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SUSAN W. HERRING



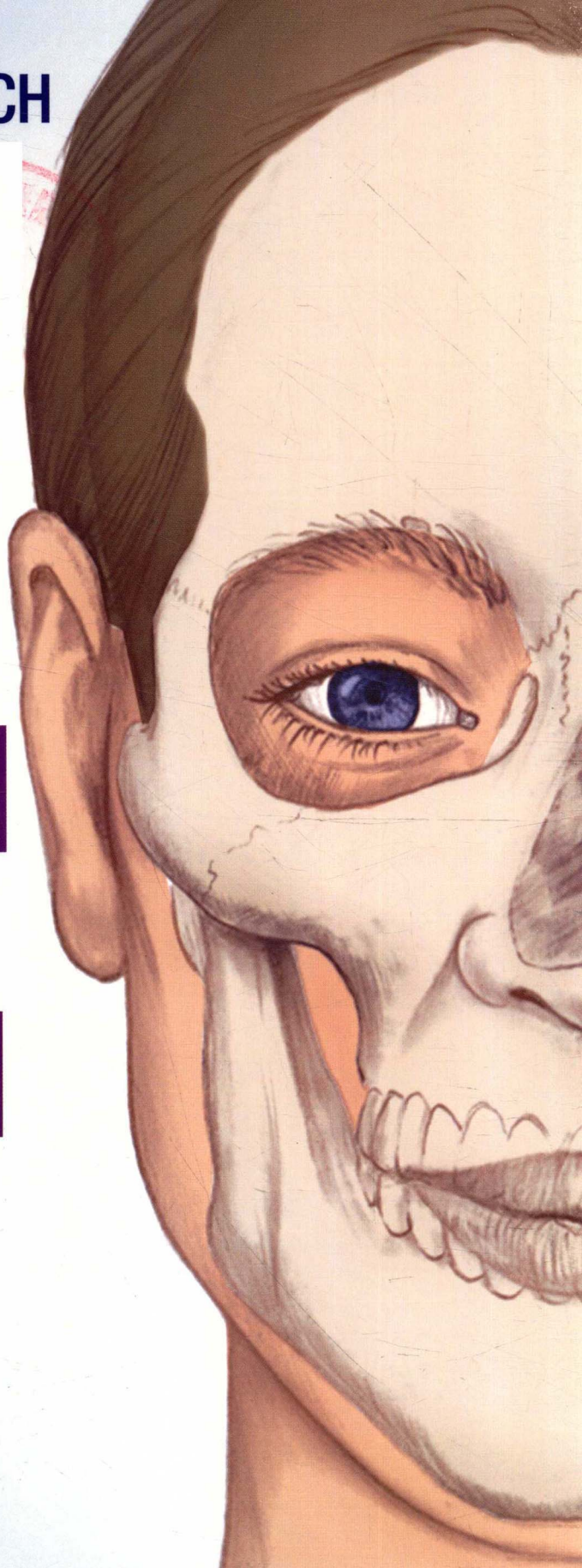
Illustrated Anatomy OF THE Head AND Neck

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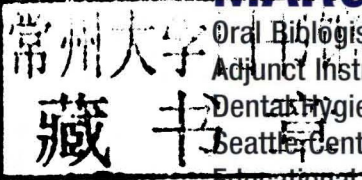
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5th
EDITION

Illustrated Anatomy OF THE Head AND Neck

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PREFACE

OVERVIEW OF NEW EDITION

To meet the needs of today's dental professional, the fifth edition of *Illustrated Anatomy of the Head and Neck* offers more than basic information on head and neck anatomy. Clinical considerations are noted throughout the textbook. Special emphasis is given in the chapter on the temporomandibular joint on the joint's complex anatomy and its associated disorders. Also included are chapters on the anatomic basis of local anesthesia for pain control and the spread of infection related to the head and neck.

FEATURES IN THIS EDITION

To facilitate the learning process, chapters are divided into the various anatomic systems, ending in the considerations for the anatomic basis for local anesthesia and the regional study of fasciae and spaces as well as the spread of infection.

Each chapter begins with learning objectives and a list of key terms with pronunciation guides from the 32nd edition of *Dorland's Medical Dictionary*. The pronunciation of each anatomic structure is also included within each chapter when introduced. The anatomic terms follow those outlined in the internationally approved official body of anatomic nomenclature; older terms are included in many cases for completeness.

Each chapter features two different types of highlighted terms. The terms appearing in bold and red are **key terms** and appear in the key terms list at the beginning of the chapter. The terms that appear in bold and black are **anatomic terms** that are important to the material being discussed in the chapter and are therefore emphasized. Both types of highlighted terms can be found in the Glossary.

