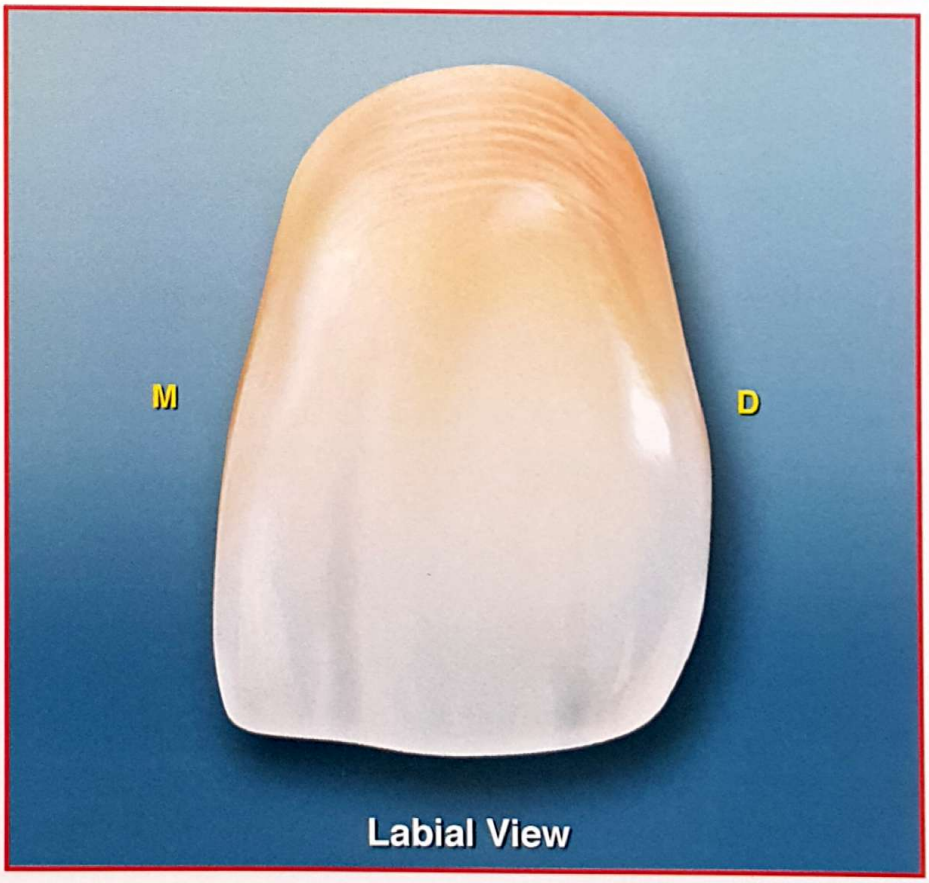
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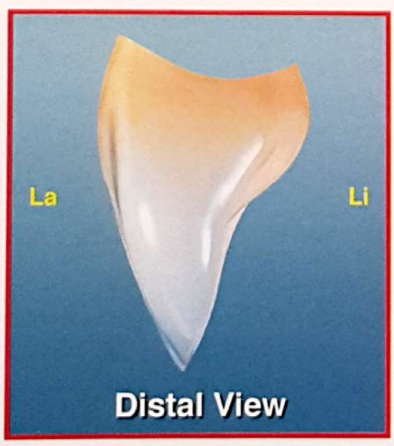






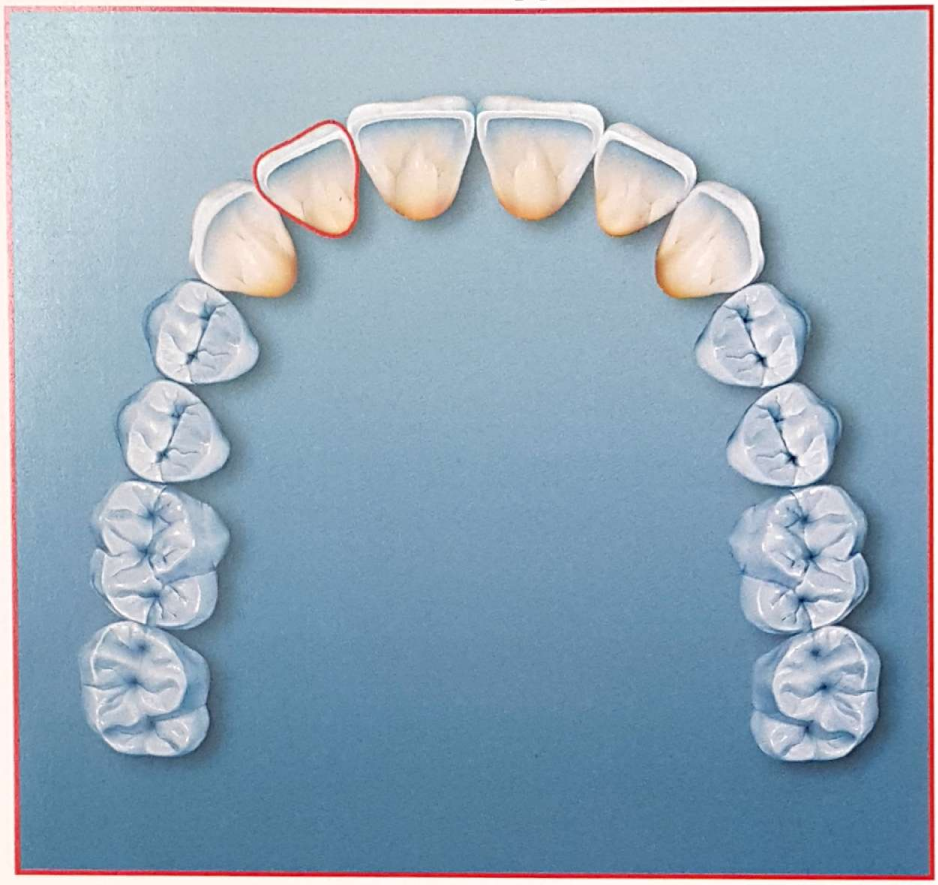


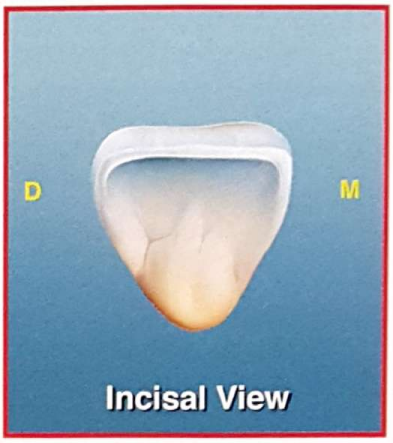




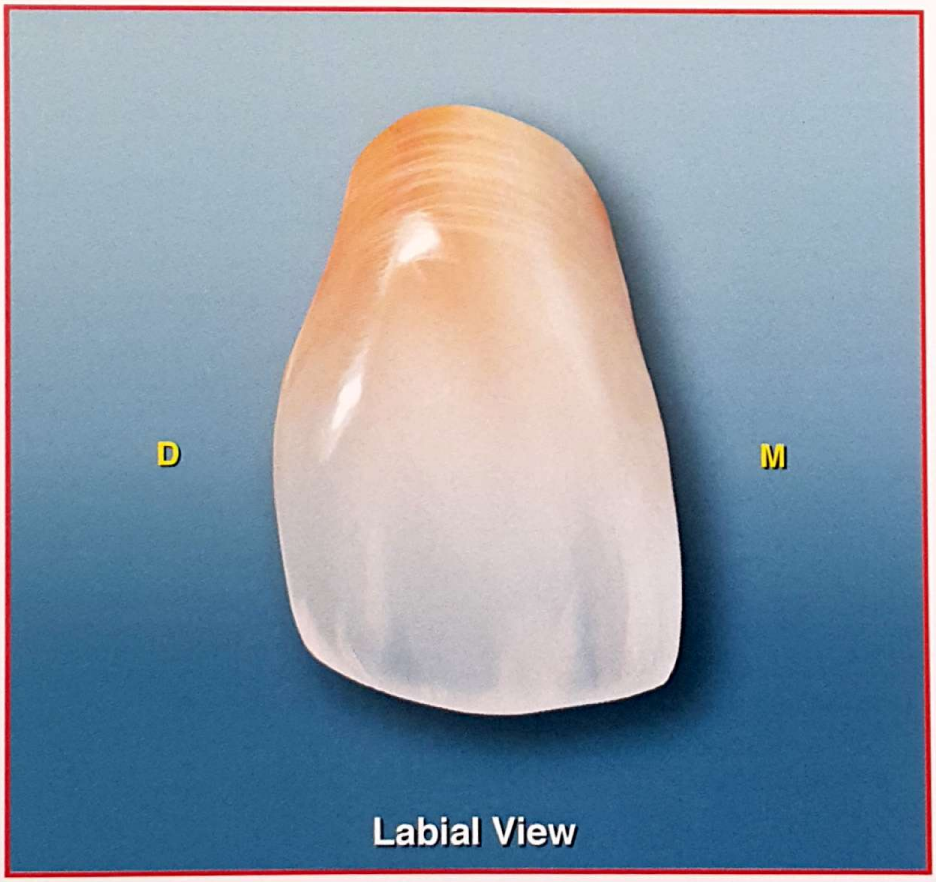
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Upper Right Lateral

