Federal State Budgetary Educational Institution of Higher Education
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**Department of Stomatology №2**

# Metodical Recommendations

# «Stomatology»

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## Formation of the Dentitions (Overview)

Humans have two sets of teeth in their lifetime. The first set of teeth to be seen in the mouth is the **primary** or **deciduous** dentition, which begins to form prenatally at approximately 14 weeks in utero and is completed postnatally at approximately 3 years of age. In the absence of congenital disorders, dental disease, or trauma, the first teeth in this dentition begin to appear in the oral cavity at the mean age of 6 months, and the last emerge at a mean age of 28 ± 4 months. The deciduous dentition remains intact (barring loss from dental caries or trauma) until the child is approximately 6 years of age. At approximately that time, the first **succedaneous** or **permanent** teeth begin to emerge into the mouth. The emergence of these teeth begins the **transition** or **mixed dentition period,** in which there is a mixture of deciduous and succedaneous teeth present. The transition period lasts from approximately 6 to 12 years of age and ends when all the deciduous teeth have been shed. At that time, the permanent dentition period begins. Thus the transition from the primary dentition to the permanent dentition begins with the emergence of the first permanent molars, shedding of the deciduous incisors, and emergence of the permanent incisors. The mixed dentition period is often a difficult time for the young child because of habits, missing teeth, teeth of different colors and hues, crowding of the teeth, and malposed teeth.

The permanent, or succedaneous, teeth replace the exfoliated deciduous teeth in a sequence of eruption that exhibits some variance, an important topic considered in Chapter 16.

After the shedding of the deciduous canines and molars, emergence of the permanent canines and premolars, and emergence of the second permanent molars, the permanent dentition is completed (including the roots) at approximately 14 to 15 years of age, except for the third molars, which are completed at 18 to 25 years of age. In effect, the duration of the permanent dentition period is 12 or more years. The completed permanent dentition consists of 32 teeth if none is congenitally missing, which may be the case. The development of the teeth, dentitions, and the craniofacial complex is considered in Chapter 2. The development of occlusion for both dentitions is discussed in Chapter 16.

## Nomenclature

The first step in understanding dental anatomy is to learn the nomenclature, or the system of names, used to describe or classify the material included in the subject. When a significant term is used for the first time here, it is emphasized in bold. Additional terms are discussed as needed in subsequent chapters.

The term **mandibular** refers to the lower jaw, or mandible. The term **maxillary** refers to the upper jaw, or maxilla. When more than one name is used in the literature to describe something, the two most commonly used names will be used initially. After that, they may be combined or used separately, as consistent with the literature of a particular specialty of dentistry, for example, **primary** or **deciduous dentition, permanent** or **succedaneous dentition.** A good case may be made for the use of both terms. By dictionary definition,1 the term *primary* can mean “constituting or belonging to the first stage in any process.” The term

*deciduous* can mean “not permanent, transitory.” The same unabridged dictionary refers the reader from the definition of *deciduous tooth* to *milk tooth,* which is defined as “one of the temporary teeth of a mammal that are replaced by permanent teeth; also called *baby tooth, deciduous tooth.*” The term *primary* can indicate a first dentition, and the term *deciduous* can indicate that the first dentition is

not permanent but not unimportant. The term *succedaneous* can be used to describe a successor dentition and does not suggest permanence, whereas the term *permanent* suggests a permanent dentition, which may not be the case because of dental caries, periodontal diseases, and trauma. All four of these descriptive terms appear in the professional literature.

**Formulae for Mammalian Teeth**

The denomination and number of all mammalian teeth are expressed by formulae that are used to differentiate the human dentition from those of other species. The denomination of each tooth is often represented by the initial letter in its name (e.g., I for incisor, C for canine, P for premolar, M for molar). Each letter is followed by a horizontal line and the number of each type of tooth is placed above the line for the maxilla (upper jaw) and below the line for the mandible (lower jaw). The formulae include one side only, with the number of teeth in each jaw being the same for humans.

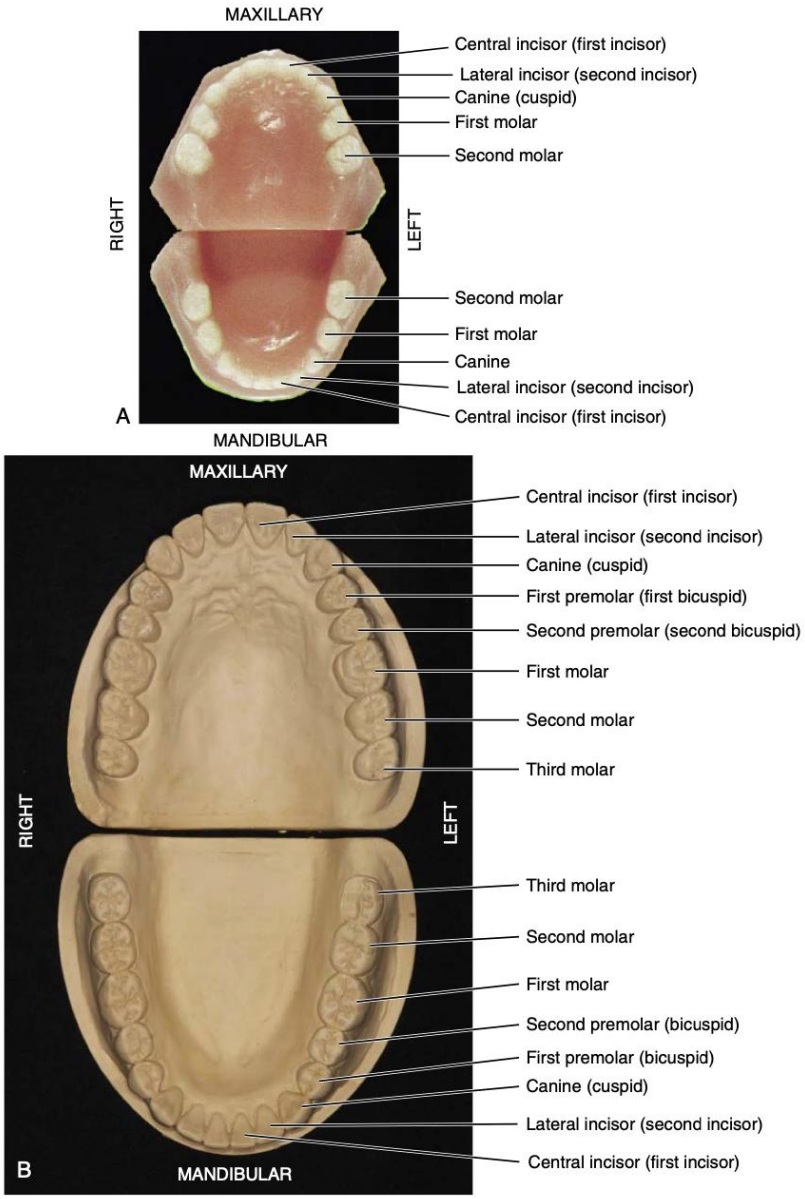
Premolars have now been added to the formula, two maxillary and two mandibular, and a third molar has been added, one max- illary and one mandibular (see Fig. 1.2B).

Systems for scoring key morphologic traits of the permanent dentition that are used for anthropologic studies are not described here. However, a few of the morphologic traits that are used in anthropologic studies2 are considered in later chapters (e.g., shov- eling, Carabelli trait, enamel extensions, peg-shaped incisors). Some anthropologists use di1, di2, dc, dm1, and dm2 notations for the deciduous dentition and I1, I2, C, P1, P2, M1, M2, and M3 for the permanent teeth. These notations are generally limited to anthropologic tables because of keyboard incompatibility.

**Tooth Numbering Systems**

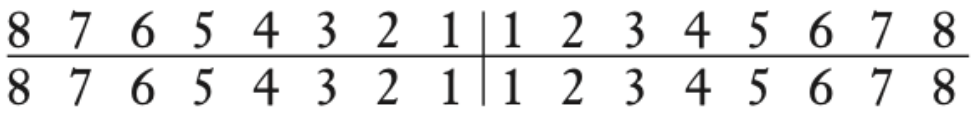
In clinical practice, some “shorthand” system of tooth notation is necessary for recording data. Several systems are in use around the world, but only a few are considered here. In 1947 a commit- tee of the American Dental Association (ADA) recommended the symbolic system (Zsigmondy/Palmer) as the numbering method of choice.3 However, because of difficulties with keyboard nota- tion of the symbolic notation system, the ADA in 1968 officially recommended the “universal” numbering system. Because of some limitations and lack of widespread use internationally, recommen- dations for a change sometimes are made.4

The **Universal** system of notation for the primary dentition uses uppercase letters for each of the primary teeth: For the maxillary teeth, beginning with the right second molar, letters A through J, and for the mandibular teeth, letters K through T, beginning with the left mandibular second molar.




• **Fig. 1.2** (A) Casts of deciduous, or primary, dentition. (B) Casts of permanent dentition. (A, From Berkovitz BK, Holland GR, Moxham BJ: *Oral anatomy, histology and embryology,* ed 3, St Louis, 2002, Mosby.) (To view Animations 1 and 2, please go to Expert Consult.)

The Zsigmondy/Palmer notation for the permanent dentition is a four-quadrant symbolic system in which, beginning with the central incisors, the teeth are numbered 1 through 8 (or more) in each arch. For example, the right maxillary first molar is designated as 6 , and the left mandibular central incisor as 1. The Palmer notation for the entire permanent dentition is as follows:




Viktor Haderup of Denmark in 1891 devised a variant of the eight-tooth quadrant system in which plus (+) and minus (−) were used to differentiate between upper and lower quadrants and between right and left quadrants. In other words, +1 indicates the upper left central incisor, and 1− indicates the lower right central incisor. Primary teeth were numbered as follows: upper right, 05+ to 01+; lower left, −01 to −05. This system is still taught in Denmark.[5]

The Universal system is acceptable to computer language, whereas the Palmer notation is generally incompatible with computers and word-processing systems. Each tooth in the universal system is designated with a unique number, which leads to less confusion than with the Palmer notation.

A two-digit system proposed by Fédération Dentaire Inter- nationale (FDI) for both the primary and permanent dentitions has been adopted by the World Health Organization and accepted by other organizations, such as the International Association for Dental Research. The FDI system of tooth notation is as follows.

**Crown and Root**

Each tooth has a crown and root portion. The crown is covered with enamel, and the root portion is covered with cementum. The crown and root join at the **cementoenamel junction** (CEJ). This junction, also called the **cervical line**, is plainly visible on a specimen tooth. The main bulk of the tooth is composed of **dentin,** which is clear in a cross section of the tooth. This cross section displays a pulp chamber and a pulp canal, which normally contain the pulp tissue. The **pulp chamber** is in the crown portion mainly, and the **pulp canal** is in the root. The spaces are continuous with each other and are spoken of collectively as the *pulp cavity.*

The four tooth tissues are *enamel, cementum, dentin,* and *pulp.* The first three are known as **hard tissues,** the last as **soft tissue.** The pulp tissue furnishes the blood and nerve supply to the tooth. The tissues of the teeth must be considered in relation to the other tissues of the orofacial structures if the physiology of the teeth is to be understood.