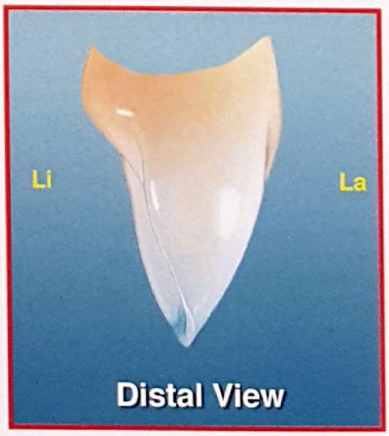






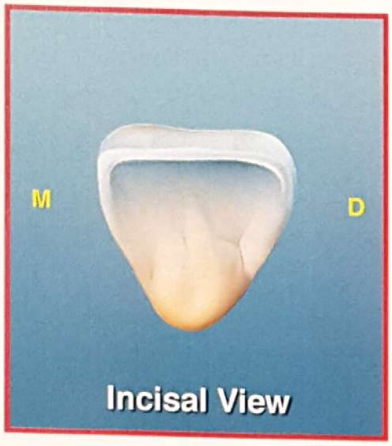


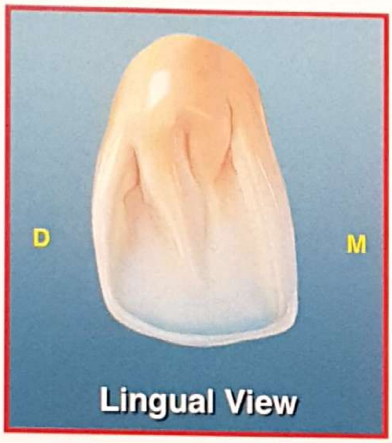


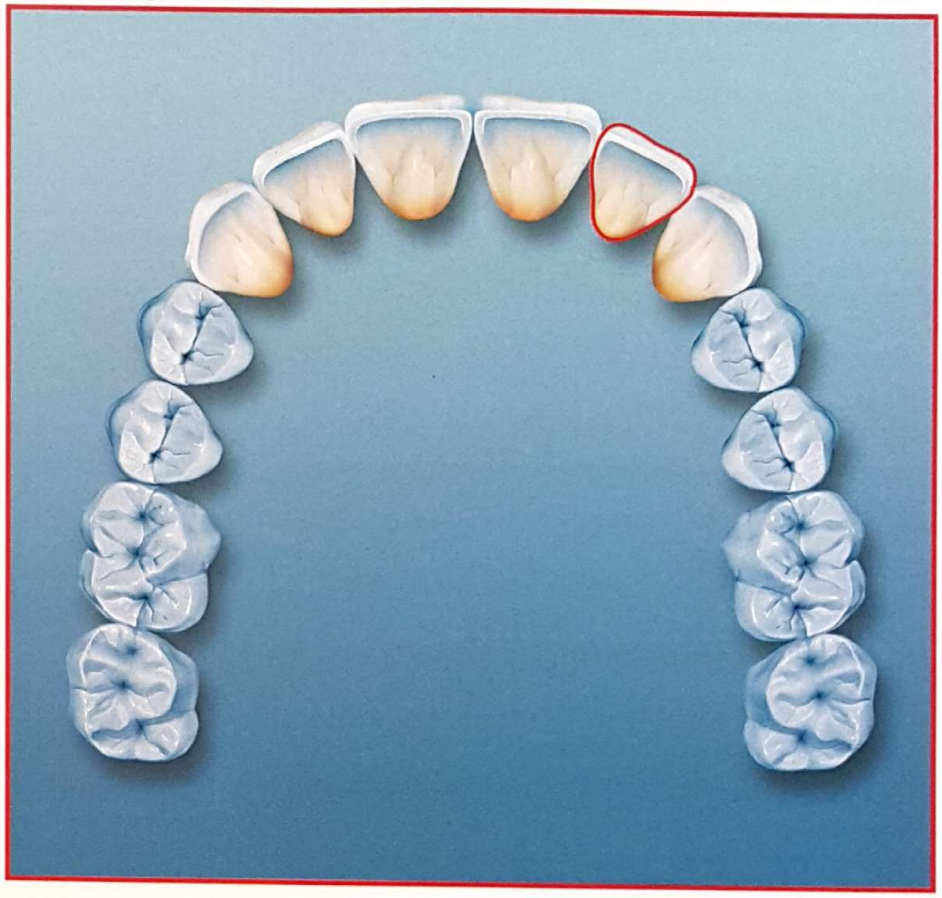


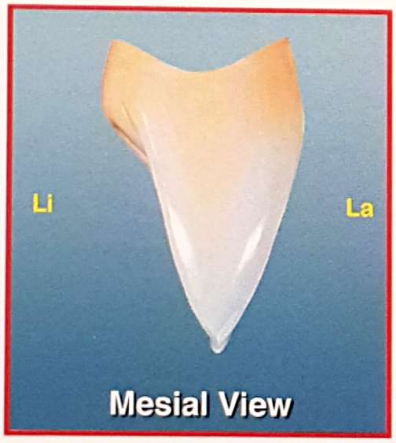
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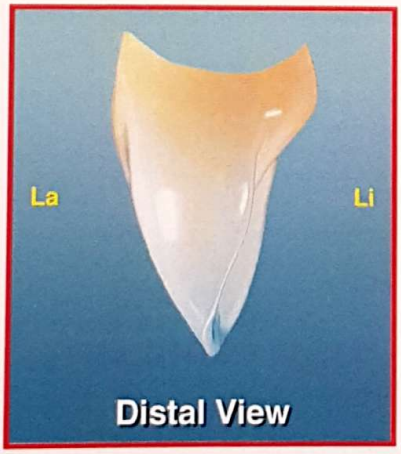
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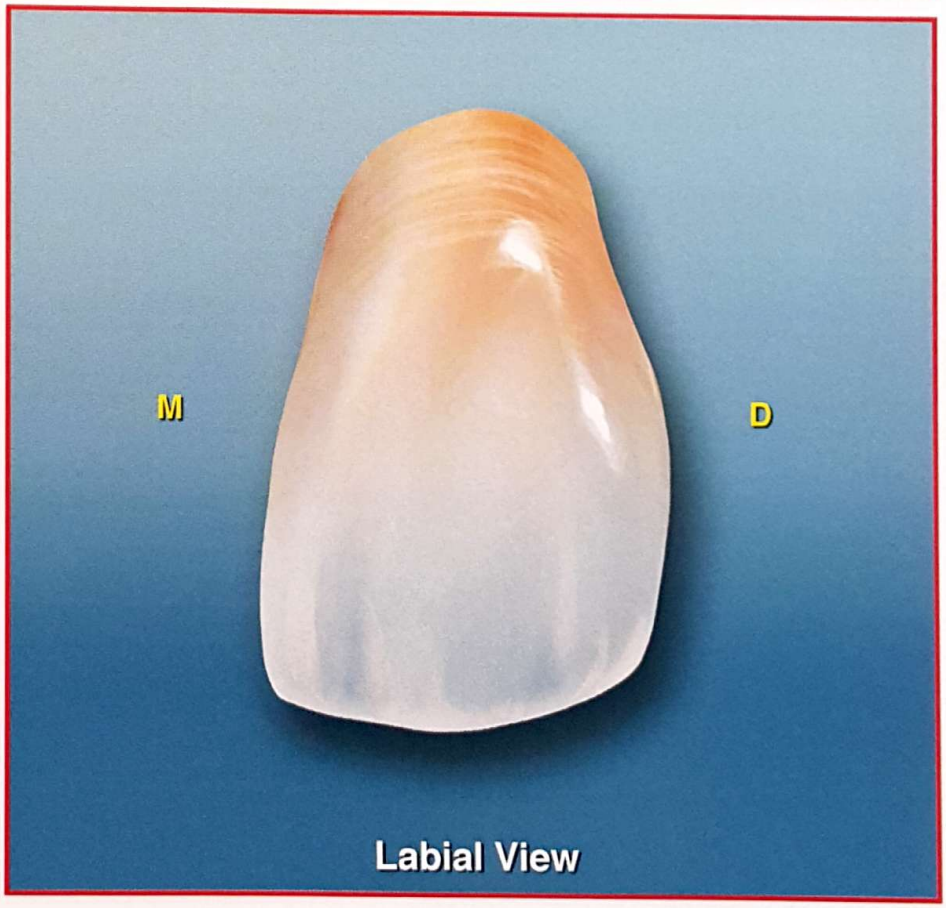