The crown of an incisor tooth may have an incisal ridge or edge, as in the central and lateral incisors; a single cusp, as in the canines; or two or more cusps, as on premolars and molars.

Incisal ridges and cusps form the cutting surfaces on tooth crowns.

The root portion of the tooth may be single, with one apex or terminal end, as usually found in anterior teeth and some of the premolars; or multiple, with a bifurcation or trifurcation dividing the root portion into two or more extensions or roots with their apices or terminal ends, as found on all molars and in some premolars.

The root portion of the tooth is firmly fixed in the bony process of the jaw, so that each tooth is held in its position relative to the others in the dental arch. That portion of the jaw serving as sup- port for the tooth is called the **alveolar process.** The bone of the tooth socket is called the *alveolus* (plural *alveoli*).

The crown portion is never covered by bone tissue after it is fully erupted, but it is partly covered at the cervical third in young adults by soft tissue of the mouth known as the *gingiva* or *gingival tissue,* or "gums." In some persons, all the enamel and frequently some cervical cementum may not be covered by the gingiva.

**Surfaces and Ridges**

The crowns of the incisors and canines have four surfaces and a ridge, and the crowns of the premolars and molars have five sur- faces. The surfaces are named according to their positions and uses (Fig. 1.8). In the incisors and canines, the surfaces toward the lips are called **labial surfaces;** in the premolars and molars, those fac- ing the cheek are the **buccal surfaces.** When labial and buccal surfaces are referred to collectively, they are called **facial surfaces.** All surfaces facing toward the tongue are called **lingual surfaces.** The surfaces of the premolars and molars that come in contact (occlusion) with those in the opposite jaw during the act of closure are called **occlusal surfaces.** These are called **incisal surfaces** with respect to incisors and canines.

The surfaces of the teeth facing toward adjoining teeth in the same dental arch are called **proximal** or **proximate surfaces.** The proximal surfaces may be called either **mesial** or **distal.** These terms have special reference to the position of the surface relative to the median line of the face. This line is drawn vertically through the center of the face, passing between the central incisors at their point of contact with each other in both the maxilla and the mandible. Those proximal surfaces that, following the curve of the arch, are faced toward the median line are called **mesial surfaces,** and those most distant from the median line are called **distal surfaces.**

Four teeth have mesial surfaces that contact each other: the **maxillary** and **mandibular central incisors.** In all other instances, the mesial surface of one tooth contacts the distal surface of its neighbor, except for the distal surfaces of third molars of perma- nent teeth and distal surfaces of second molars in deciduous teeth, which have no teeth distal to them. The area of the mesial or distal surface of a tooth that touches its neighbor in the arch is called the **contact area.**

Central and lateral incisors and canines as a group are called **anterior teeth;** premolars and molars as a group, **posterior teeth.**

**Other Landmarks**

To study an individual tooth intelligently, one should recognize all landmarks of importance by name. Therefore, at this point, it A **cusp** is an elevation or mound on the crown portion of a tooth making up a divisional part of the occlusal surface.

A **tubercle** is a smaller elevation on some portion of the crown produced by an extra formation of enamel. These are deviations from the typical form.

A **cingulum** (Latin word for "girdle") is the lingual lobe of an anterior tooth. It makes up the bulk of the cervical third of the lingual surface. Its convexity mesiodistally resembles a girdle encircling the lingual surface at the cervical third.

A **ridge** is any linear elevation on the surface of a tooth and is named according to its location (e.g., buccal ridge, incisal ridge, marginal ridge).

**Marginal ridges** are the rounded borders of the enamel that form the mesial and distal margins of the occlusal surfaces of pre- DG molars and molars, as well as the mesial and distal margins of the lingual surfaces of the incisors and canines.

**Triangular ridges** descend from the tips of the cusps of molars and premolars toward the central part of the occlusal surfaces. They are so named because the slopes of each side of the ridge are inclined to resemble two sides of a triangle. They are named after the cusps to which they belong, for example, the triangular ridge of the buccal cusp of the maxillary first premolar.

When a buccal and a lingual triangular ridge join, they form a **transverse ridge.** A transverse ridge is the union of two triangular ridges crossing transversely the surface of a posterior tooth.

The **oblique ridge** is a ridge crossing obliquely the occlusal surfaces of maxillary molars and formed by the union of the triangular ridge of the distobuccal cusp and the distal cusp ridge of the mesiolingual cusp.

A **fossa** is an irregular depression or concavity. **Lingual fossae** are on the lingual surface of incisors. **Central fossae** are on the occlusal surface of molars. They are formed by the convergence of ridges terminating at a central point in the bottom of the depression where there is a junction of grooves. **Triangular fossae** are found on molars and premolars on the occlusal surfaces mesial or distal to marginal ridges. They are sometimes found on the lingual surfaces of maxillary incisors at the edge of the lingual fossae where the marginal ridges and the cingulum meet.

A **sulcus** is a long depression or valley in the surface of a tooth between ridges and cusps, the inclines of which meet at an angle. A sulcus has a developmental groove at the junction of its inclines. (The term *sulcus* should not be confused with the term *groove*.)

A **developmental groove** is a shallow groove or line between the primary parts of the crown or root. A **supplemental groove,** less distinct, is also a shallow linear depression on the surface of a tooth, but it is supplemental to a developmental groove and does not mark the junction of primary parts. **Buccal** and **lingual grooves** are developmental grooves found on the buccal and lingual surfaces of posterior teeth.

**Pits** are small pinpoint depressions located at the junction of developmental grooves or at terminals of those grooves. For example, *central pit* is a term used to describe a landmark in the central fossa of molars where developmental grooves join.