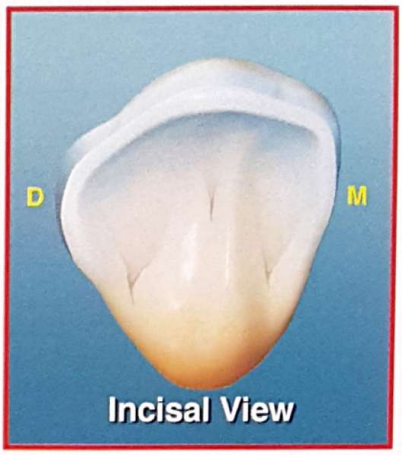


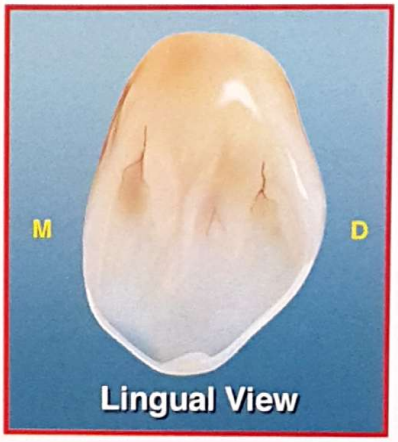


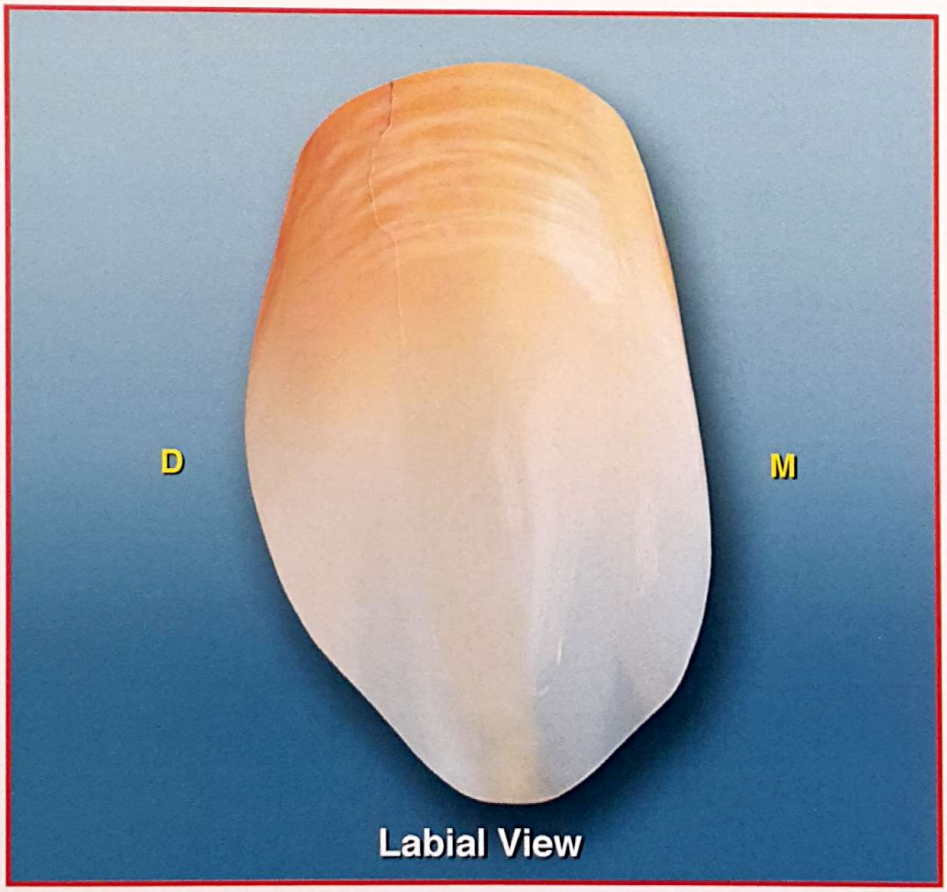
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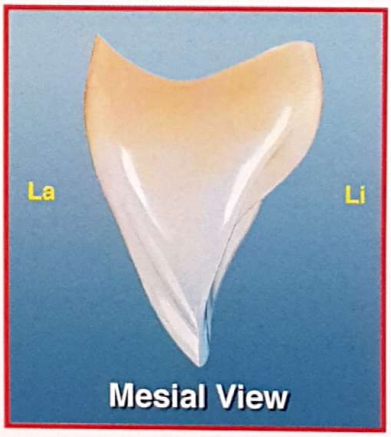
Upper Right Cuspid

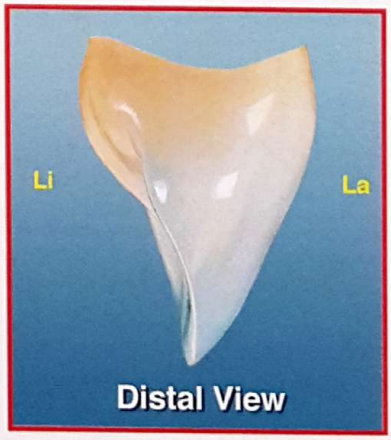






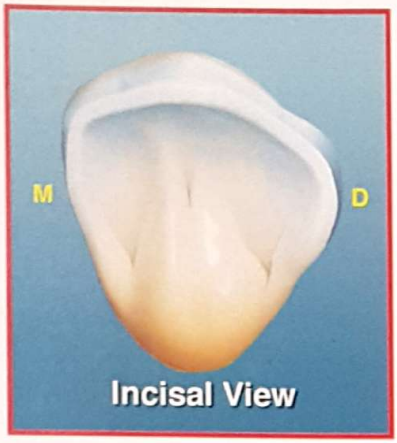


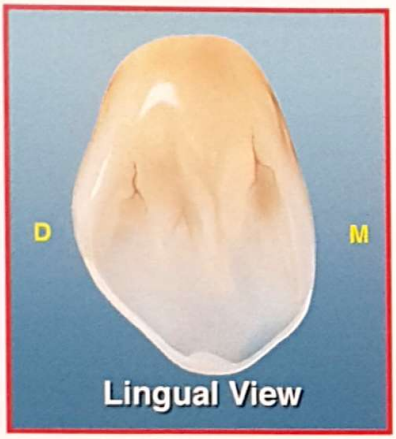




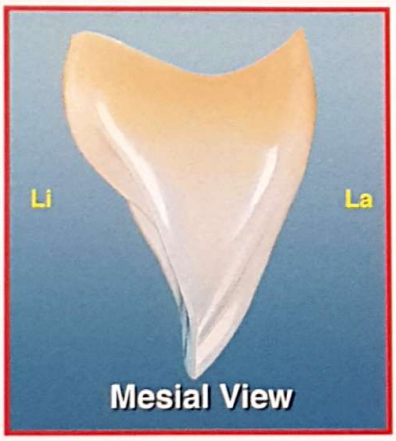
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Upper Left Cuspid

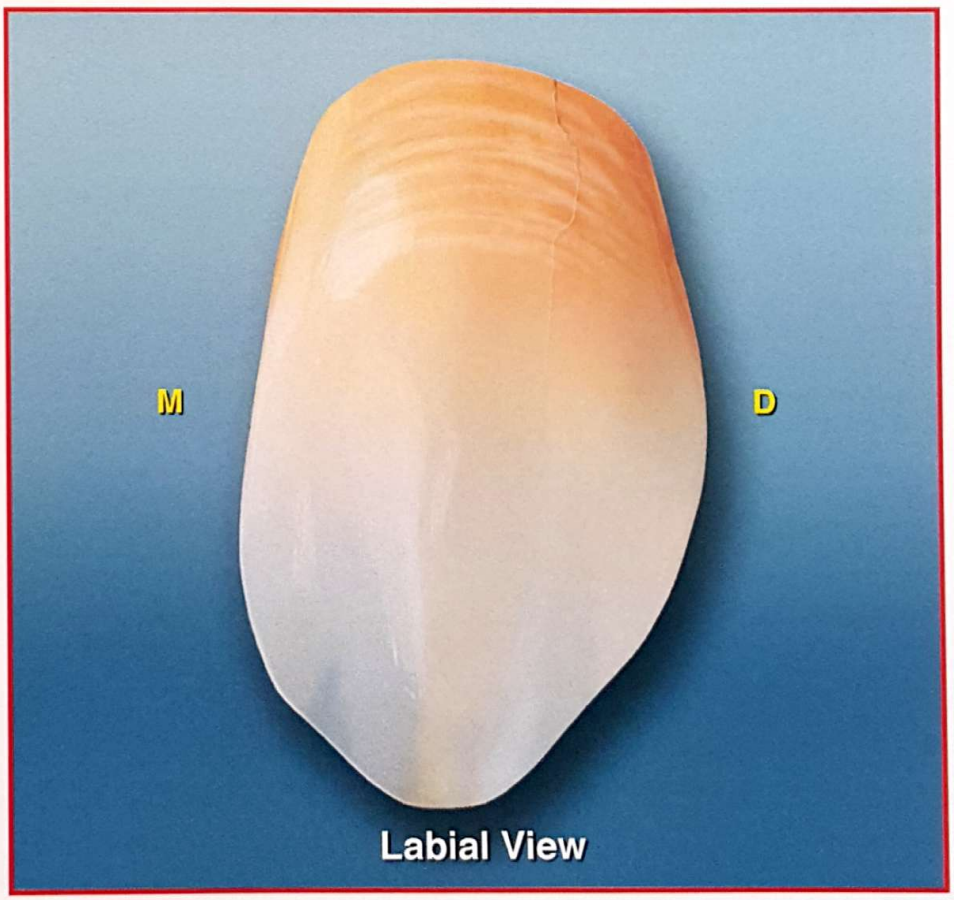








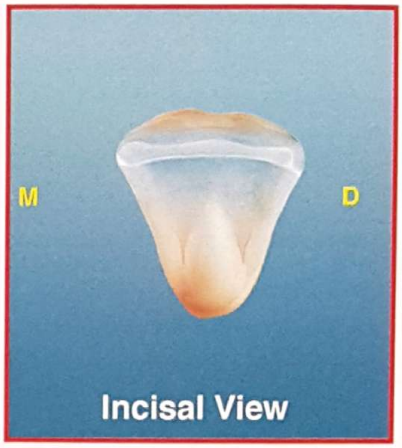


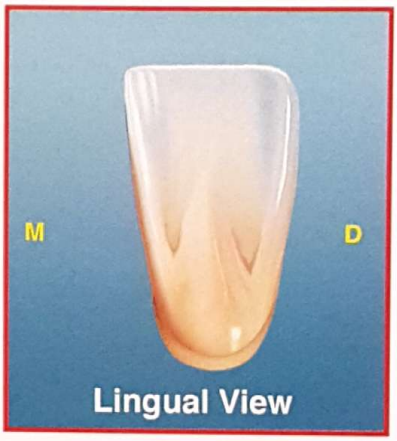


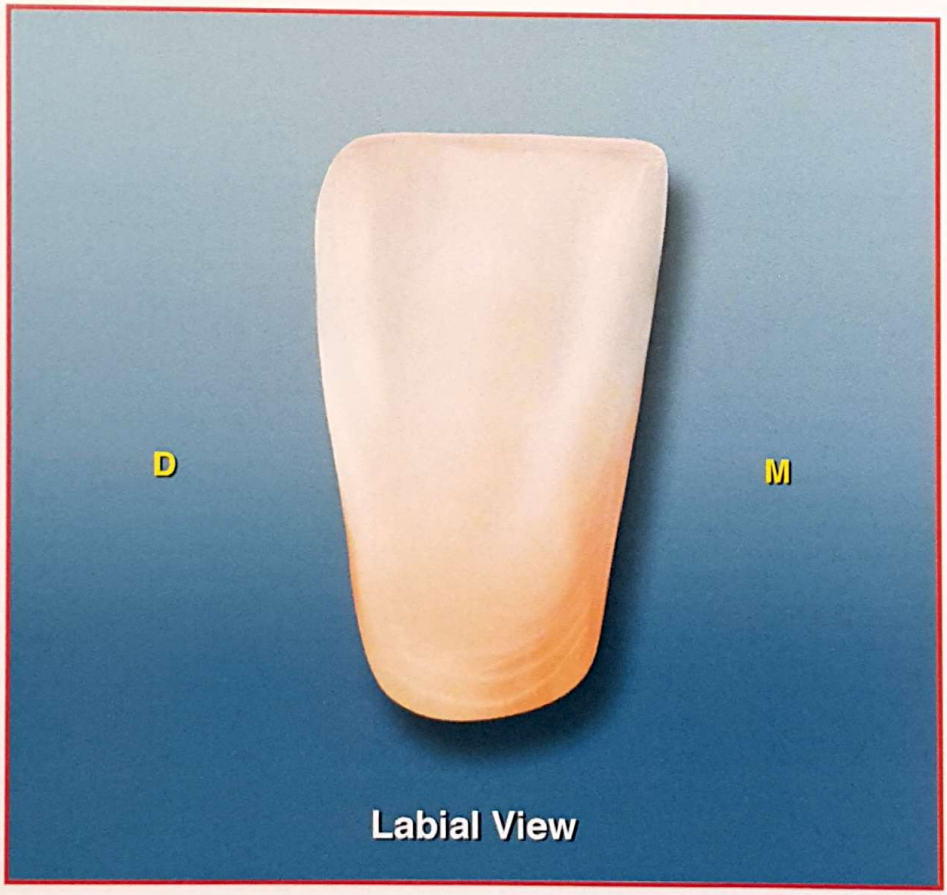
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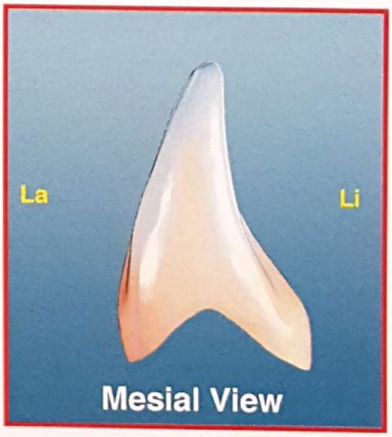
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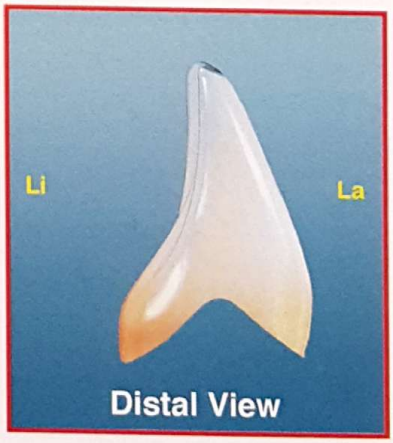












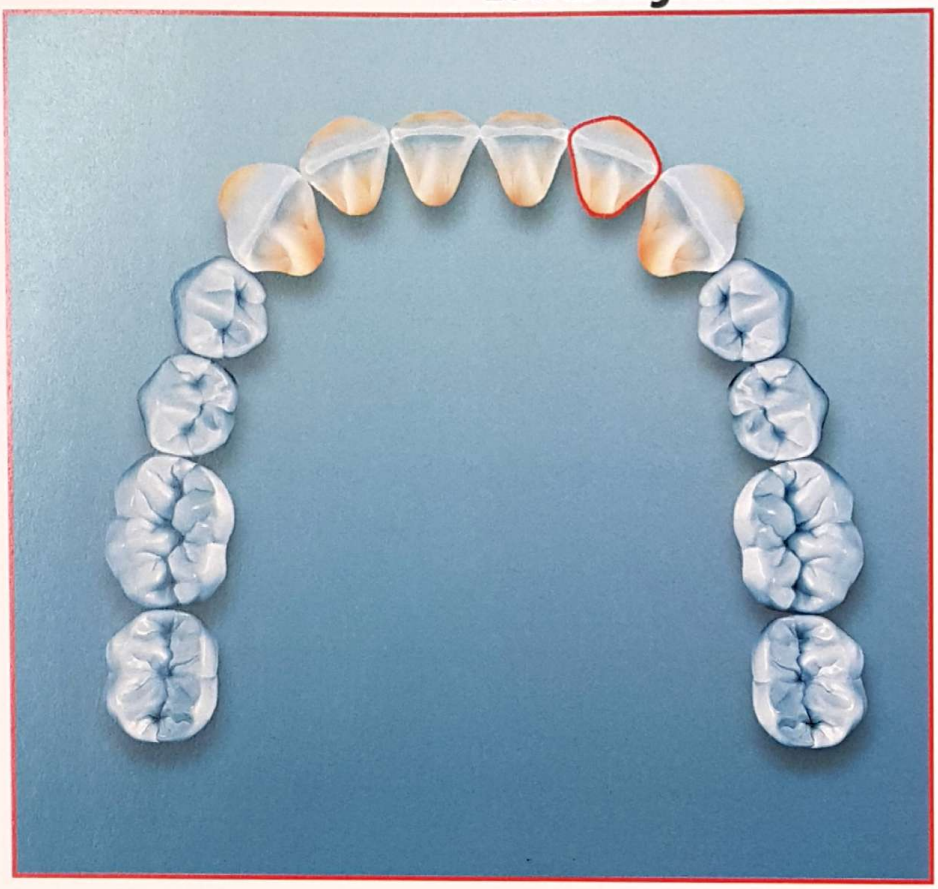
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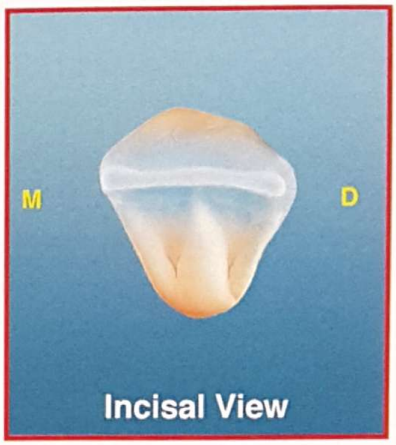
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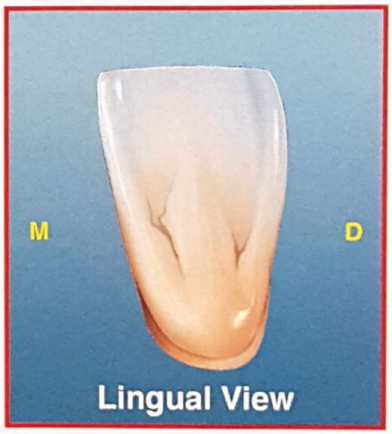


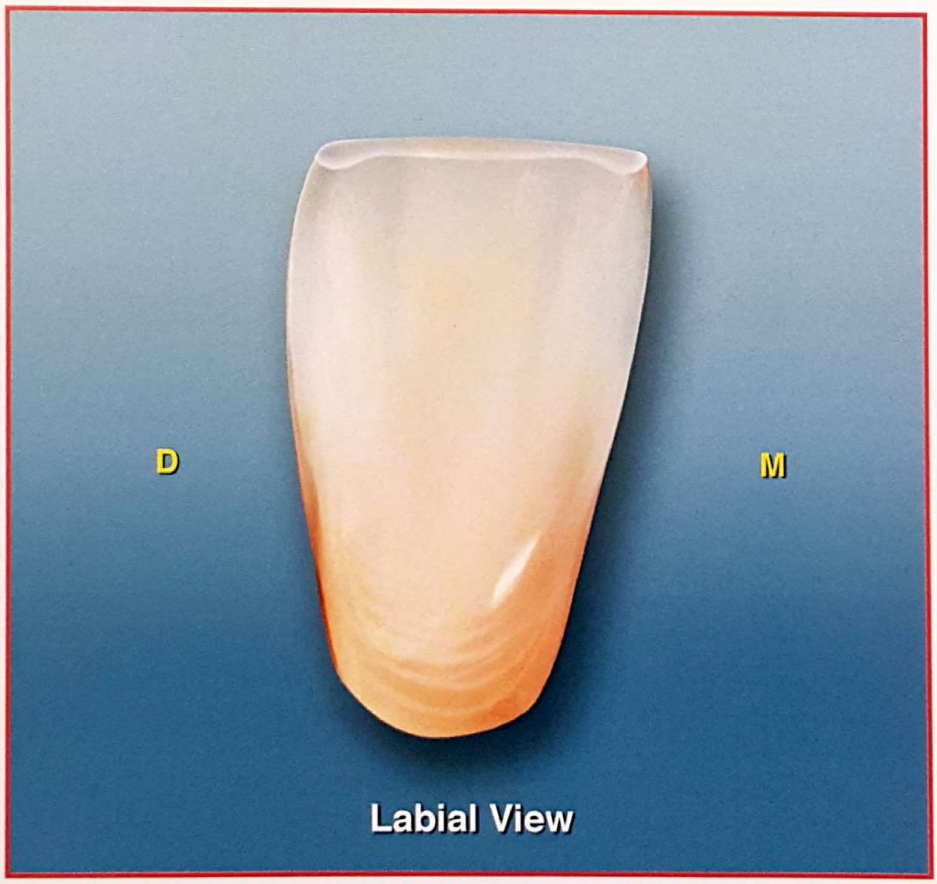
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Lower Right Lateral