A **lobe** is one of the primary sections of formation in the development of the crown. Cusps and mamelons are representative of lobes. A **mamelon** is any one of the three rounded protuber- ances found on the incisal ridges of newly erupted incisor teeth.

Although they are generally considered to be a feature of the per- manent incisors, mamelon-like serrations may also be found on newly erupted primary incisors.

The **roots** of the teeth may be single or multiple. Both max- illary and mandibular anterior teeth have only one root each. Mandibular first and second premolars and the maxillary second premolar are single rooted, but the maxillary first premolar has two roots in most cases, one buccal and one lingual. Maxillary molars have three roots, one mesiobuccal, one distobuccal, and one lingual. Mandibular molars have two roots, one mesial and one distal. It must be understood that descriptions in anatomy can never follow a hard-and-fast rule. Variations frequently occur. This is especially true regarding tooth roots, such as the facial and lingual roots of the mandibular canine.

**Division Into Thirds, Line Angles, and Point Angles**

For purposes of description, the crowns and roots of teeth have been divided into thirds, and junctions of the crown surfaces are described as line angles and point angles. Actually, there are no angles or points or plane surfaces on the teeth anywhere except those that appear from wear (e.g., **attrition, abrasion**) or from accidental fracture. *Line angle* and *point angle* are used only as descriptive terms to indicate a location.

When the surfaces of the crown and root portions are divided into thirds, these thirds are named according to their location. Looking at the tooth from the labial or buccal aspect, we see that the crown and root may be divided into thirds from the incisal or occlusal surface of the crown to the apex of the root. The crown is divided into an incisal or occlusal third, a middle third, and a cervical third. The root is divided into a cervical third, a middle third, and an apical third.

The crown may be divided into thirds in three directions: inci- socervically or occlusocervically, mesiodistally, or labiolingually or buccolingually. Mesiodistally, it is divided into the mesial, middle, and distal thirds. Labiolingually or buccolingually, it is divided into labial or buccal, middle, and lingual thirds. Each of the five surfaces of a crown

may be so divided. There will be one middle third and two other thirds, which are named according to their location (e.g., cervical, occlusal, mesial, lingual).

A **line angle** is formed by the junction of two surfaces and derives its name from the combination of the two surfaces that join. For example, on an anterior tooth, the junction of the mesial and labial surfaces is called the **mesiolabial line angle.**

Because the mesial and distal incisal angles of anterior teeth are rounded, **mesioincisal line angles** and **distoincisal line angles** are usually considered nonexistent. They are spoken of as **mesial** and **distal incisal** angles only.

A **point angle** is formed by the junction of three surfaces. The point angle also derives its name from the combination of the names of the surfaces forming it. For example, the junction of the mesial, buccal, and occlusal surfaces of a molar is called the **mesiobucco-occlusal point angle.**

**Summary**

Terminology is an established basis for communication, and therefore the importance of learning the nomenclature for dental anatomy cannot be minimized. The terms used in describing the morphology of teeth are used in every aspect of dental practice.

Although there is no such thing as an established invariable norm in nature, in the study of anatomy it is necessary that there be a starting point. Therefore we must begin with an **arbitrary criterion,** accepted after experimentation and due consideration. Because restorative dentistry must approach the scientific as closely as manual dexterity will allow, models, plans, photographs, and natural specimens should be given preference over the written text on this subject.

Every curve and segment of a normal tooth has some functional basis, and it is important to reproduce them accurately. The successful clinician in dentistry or, for that matter, any designer of dental restorations should be able to mentally create pictures of the teeth from any aspect and relate those aspects of dental anatomy to function. Complete pictures can be formed only when one is familiar with the main details of tooth form.

## Dental histology

Enamel is the hardest tissue of the body. It covers the crown and part of the neck of the tooth in the form of a cap, protecting the tooth from external influences. The thickness of the enamel varies. The thickest layer in the area of the chewing tubercles (1.5 – 1.7 mm), the thinnest – at the neck of the tooth.

The enamel consists of inorganic substances (96-98%), the vast majority of which are calcium phosphates and carbonates, and about 4% - calcium fluoride. Organic compounds in

the enamel a small amount (2% and 4%), they are represented by ceratocanthinae, proteins, lipids, and glycosaminoglycans. The chemical composition of enamel can change depending on the metabolism in the body and the remineralization of the organic matrix of enamel.

On the side surfaces of the tooth enamel is covered with cuticle, on the chewing surface it is not, because it is erased immediately after the inclusion of the tooth in the act of chewing. On the crown of the tooth there is a pellicle – a thin film of organic compounds that is tightly bound to the enamel. It appears after teething, it includes compounds that fall out of saliva (mucoproteins and proteids). Pellicle affects the processes of diffusion, enamel permeability, regulates the flow of substances from saliva, protects the tooth from decalcification in an acidic environment. On top of the pellicle is plaque, which is formed by microflora, microbial products, flaked epithelium, food residues. Dental plaque can be mineralized by minerals coming from saliva. In this case, dental stones are formed on the surface of the teeth, which cause periodontal diseases. Currently, it is shown that the enamel is undergoing metabolic processes. Enamel is permeable to water, ions, vitamins, amino acids and other substances.

Dentin. The degree of mineralization of dentin is less than that of enamel, but somewhat higher than in bone, and is 70-72%. Inorganic substances are represented by calcium and magnesium phosphates, calcium carbonate and calcium fluorides. Organic compounds make up 28-30%, mainly collagen and mucoproteins.