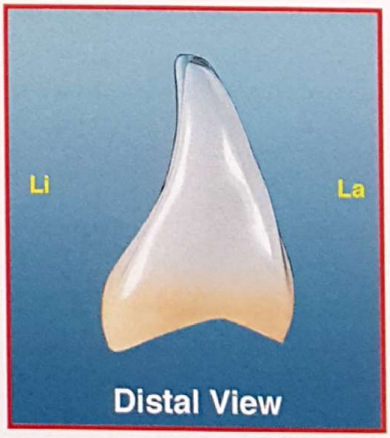






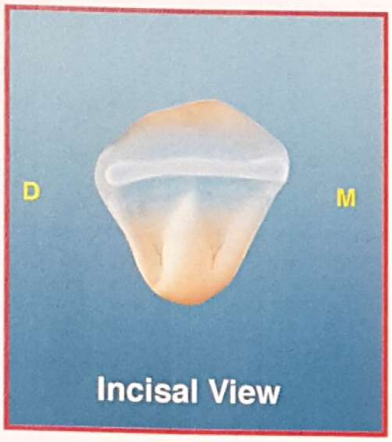




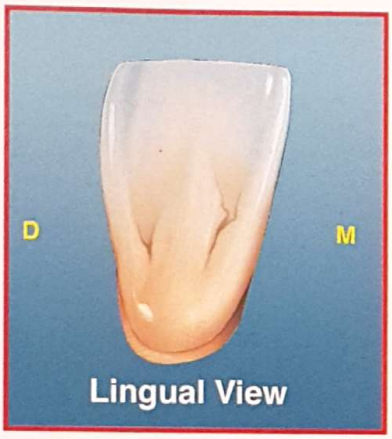


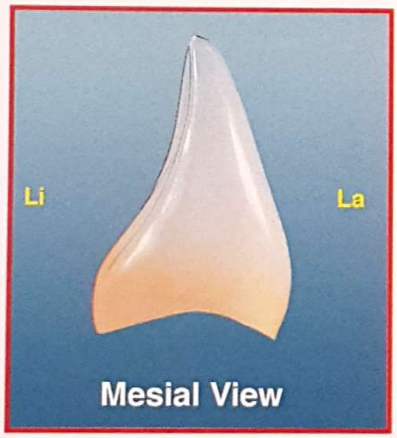
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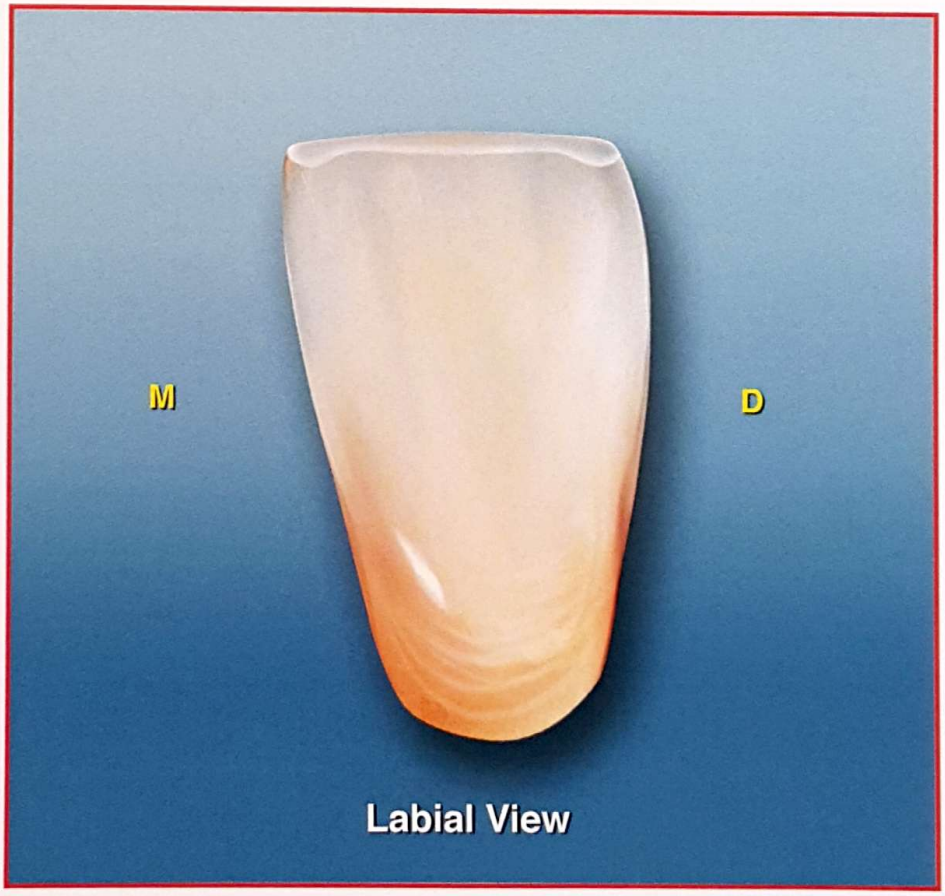
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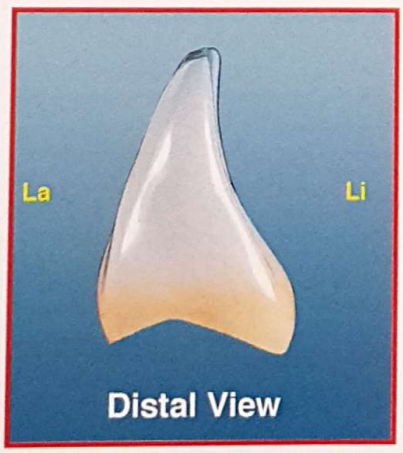






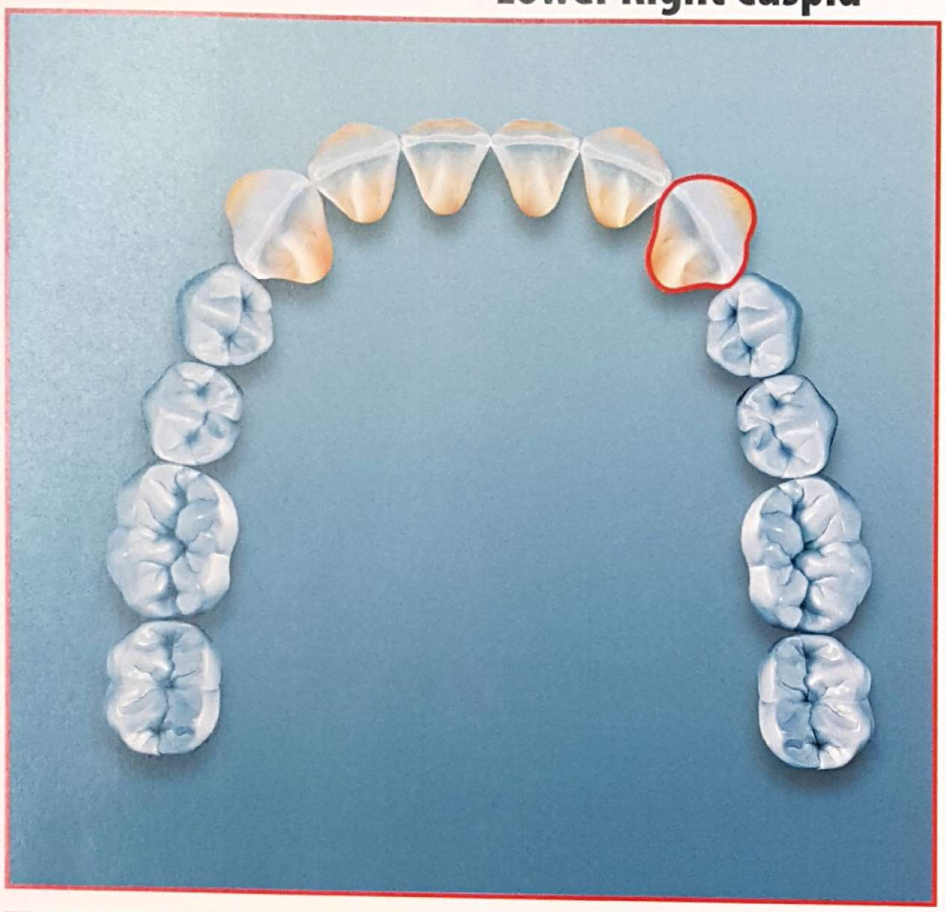


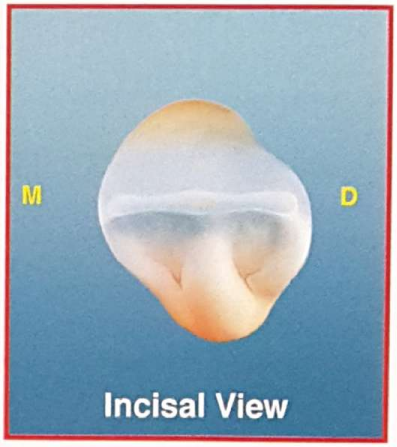


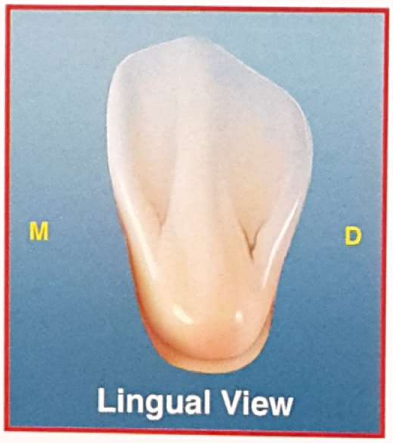


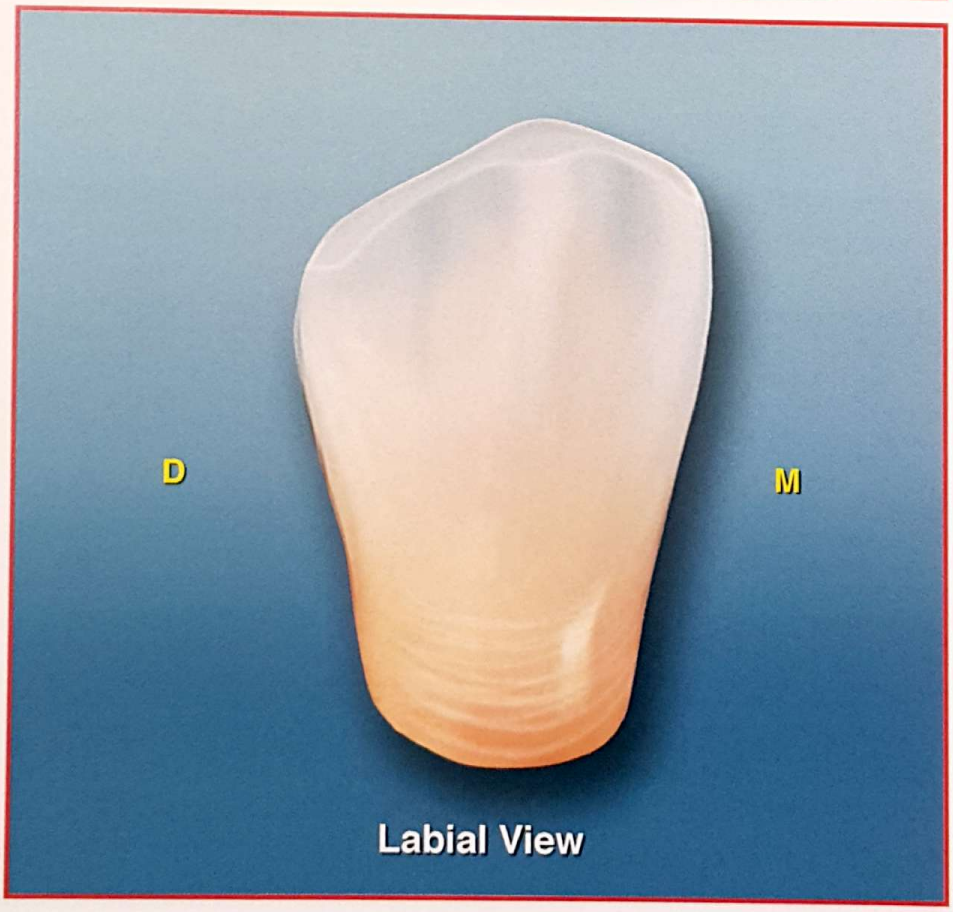
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Lower Right Cuspid

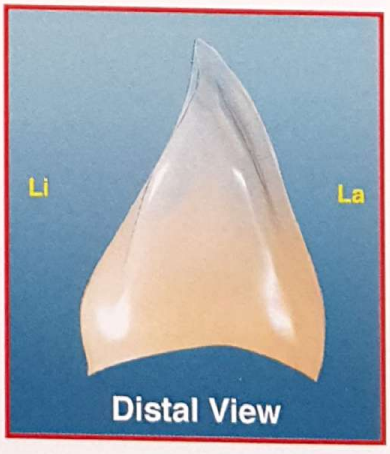






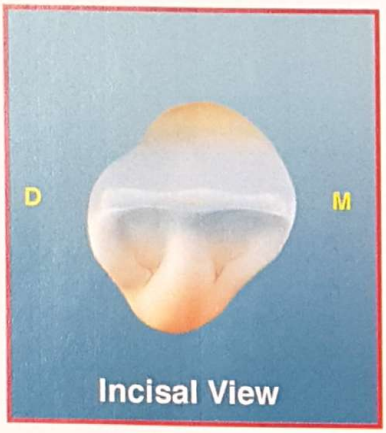


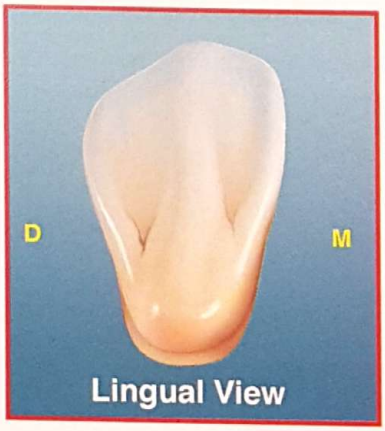




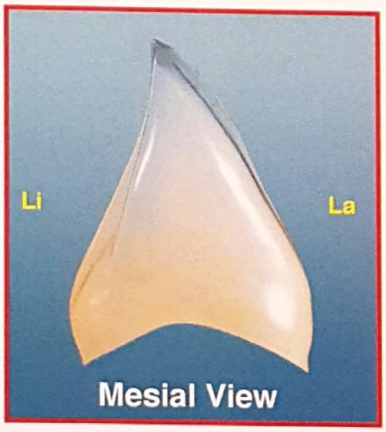
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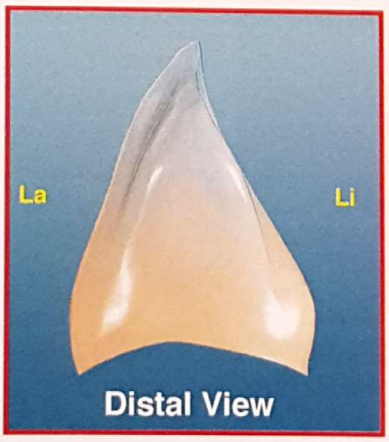
Lower Left Cuspid

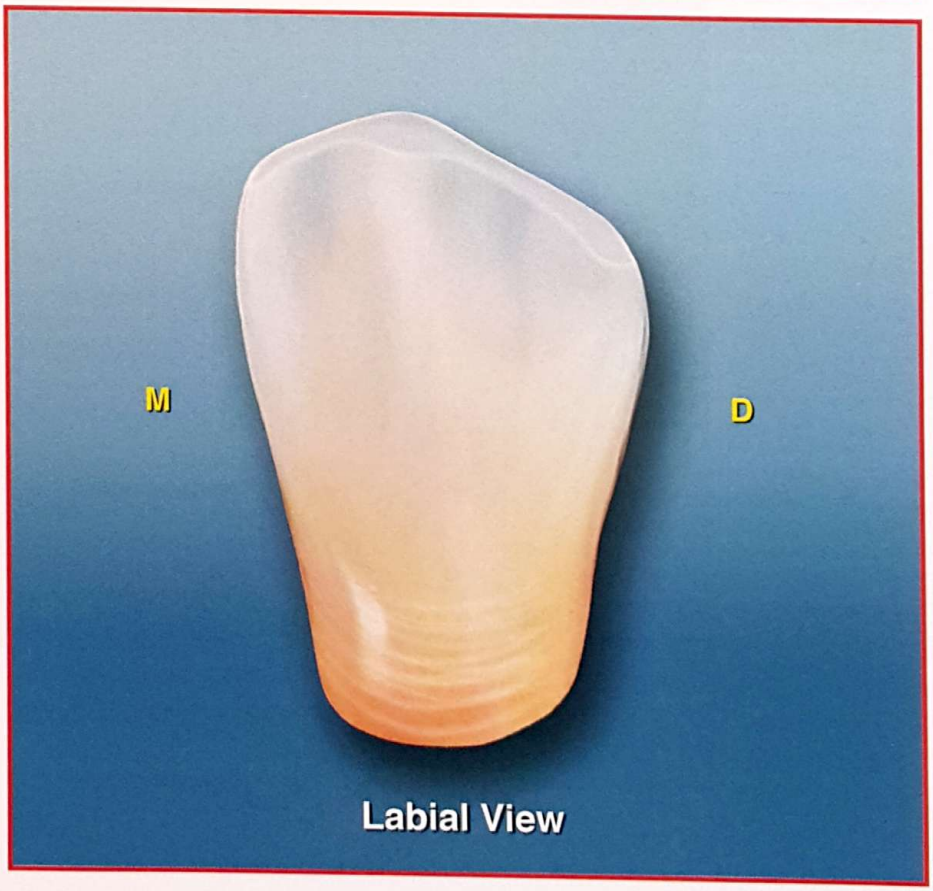






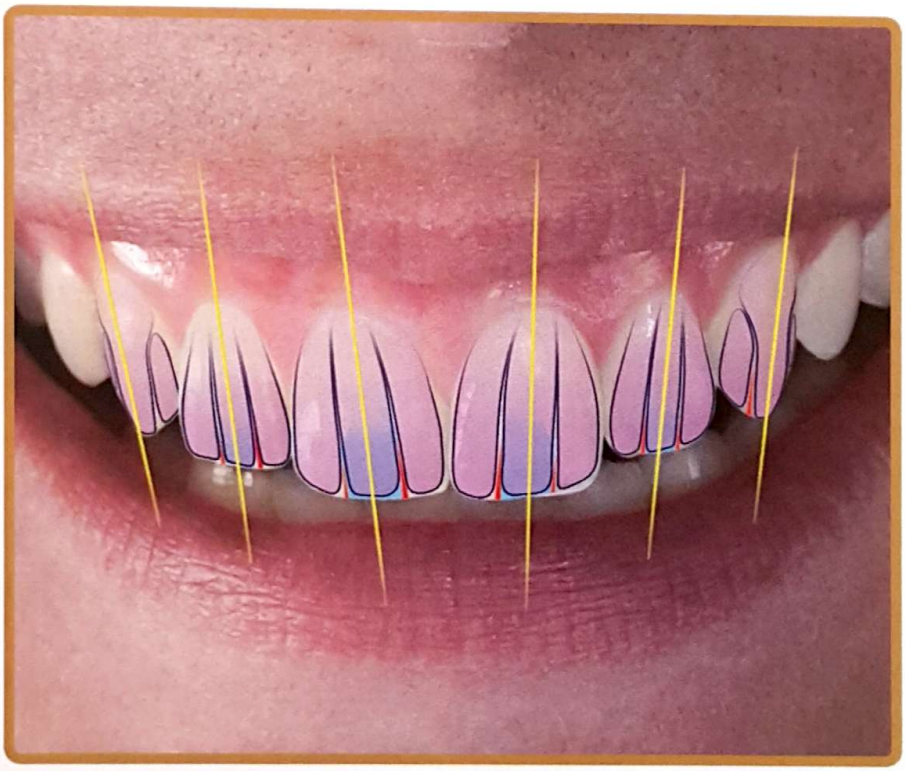






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Glossary



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accentuate To accent or emphasize. To give prominence. We can accentuate an area by adding to it or by reducing the surrounding areas. The dental technician accentuates the areas which have prominence in natural teeth in order to make a restoration look natural.

alveolar process The raised extension of the mandible or maxilla that surrounds and supports the teeth.

alveolus The socket in the alveolar process, lined with the periodontal membrane, in which the tooth sits.

anatomic crown The part of a tooth that is covered with enamel, extending from the cemento-enamel junction to the cusp tips or incisal edge.

anatomic teeth Restorations that match the anatomy of natural teeth.

anatomical Pertaining to anatomy. Lifelike, real. Having a certain form. In dentistry, having all the features of natural teeth.