Dentin consists of an amorphous substance and collagen fibers impregnated with mineral salts. The entire thickness of the dentin is permeated by a network of dentine tubules that run radially towards the enamel and cement, and have the appearance of thin tubes with a diameter of 1 to 3-4 microns. Inside the tubules are cytoplasmic processes of dentinoblasts located outside the dentin and occupying the peripheral part of the tooth pulp. In the area of the root of the tooth, the dentine tubules form contacts with the cement tubules, where the processes of cementocytes lie. Dentin, like other hard tissues of the tooth, does not have blood vessels, and the entire set of anastomosing tubules makes up a complex conductor-transport system for enamel, cement and dentin. Metabolism, delivery of plastic materials, etc. is provided by diffusion through the system of tubules on the side of the tooth pulp and on the side of the periodontal. The production of dentin by dentinoblasts occurs throughout a person's life. The formation of new portions of dentin (so-called secondary dentin) gradually leads to a narrowing of the pulp cavity. The production of secondary dentin is sharply increased when the hard tissues of the tooth are destroyed (for example, by the carious process), when the teeth are pathologically erased.

Cement covers the root, the neck of the tooth. The chemical composition and structure of cement is very similar to coarse-fiber bone tissue, 30% of it is made up of organic substances and 70% of inorganic compounds, mainly salts of phosphate and calcium carbonate. Unlike bone tissue, cement normally does not contain blood vessels. Its nutrition occurs by the diffusion of nutrients from the periodontal blood vessels.

**Сроки прорезывания молочных зубов**

| Dent | The month |
|---|---|
| Central incisors of the lower jaw | 6,5 |
| Lateral incisors of the lower jaw | 7 |
| Central incisors of the upper jaw | 7,5 |
| Lateral incisors of the upper jaw | 8 |
| The first molars | 12-16 |
| Canine tooth | 16-20 |
| The second molars | 20-30 |

**The rule of four fours**

every four months, four teeth erupt (starting with the four incisors of the lower jaw at the age of 7 months)

| Age (in months) | Number of cutouts teeth | Teething |
|---|---|---|
| 7 | 4 | • the incisors of the lower jaw (4) |
| 11 | 8 | • the incisors of the lower jaw (4)<br>• the incisors of the upper jaw (4) |
| 15 | 12 | • lower jaw incisors (4)<br>• upper jaw incisors (4)<br>• first molars (4) |
| 19 | 16 | • lower jaw incisors (4)<br>• upper jaw incisors (4)<br>• first molars (4)<br>• fangs (4) |
| 23 | 20 | • lower jaw incisors (4)<br>• upper jaw incisors (4)<br>• first molars (4)<br>• fangs (4)<br>• second molars (4) |

**Сроки выпадения молочных зубов**

| Dent | Age (advanced in years) |
|---|---|
| Central incisors | 6-7 |

| | |
|---|---|
| Lateral incisor | 7-8 |
| The first molars | 9-11 |
| Fangs of the lower jaw | 9-12 |
| Canines of the upper jaw | 10-12 |
| The second molars | 10-12 |

**Сроки прорезывания постоянных зубов**

| Dent | First signs of mineralization | Maturation of enamel | Teething | End of root formation |
|---|---|---|---|---|
| First molar of the lower jaw | at birth | 2,5-3 years | 6-7 years | 9-10 years |
| First molar of the upper jaw | at birth | 3-4 years | 6-7 years | 9-10 years |
| Central incisors of the lower jaw | 3-4 месяца | 4-5 years | 6-7 years | 9 years |
| Central incisors of the upper jaw | 3-4 месяца | 4-5 years | 7-8 years | 10 years |
| Lateral incisors of the lower jaw | 3-4 месяца | 4-5 years | 7-8 years | 10 years |

| | | | | |
|---|---|---|---|---|
| Lateral incisors of the upper jaw | 10 месяцев | 4-5 years | 8-9 years | 11 years |
| Fangs of the lower jaw | 4-5 месяцев | 6-7 years | 9-10 years | 12-14 years |
| First premolars of the upper jaw | 1½-1¾ years | 5-6 years | 10-11 years | 12-13 years |
| First premolars of the lower jaw | 1¾ - 2 years | 5-6 years | 10-12 years | 12-13 years |
| Second premolars of the upper jaw | 2-2¼ years | 6-7 years | 10-12 years | 12-14 years |
| Вторые премоляры нижней челюсти | 2¼ -2½ years | 6-7 years | 11-12 years | 13-14 years |
| Клыки верхней челюсти | 4-5 month | 6-7 years | 11-12 years | 13-15 years |
| Вторые моляры нижней челюсти | 2½-3 years | 7-8 years | 11-13 years | 13-14 years |
| Вторые моляры верхней челюсти | 2½-3 years | 7/8 years | 12-13 years | 14-16 years |
| Третьи моляры нижней челюсти | 8-10 years | 12-14 years | 17-21 years | 19-21years |

| | | | | |
|---|---|---|---|---|
| Третьи моляры верхней челюсти | 7-9 years | 12-14 years | 17-21 years | 19-21 years |

- By the time of teething, approximately 50% of the root has been formed
- The tip of the root is finally formed about 2-3 years after teething

**What is a broken or dislocated jaw?**

A broken or dislocated jaw is an injury to one or both of the joints that connect your lower jawbone to the skull. Each of these joints is called the temporomandibular joint (TMJ). The TMJ can break, crack, or become unhinged from the skull. The unhinging of the jaw joint is known as a dislocation.

A broken, fractured, or dislocated jaw can create problems with eating and breathing. Immediate medical attention is necessary to minimize complications and accelerate healing.