anatomy The form or structure of an object. The features that define the shape of a tooth. Dental anatomy can be thought of as a series of convexities and concavities that form the light reflective surfaces that create the apparent shape of the tooth.

anterior The front of an object. The front of the mouth, or pertaining to the front of the mouth or the front teeth.

anterior teeth The front teeth. The central incisors, lateral incisors and cuspids of each arch. The anterior teeth define the smile.

apical foramen The opening of the pulp canal through the tip of the root

asymmetrical Not symmetrical. Having two halves or parts, divided by a center line, which are not the same shape, size or arrangement.

axes Plural of axis. There are 9 axes which we use to describe the rotation of a tooth in the mouth. Using these 9 axes, we can accurately describe any rotational position of the tooth.

axial Pertaining to an axis.

axial wall One of the four vertical surfaces of a tooth. The mesial, distal, labial or buccal, and lingual surfaces.

axis An imaginary line running through an object, around which the object can be rotated. There are 9 axes which we use to describe the rotation of a tooth in the mouth. Using these 9 axes, we can accurately describe any rotational position of the tooth.

basic esthetic composition A generic arrangement of anterior teeth that you can use for most cases when you have no other reference such as a preoperative model. The basic composition is thus: 1. Centrals flat to the front of the mouth, on the occlusal plane and vertical in profile. 2. Laterals face on the curve of the arch, 1 to 2 mm shorter than the centrals and vertical in profile. 3. Cuspids on the curve of the arch, 1 to 3 mm shorter than the centrals, rotated out slightly at the gingival with the mesials rotated slightly out and the distals in.

bruxism Habitual grinding of the teeth, particularly during sleep.

buccal corridor The visual separation between the cheeks and the buccal surfaces of the posterior teeth seen when a person smiles.

canine A cuspid, so called because of its canine shape (like a dog's tooth).

cavum oris The mouth.

cemento-enamel junction The line on the surface of a tooth which marks the meeting of the cementum and the enamel. The cervical line.

cementum The hard, bony layer covering the dentin on the root of the tooth.

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central Pertaining to the middle of an object. A central incisor.

central incisor One of the two anterior teeth in the middle of each arch. The tooth next to the median line.

cervical Pertaining to the cervix or the narrowest part of an object. On a tooth, the part of the tooth just below the cemento-enamel junction.

cervical third The third of the tooth closest to the cervix.

cervix The narrowest part of an object. A neck. The neck of the tooth, just below the cemento-enamel junction.

check line An enamel crack in a natural tooth which usually runs vertically.

cingulum The lingual lobe of an anterior tooth which is located in the gingival third of the lingual surface.

clinical crown The part of a tooth that is exposed in the mouth. As the gingiva recede, the clinical crown gets longer.

concavity A hollowed or rounded inward shape. Causes shadows on the surface of teeth.

contact area The area where the proximal surface of one tooth touches another. Sometimes called a contact point.

convexity Curved or rounded outward like the surface of a sphere. The area that reflects light from a tooth, giving it shape.

coronal Pertaining to the crown, or the highest part of an object.

cortical plate The hard, outer shell of the alveolar process.

cosmetic Beautified or arranged to enhance appearance.

cosmetic dentistry The practice of dentistry for the improvement of appearance.

craze To develop a series of fine cracks in a surface, such as enamel cracks.

crown The highest part of an object. A cover. The highest part of a natural tooth.

crown-root ratio The ratio of the anatomic crown length to the root length.

curve of the arch An imaginary curved line following the facial surfaces of all the teeth in the dental arch.

cuspid A tooth having a single cusp. The most distal of the anterior teeth in each arch. The third tooth from the midline. The cuspids are used primarily for tearing.

cuspid guidance Immediate disclusion of the posterior teeth in lateral excursion due to contact between the opposing cuspids.

cuspid rise Cuspid guidance.

dental Pertaining to the teeth.

dental arch The arched, composite structure of the teeth and the supporting alveolar bone.

dental technology The art, study and manufacture of dental restorations.

dentin The hard tissue which forms the main body of a tooth. It surrounds the pulp and is covered by the enamel and the cementum.

dentition The teeth.

depression A concavity on a surface.

developmental groove The slight depression dividing the lobes on an anterior tooth. Sometimes used to describe the dissectional grooves on posterior teeth.

diastema A space between two adjacent teeth.

distal Facing away from the median line, following the curve of the arch.

distal surface The surface of the tooth facing away from the median line, following the curve of the dental arch.

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edentulous An area of the mouth where the natural teeth have been removed.

elongate To make longer.

embrasure A V-shaped space formed by the curved proximal surfaces of adjacent teeth. In dental technology, we define 4 embrasures surrounding the proximal contacts. For anterior teeth: gingival, incisal, labial and lingual. For posterior teeth: gingival, occlusal, buccal and lingual.

emergence profile The contour of a tooth or restoration where it emerges from the gingiva.

enamel A hard, glossy coating. The smooth, translucent hard substance which covers the crown of a tooth over the dentin.

enamel crack A small, vertical crack in the enamel that forms due to stress or trauma.

enamel prisms/enamel rods The calcified, microscopic prisms radiating from the dentin that form tooth enamel.

epithelial attachment The attachment of the gingiva to the tooth surface at the base of the gingival crevice.

esthetic Relating to the qualities of beauty in natural dentition or a dental restoration.

esthetic composition The esthetic arrangement of the teeth relative to one another and the dental arch.

esthetics The visual attractiveness of the natural teeth.

facet A small, smooth flat surface

facial Pertaining to the face.

facial surface The surface of a tooth closest to the face. Commonly used to refer to the labial surface of an anterior tooth or the buccal surface of a posterior tooth.

flat to the front The esthetic principle describing the central incisors being positioned flat to the front of the mouth. This is one of the things most often done incorrectly in dental restorations. Except in the case of crowding, the labial surfaces of both centrals should be parallel and flat to the front of the mouth, not in the curve of the arch.

gingiva The soft tissues surrounding the teeth. The gums. The fibrous tissue covered by mucous membrane that immediately surrounds a tooth and is continuous with the periodontal membrane.

gingival Referring to the gingiva. The area of the tooth closest to the gingiva.

gingival attachment The epithelial attachment.

gingival bulge The convex area just above the cervical line that deflects food away from the gingiva.

gingival collar The area of connection between the gingiva and the teeth.

gingival crest The apical (longest) portion of the gingival collar.

gingival crevice The V-shaped contour between the gingiva and the surface of the tooth.

gingival depression A small depression at the gingival of a cuspid, distal to the long axis.

gingival sulcus The gingival crevice.

golden proportion A concept used to describe the relative proportions of the central and lateral incisors, where 3/2 is the approximate ratio. That is, in the space occupied by a central and a lateral, the central will take up 3/5 of the space and the lateral will take 2/5. Another way to think of it is that the lateral is 2/3 the size of the central.

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height of contour The maximum contour of a surface in any direction. Convex areas of a tooth that reflect light and give shape to the tooth.

high lip line The highest position of the vermillion border of the upper lip in a smile.

imbrication lines Small semi-circular lines in the gingival third area that diffuse light reflected from the surface.

incisal Cutting. Pertaining to the cutting edge of an anterior tooth.

incisal edge The narrow biting edge or facet area of an anterior tooth.

incisal third The third of an anterior tooth closest to the incisal edge.

incisive papilla An area directly lingual to the two maxillary central incisors at the midline of the mouth where nerves and blood vessels come through the bone.

incisor A tooth with a narrow biting edge, located at the front of the dental arch.

individualize To make teeth appear natural by making them appear separate or different.

interdental Between the teeth.

interdental papilla The soft tissue between adjacent teeth.

interproximal Between the proximal surfaces of two teeth.

labia oris The lips.

labial Pertaining to the lips.

labial depression A depression on the labial surface (toward the lips) of an anterior tooth between the mesial and distal lobes.

labial surface The surface of an anterior tooth that faces the lips.

lamina dura The layer of bone forming the wall of the alveolus.

lateral To the side.

lateral incisor The anterior tooth to the side of the central incisor. The second tooth from the median line of the arch.

line angle The ridge formed by intersection of two planes. Often used to described the junction of the labial surface with the proximal surface.

lingual Pertaining to the tongue.

lingual concavity/lingual fossa The depression on the lingual surface of an anterior tooth bordered by the incisal edge, the cingulum and the marginal ridges.

lingual surface The surface of a tooth facing the tongue.

lip line The level of the vermilion border of the lip relative to the teeth.

lip support The condition in which the upper teeth hold the upper lip forward.

lobe A segment from which a natural tooth develops. Anterior teeth have three labial lobes.

long axis An imaginary line that runs vertically through the center of a tooth. All anatomical features must be in correct relationship to the long axis in order for the teeth to appear natural. The long axis is not to be confused with a rotational axis

long clinical crown A tooth with recessed gingiva where the clinical crown is longer than the anatomic crown.

low lip line The level of the vermillion border of the upper lip when it is completely relaxed.

mamelons The three raised lobes on the incisal edge of an adolescent tooth.

mandible The lower jaw.

mandibular Pertaining to the mandible. Lower.

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marginal Pertaining to a margin or border of an object.

marginal ridge An elevation of enamel which forms the mesial or distal border of the lingual surface of an anterior tooth.

maxilla Either of the two halves of the upper jaw, fused at the suture line, that contain the upper teeth. Commonly used to describe the entire upper jaw.

maxillae Plural of maxilla. Both halves of the upper jaw, taken as a whole.

maxillary Pertaining to the maxillae. Upper.

median line An imaginary line which extends vertically through the middle of the face. Also the midline of a model through the centrals.

mesial Toward the median line, following the curve of the dental arch.

mesial surface The surface of a tooth facing the median line, following the curve of the dental arch.

mesial triangle A triangle formed by the mesial lobe, the cemento-enamel junction and the midline of the proximal surface.

middle third The third of the tooth closest to the center.

midline An imaginary line which extends vertically through the middle of the face. Also the median line of a model through the centrals.

morphology The study of anatomy. The anatomy of an object taken as a whole.