**Causes of a broken or dislocated jaw**

Experiencing facial trauma is the primary cause of a broken or dislocated jaw. The jawbone extends from your chin to behind your ear. Common types of injury that can cause fractures or dislocations in the jawbone are:

- physical assault in the face
- sports injuries
- vehicle accidents
- accidental falls in the home
- industrial or workplace accidents

**Symptoms of a broken jaw include:**

- pain
- swelling, including facial swelling
- bleeding, including bleeding from the mouth
- breathing difficulties
- discomfort when chewing
- jaw stiffness
- numbness and bruising in the face
- dental-related discomfort, such as numbness in the gums or loosened teeth

Pain, swelling, and bleeding are the most immediate symptoms of a broken jaw. Your entire face can swell, making your jaw painful and stiff. Bleeding from the mouth can occur, causing breathing difficulties in some people. The blood flow can block your airways. You may experience the most pain and tenderness when chewing or speaking. If you have a severe jaw fracture, you might experience limited ability to move your jaw or be unable to move your jaw at all.

Numbness and bruising in the face and gums are also normal to have if your jaw is fractured or broken. Breaking the bone can cause other abnormalities with the shape of your face. You might notice that your jaw or face has a lumpy appearance. The impact of your injury could also cause loosened or lost teeth.

Dislocated jaw

The signs of a dislocated jaw can be different than those of a broken jaw. Pain is a factor, and it may become worse when you move your mouth or your body. Additional signs of a dislocated jaw include the following:

- Your jaw might appear to jut out too much, as in an overbite.
- You might notice that your teeth don't line up as they usually do and your bite feels strange.
- An abnormal bite can prevent you from closing your mouth completely, and this might cause drooling.
- Speaking may be difficult.

**Diagnosing a broken or dislocated jaw**

Your doctor will diagnose a broken jaw or dislocation by asking you your history, doing a physical exam, and taking relevant X-rays. A simple dislocation could be treated by an oral surgeon or dentist. A serious fracture that requires surgery would need a specialist, such as a facial plastic and reconstructive surgeon, a head and neck surgeon, or an oral surgeon.

**Treatment for jaw injuries**

If you injure your jaw, it will most likely be treated as an emergency. While waiting for medical care, support your lower jaw to help stabilize it and keep your airway open.

**Treating a dislocated jaw**

A doctor must manipulate a dislocated jaw back into the correct position. Sometimes your doctor can do this manually. You'll receive local anesthetics and muscle relaxants to minimize the pain and to help your jaw muscles loosen up enough to allow the manipulation. In some cases, surgery may be necessary to set the TMJ back into the normal position.

**Treating a broken jaw**

Treatment for a jaw fracture or break might also require surgery, depending on the extent of the injury. Clean breaks may heal on their own while your jaw is immobilized. Multiple fractures of the jawbone or displaced breaks in the part of the bone that's pushed off to one side may require surgical repair.

Broken and dislocated jaws are bandaged or wired shut during recovery.

Your doctor may treat your dislocation and minor fracture simply by wrapping a bandage around your head and under your chin to keep you from opening your jaw wide. Anti-inflammatory medications such as ibuprofen (Advil, Motrin) and naproxen (Aleve) can dull the pain and reduce swelling.

Severe breaks might require wiring to promote healing. Wires and elastic bands keep your jaw closed and your bite in place. Keep a pair of scissors or wire cutters in your home during your recovery. The tools will allow you to open the wires if you experience vomiting or choking. If the wires need to be cut, notify your doctor so they can replace the wires as soon as possible.

Recovery from a jaw fracture or dislocation requires patience. You won't be able to open your jaw very wide or at all for at least six weeks during treatment. Your doctor will prescribe painkillers and antibiotics to prevent infection. You'll also be on a liquid diet to provide you with nutrition during this time while you're unable to chew solid food.

Soft diet for a broken or dislocated jaw

You will need to follow a soft diet as you recover from a dislocated or broken jaw. Avoid foods that are crunchy or chewy if you have a dislocation or minor fracture that will heal on its own. Items such as fresh meats, raw produce, or crunchy snack foods can cause strain and pain to your healing jaw. A soft diet that includes the following can be easy to chew:

- canned meat
- well-cooked pasta
- well-cooked rice
- soup
- canned fruit

A wired jaw will need an even more drastic dietary change. Because you won't be able to open and close your mouth, you'll need to get your daily allowance of vitamins and minerals through a straw during your recovery. Getting enough calories can be a concern for some people with jaw injuries. Pureed foods prepared with whole milk or cream can help add calories when needed. Pureeing fruits, vegetables, and well-cooked meats can give you the protein and other nutrients you need to stay healthy. You can use oatmeal, cream of wheat, and other soft grains as the base for your meals.

Healthy eating while your jaw is wired means eating more frequently than you're probably used to doing. Instead of eating three or four meals per day, aim for six to eight small meals. Eating small amounts throughout the day helps you meet your required calorie count. Smaller, more frequent meals can also provide a variety of flavors when you're drinking eight smoothies each day.

Drink milk and juice to boost your calorie count. Cut back on water, coffee, tea, and diet soda. These beverages have no calories. They will not help you sustain your weight while you're on a restrictive diet.

Eat lukewarm foods. Your teeth may be more sensitive than usual after your injury, and extreme temperatures on either side of the spectrum can hurt. Consider choosing baby food to accommodate your need for vitamins. Use water or milk to thin heavier soups, gravies, or jarred foods if their consistency is too thick to get through a straw.

## Recovery and outlook

The outlook is very good for most people who experience a broken or dislocated jaw. Dislocation and nonsurgical factures heal in four to eight weeks, whereas recovery from a surgical fracture could take up to several months. In most cases, the jaw heals successfully and there are few long-term effects.

However, you're more likely to have recurring joint pain in your jaw after your injury. This is a condition called temporomandibular joint disorder, which is also referred to as TMJ disorder. People who have dislocated their jaw may have an increased risk of a future dislocation as well. Protect your jaw from future pain or injury by supporting your chin when you sneeze or yawn.