Ness Teeth™ A set of large, anatomic study teeth created by John C. Ness, CDT, founder of PTC.

oral Pertaining to the mouth.

oral cavity The inside of the mouth.

overbite Vertical overlap of the upper and lower teeth.

overjet Horizontal overlap of the upper and lower teeth.

papilla A small elevation of soft tissue.

parallel Lines in the same plane or surfaces which can be extended indefinitely without meeting.

parameter A limit or boundary.

perikymata Very small horizontal ridges on the surface of a tooth caused by the formation of the enamel prisms. Perikymata diffuse light reflected from the surface, and become less noticeable over time, due to the wear of the enamel surface.

periodontal ligament/periodontal membrane The thin, fibrous membrane surrounding the root of a tooth and continuous with the epithelial attachment.

primary anatomy The basic physical features of a tooth. On a posterior tooth, all features except the secondary and auxiliary grooves.

plane A flat surface.

primary plane On an anterior tooth, the flat plane inside the mesial and distal lobes which is in alignment with the long axis. These planes are shown on the Primary Ness Teeth™.

profile A side view of an object. A vertical cross-section or outline.

proximal contact The area of a tooth that touches another tooth on the proximal surface. The proximal contact is an ovoid area just below the marginal ridge and just buccal to the central dissectional groove in natural tooth contacts.

proximal surface The surface of a tooth facing an adjacent tooth. A mesial or distal surface.

proximal wall The proximal surface of a tooth.

pulp The soft, fibrous, central core of a tooth, consisting of the nerve and blood vessels.

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pulp canal The portion of the pulp cavity that lies within the tooth root. The root canal.

pulp cavity The central hollow chamber of a tooth that contains the pulp.

pulp chamber The portion of the pulp cavity located in the crown of the tooth.

pulp horn An extension of the pulp chamber under a cusp or incisal edge.

quadrant One half of the dental arch. The four quadrants (in the order in which they are charted) are upper right, upper left, lower left and lower right.

ridge A long, narrow elevation.

root The part of a tooth that is anchored in the bone, typically below the gingiva.

root canal The portion of the pulp cavity that lies within the tooth root. The pulp canal.

rotation Movement of an object about a fixed axis.

rotational axis An imaginary line about which an object can be rotated.

"S" curve A curving depression on the labial surface of an incisor in the shape of a lazy "S". The curve starts in the disto-gingival area and blends into the central lobe, causing a pleasing visual blending of the tooth into the tissue. The "S" curve tends to accentuate the length and fullness of the mesial lobe and shorten the distal lobe, enhancing the long axis of the tooth.

secondary anatomy The features of a tooth that come after the primary anatomy.

smile line A curved line that follows the incisal edges of the centrals and laterals and the tips of the cuspids.

soft esthetic composition An arrangement of anterior teeth that you can use to create a softer, more delicate appearance for a patient. The standard female composition is thus: 1. Centrals flat to the front of the mouth, one depressed slightly from the other, on the occlusal plane and vertical in profile. 2. Laterals on the curve of the arch, depressed at the neck, mesials rotated out, 1 to 2 mm shorter than the centrals. Rotate one lateral slightly to the distal on the labio-lingual axis and the other slightly to the mesial. 3. Cuspids on the curve of the arch, 1 to 3 mm shorter than the centrals, rotated out slightly at the gingival with the mesials rotated slightly out and the distals in.

stable reference A source of information which never changes.

strong esthetic composition An arrangement of anterior teeth that you can use to create a stronger, more aggressive appearance for a patient. The standard male composition is thus: 1. Centrals flat to the front of the mouth, one depressed slightly from the other, on the occlusal plane and vertical in profile. 2. Laterals on the curve of the arch, depressed from the centrals, mesials rotated in, 1 to 2 mm shorter than the centrals. 3. Cuspids on the curve of the arch, 1 to 3 mm shorter than the centrals, rotated out slightly at the gingival with the mesials rotated slightly out and the distals in.

subgingival Below the gums. The area of a tooth below the gingival line.

sulcus A groove or furrow.

symmetrical Having equal or opposite shape and size on either side of a center line. A mirror image.

tooth arrangement The esthetic arrangement of the teeth relative to one another and the dental arch.

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turn of the arch The shape of the upper cuspid and its placement in the upper dental arch. The six anterior teeth follow the arch. At the distal of the cuspid, the arch turns sharply to the posterior teeth.

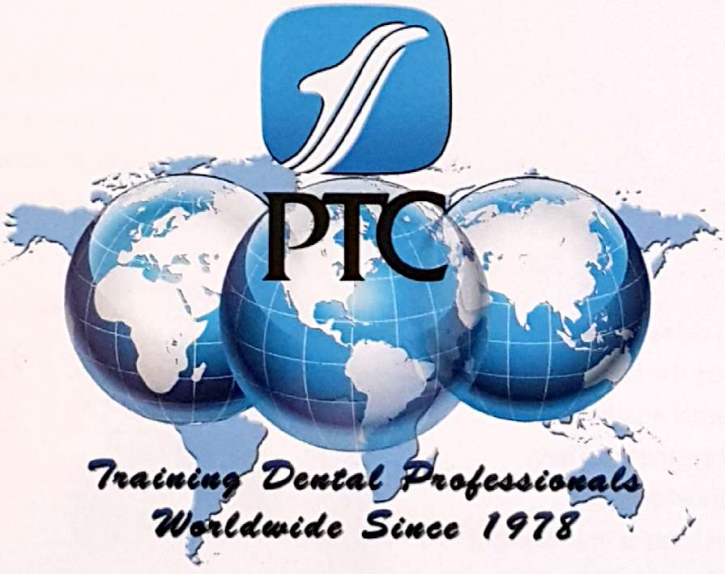
vertical transitional line angle The vertical angles which delineate the transition from the labial surface at the mesial and distal lobes into the interproximal embrasures.

vermillion border The area along the crest of the lip bordered by the dry, reddish skin of the outer lip and the moist mucous membrane lining the lip.

wear facet A worn surface caused by one tooth touching and wearing against another.

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Dental Lab
Training Systems



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PTC Overview

Training Dental Technicians for 30 Years

PTC is the world leader in providing technical management training systems to dental professionals. PTC systems are in use in over 35 countries with over 6,000 technicians certified in PTC technical courses.

PTC programs are being continually updated to meet the changing demands of today's modern laboratories.

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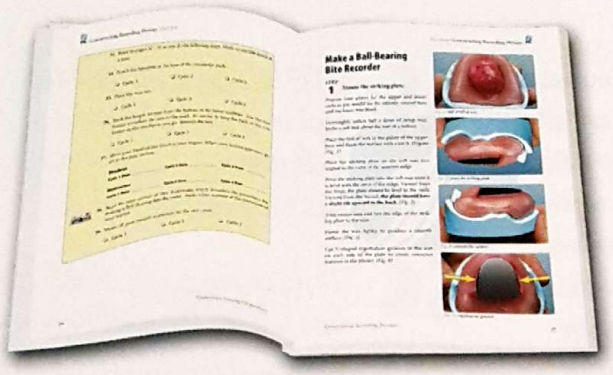
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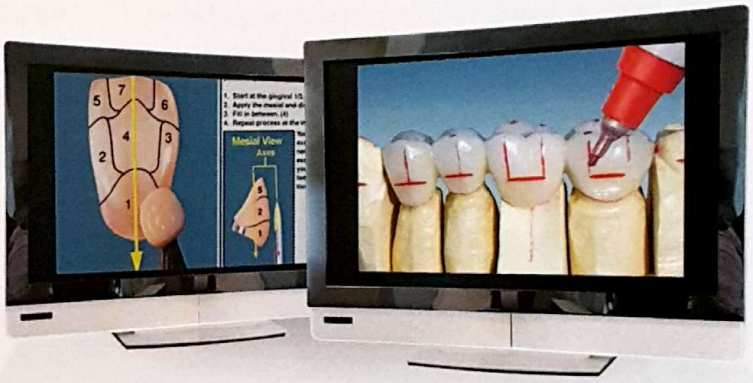


1 TechGuides

The PTC TechGuide Workbooks include step by step instructions detailing when to read the manual, watch the video, or complete a practical exercise, with check off points for the student and the trainer after each step. Finally, the student is tested on their knowledge with exercises after each chapter.

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PTC Trainer



James Mahan, CDT is the President and CEO for Productivity Training Corporation. As the principal trainer for the past 10 years he has trained hundreds of laboratory owners, managers and technicians in PTC technology as well as business management fundamentals. A consultant for Ness Consulting International he has trained dental technicians and owners around the world in Europe, the Middle East, and Asia. He draws on 40 years of dental laboratory experience as a dental lab owner, manager and dental technician to help laboratory owners establish better control of their business.

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Anterior Anatomy
Gain full command of anterior anatomy and the ten fundamentals you must know and fully understand to create and control the complex features of a natural smile.

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Anterior and Posterior Porcelain Application
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Anterior Contouring
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Posterior Contouring
Learn how identifying and marking guidelines for every action takes the guess work out of posterior contouring. You will learn how primary planes contribute to increased quality and production.

Color in Dental Ceramics
Learn the science of the subtractive color system and how controlling Hue, Chroma and Value will enable you mix porcelains and stains to match any custom shade .

Constructing Recording Devices
You will learn to construct an esthetic control base that allows the dentist to record important features of the face and mouth that are essential for the proper placement of teeth in the denture. You will also learn to assemble a Ball Bearing Bite Recorder that is used by the dentist to establish a comfortable natural vertical dimension in the patient.

Anterior and Posterior Setups
In this course you will learn nine rotational axes and the fundamental 5 step sequence for setting anterior and posterior teeth. You will use the Esthetic Control Base and an occlusal control plate to guide you in correctly positioning the teeth in the upper and lower arches.

Tissue Waxing and Carving
The art of denture construction includes duplicating the look of natural tissues of the mouth. This course simplifies the process of precisely placing and contouring all the delicate tissue contours while still maintaining the self cleansing nature of the denture.

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