## The Muscles of Mastication

The muscles of mastication are associated with movements of the jaw (temporomandibular joint). They are one of the major muscle groups in the head – the other being the muscles of facial expression. There are four muscles:

- Masseter
- Temporalis
- Medial pterygoid
- Lateral pterygoid

The muscles of mastication develop from the first pharyngeal arch. Thus, they are innervated by a branch of the trigeminal nerve (CN V), the mandibular nerve.

In this article, we shall look at the anatomy of the muscles of mastication – their attachments, actions and innervation.

*(NB: It is important to note that all the muscles mentioned here are bilateral structures).*

### Masseter

The masseter muscle is the most powerful muscle of mastication. It is quadrangular in shape, and can be split into two parts: deep and superficial.

The entirety of the muscle lies superficially to the pterygoids and temporalis, covering them.

- Attachments: The superficial part originates from maxillary process of the zygomatic bone. The deep part originates from the zygomatic arch of the temporal bone. Both parts attach to the ramus of the mandible.
- Actions: Elevates the mandible, closing the mouth.
- Innervation: Mandibular nerve (V3).

### Temporalis

The temporalis muscle originates from the temporal fossa – a shallow depression on the lateral aspect of the skull. The muscle is covered by tough fascia which can be harvested

surgically and used to repair a perforated tympanic membrane (an operation known as a myringoplasty).

- Attachments: Originates from the temporal fossa. It condenses into a tendon, which inserts onto the coronoid process of the mandible.
- Actions: Elevates the mandible, closing the mouth. Also retracts the mandible, pulling the jaw posteriorly.
- Innervation: Mandibular nerve (V3).

**Medial Pterygoid**

The medial pterygoid muscle has a quadrangular shape, with two heads; deep and superficial. It is located inferiorly to the lateral pterygoid.

- Attachments:
    - The superficial head originates from the maxillary tuberosity and the pyramidal process of palatine bone.
    - The deep head originates from the medial aspect of the lateral pterygoid plate of the sphenoid bone.
    - Both heads attach to the ramus of the mandible near the angle of mandible.
- Actions: Elevates the mandible, closing the mouth.
- Innervation: Mandibular nerve (V3).

**Lateral Pterygoid**

The lateral pterygoid muscle has a triangular shape, with two heads; superior and inferior. It has horizontally orientated muscle fibres, and thus is the major protractor of the mandible.

- Attachments:
    - The superior head originates from the greater wing of the sphenoid.
    - The inferior head originates from the lateral pterygoid plate of the sphenoid.
    - The two heads converge into a tendon which attaches to the neck of the mandible.
- Actions: Acting bilaterally, the lateral pterygoids protract the mandible, pushing the jaw forwards. Unilateral action produces the ‘side to side’ movement of the jaw.
    - *Note: Contraction of the lateral pterygoid will produce lateral movement on the contralateral side. For example, contraction of left lateral pterygoid will deviate the mandible to the right.*
- Innervation: Mandibular nerve (V3).

## Tooth Anatomy

### Types of teeth

Most people start off adulthood with 32 teeth, not including the wisdom teeth. There are four types of teeth, and each plays an important role in how you eat, drink, and speak.

The different types include:

- Incisors. These are the chisel-shaped teeth that help you cut up food.
- Canines. These pointy teeth allow you to tear and grasp food.
- Premolars. The two points on each premolar help you crush and tear food.
- Molars. Multiple points on the top surface of these teeth help you chew and grind food.

Read on to learn more about the anatomy and structure of your teeth and conditions that can affect your teeth. We'll also provide some dental health tips.

### Structure and function

#### Root

The root is the part of the tooth that extends into the bone and holds the tooth in place. It makes up approximately two-thirds of the tooth.

It's made up of several parts:

- Root canal. The root canal is a passageway that contains pulp.
- Cementum. Also called cement, this bone-like material covers the tooth's root. It's connected to the periodontal ligament.

- Periodontal ligament. The periodontal ligament is made of connective tissue and collagen fiber. It contains both nerves and blood vessels. Along with the cementum, the periodontal ligament connects the teeth to the tooth sockets.
- Nerves and blood vessels. Blood vessels supply the periodontal ligament with nutrients, while nerves help control the amount of force used when you chew.
- Jaw bone. The jaw bone, also called the alveolar bone, is the bone that contains the tooth sockets and surrounds the teeth's roots; it holds the teeth in place.

**Neck**

The neck, also called the dental cervix, sits between the crown and root. It forms the line where the cementum (that covers the root) meets the enamel.

It has three main parts:

- Gums. Gums, also called gingiva, are the fleshy, pink connective tissue that's attached to the neck of the tooth and the cementum.
- Pulp. Pulp is the innermost portion of the tooth. It's made of tiny blood vessels and nerve tissue.
- Pulp cavity. The pulp cavity, sometimes called the pulp chamber, is the space inside the crown that contains the pulp.

**Crown**

The crown of a tooth is the portion of the tooth that's visible.

It contains three parts:

- Anatomical crown. This is the top portion of a tooth. It's usually the only part of a tooth that you can see.
- Enamel. This is the outermost layer of a tooth. As the hardest tissue in your body, it helps to protect teeth from bacteria. It also provides strength so your teeth can withstand pressure from chewing.

- Dentin. Dentin is a layer of mineralized tissue just below the enamel. It extends from the crown down through the neck and root. It protects teeth from heat and cold.

**Innervation and blood supply of the teeth**

The innervation and blood supply of the maxillary and mandibular teeth are dependent on the blood vessels and the nerves that supply the upper and lower jaws. As the maxilla is deemed part of the midface and the mandible part of the lower face respectively, it is logical to assume that they have separate neurovasculature.

While it is true that within the alveolar bone the maxillary and mandibular nerves and vessels mirror one another, there are anatomical differences with extra branches and adjacent structures, such as the mental foramen of the mandible or the greater palatine foramen of the hard palate.

**Neurovasculature of the maxillary dental arcade**

**Innervation of the maxillary teeth**

The maxillary nerve, which is the second division of the trigeminal nerve (CN V/II) carries sensory fibers teeth of the maxillary dental arch. It runs laterally to the cavernous sinus and exits the skull via the foramen rotundum in the middle cranial fossa, leading into the pterygopalatine fossa.

Here it divides into four major branches, which are the posterior superior alveolar nerve, the infraorbital nerve, the zygomatic nerve, and ganglionic branches to the pterygoid plexus.

The infraorbital nerve gives off two branches which contribute to the superior dental plexus. These are the anterior superior alveolar nerve and the middle superior alveolar nerve. The other branches of the maxillary nerve are the ganglionic branches, the posterior superior alveolar nerve and the zygomatic nerve. The infraorbital nerve forms a plexus with the posterior superior alveolar nerve, which is known as the superior dental plexus.

- The posterior superior alveolar turns laterally into the pterygomaxillary fissureand into the infratemporal fossa. It descends via the infratemporal surface of the maxilla to form the posterior portion of the superior dental plexus and innervates the posterior aspect of the maxillary sinus as well as the maxillary molars.
- The middle superior alveolar nerve varies upon its path and as it descends to form the middle portion of the superior dental plexus it innervates the medial and lateral aspects of the maxillary sinus and the premolars. It may, in some cases, also innervate the mesiobuccal root of the first molar, if it is not covered by the posterior superior alveolar nerve.
- Lastly, the anterior superior alveolar nerve descends to form the anterior portion of the superior dental plexus. It innervates the anterior aspect of the maxillary sinus as well as the incisors and the canines.

Before we continue, a few additional words must be said about the infraorbital nerve. It continues from the pterygopalatine fossa through the inferior orbital fissure and into the orbit. It leaves the orbit via the inferior orbital groove and the infraorbital canal anteriorly and finally emerges on the face via the infraorbital foramen. Here it divides into three branches which are the nasal, the inferior palpebral and the superior labial. These branches supply the alar cartilage of the nose, the dermis of the lower eyelid and the upper lip respectively.

**Blood supply and venous drainage of the maxillary teeth**

From the external carotid artery arises the maxillary artery which supplies both the maxillary and mandibular teeth.

The maxillary arch is supplied by a plexus of three arterial branches which include the anterior superior alveolar artery, the middle superior alveolar artery and the posterior superior alveolar artery.

- The posterior superior alveolar artery stems from the third division of the maxillary artery. It arises in the middle cranial fossa before the maxillary artery enters the pterygopalatine fossa. It continues on and enters the infratemporal surface of the maxilla to supply the maxillary sinus, the premolars and the molars.
- The middle superior alveolar artery arises from the infraorbital artery as does the anterior superior alveolar artery. Sometimes however this artery is not present. If it is, it arises within the infraorbital canal where it descends to supply the maxillary sinus and the plexus at the level of the canine.

- The anterior superior alveolar artery also arises at the level of the middle superior alveolar artery and runs with it to supply the anterior portion of the maxillary arch, the maxillary sinus and the anterior teeth.

As for the venous drainage, the posterior superior alveolar vein, the middle superior alveolar vein and the anterior superior alveolar vein drain into the pterygoid venous plexus.

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**Neurovasculature of the mandibular dental arcade**

**Innervation of the mandibular teeth**

The mandibular teeth are primarily supplied by the inferior alveolar nerve which is a branch of the mandibular nerve (third division of the trigeminal nerve).

The mandibular nerve carries fibers that are both sensory and motoric due to the merger of its large sensory and small motor roots just after it exits the skull via the foramen ovale. It enters the infratemporal fossa and immediately gives rise to a meningeal branch, a superior and an inferior division.

The anterior division is smaller and motoric, save the buccal branch which remains sensory. The other branches include the masseteric nerve, the anterior and posterior deep temporal nerves, the medial pterygoid nerve and the lateral pterygoid nerve. The posterior division is the larger of the two and has the exact opposite ratio of motoric and sensory branches than the anterior division. The singular motoric branch is that of the mylohyoid nerve, whereas the sensory branches are the auriculotemporal nerve, the lingual nerve and the inferior alveolar nerve.

The inferior alveolar nerve is the largest of the mandibular branches and it descends to the lateral pterygoid muscle before running between the sphenomandibular ligament and the ramus of the mandible and finally entering the mandibular foramen and running through it to the level of the second premolar, where just like the inferior alveolar artery, it terminates on the corresponding mental and incisive nerves. It innervates all of the mandibular teeth, the periodontal ligaments and the gingiva from the premolars anteriorly to the midline.

- The mental nerve supplies the chin, the lower lip, the facial gingiva and the mucosa from the second premolar anteriorly.
- The incisive nerve supplies the teeth and the periodontal ligaments from the first premolar anteriorly.

**Blood supply and venous drainage of the mandibular teeth**

The maxillary artery gives rise to a single branch to supply the mandibular teeth which is known as the inferior alveolar artery. It descends inferiorly along with the inferior alveolar nerve and enters the bone via the mandibular foramen. At the level of the second premolar, it terminates into the branches of the mental and incisive arteries after it has supplied all of the mandibular teeth.

The mental and incisive arteries supply the labial gingiva of the anterior teeth and the anterior teeth themselves respectively.

The inferior alveolar vein is the sole collector of the blood pumped around the mandible and it drains into the pterygoid venous plexus.