All chapter topics discussed in depth have been chosen for their relevance to the needs of the dental professional and to build on former topics. Within each chapter are cross-references to other figures or chapters so the reader can review or investigate interrelated subjects. The content of this edition incorporates additional input from students and educators as well as the latest information from scientific studies and experts.

High-quality, full-color original illustrations and photographs are included throughout the text to reinforce a three-dimensional understanding of anatomy. We are excited to have added new osteology figures as provided for by Neil S. Norton, PhD, Professor of Oral Biology, School of Dentistry, Creighton University. He is the editor of the outstanding atlas, *Netter's Dental Anatomy*. Other in-depth figures have also been added or expanded within this new edition to improve overall anatomic understanding.

Tables and boxes summarizing important information appear throughout the text. Flow charts have been included to help with

coordination of structures. Identification exercises and updated review questions are included for each chapter; both are great tools for self-study as well as study group discussion.

At the end of the book are two appendices. **Appendix A** is an updated bibliography that references published works relevant to head and neck anatomy. **Appendix B** provides a review of the procedures for performing extraoral and intraoral examinations. Following Appendix B are a Glossary containing both key terms and anatomic terms that uses short, easy-to-remember definitions and a detailed index to quickly look up topics.

This textbook is coordinated with *Illustrated Dental Embryology, Histology, and Anatomy* by Margaret J. Fehrenbach and Tracy Popowics and can be considered a companion textbook to complete the curriculum in oral biology. Many of the figures in this text also appear as hand-drawn outlines in the *Dental Anatomy Coloring Book*, edited by Margaret J. Fehrenbach.

NOTABLE IN THIS EDITION

The important anatomy-related key chapters on the temporomandibular joint, local anesthesia anatomy, and spread of infection have been significantly revised to allow for the latest updated evidence-based information. **Thirty-six full-color flashcards** are located in the back of the text. The cards are perforated for easy removal from the text and are an excellent study tool for students who want to test their knowledge of head and neck anatomy.

The **Evolve website** continues to be an important component, as it was in the last edition, and has been expanded. This site provides a variety of resources for both instructors and students. Included for instructors are an image collection, answer keys, and a test bank. For students, we have included discussion questions for each chapter and practice quizzes.

In addition, we have continued to have the resource of **TEACH** online, an exciting coordinated effort for instructors, which includes a Lesson Plan Manual for all topics covered in the textbook. It features updated online PowerPoint slides with notes that can be individualized for custom presentations. There are also other related materials for both students and instructors. Elsevier sales representatives will be able to help demonstrate the latest in this exciting digital format; student dental professionals can check with their instructors.

As authors, we have tried to make the text easy to understand and interesting to read. We hope that it challenges the reader to incorporate the information presented into clinical situations.

Margaret J. Fehrenbach, RDH, MS
Susan W. Herring, PhD

ACKNOWLEDGMENTS

Our families and friends need to be thanked for their understanding of our devotion to the Work. Finally, we would like to thank Editors Kristin Wilhelm, Rebecca Leenhouts, and Carrie Stetz as well as the staff of Elsevier for making this latest edition possible.

Margaret J. Fehrenbach, RDH, MS
Susan W. Herring, PhD

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FLASHCARDS

Introduction to Head and Neck Anatomy

LEARNING OBJECTIVES

1. Define and pronounce the **key terms** and **anatomic terms** in this chapter.
2. Discuss the clinical applications of head and neck anatomy by dental professionals.
3. Discuss anatomic variation and how it applies to head and neck structures.
4. Correctly complete the review questions and activities for this chapter.
5. Apply the correct anatomic nomenclature during dental clinical procedures.

KEY TERMS

Anatomic nomenclature (an-uh-tom-ik no-muhn-klay-chuhr) System of names for anatomic structures.

Anatomic position Erect position, arms at sides, palms and toes directed forward, with eyes looking forward.

Anterior Front of area.

Apex/Apices (ay-peks, ay-pih-sees) Pointed end(s) of conical structure.

Contralateral (kon-truh-lat-uh-uhl) Structure on opposite side.

Deep Structure located inwards and away from surface.

Distal (dis-tuhl) Area farther away from median plane.

Dorsal (dor-suhl) Back of area.

External Outer side of wall of hollow structure.

Frontal plane (frun-tuhl) Plane related to imaginary line dividing body

at any level into anterior and posterior parts.

Frontal section Section through any frontal plane.

Horizontal plane Plane related to imaginary line dividing body at any level into superior and inferior parts.

Inferior Area facing away from head and toward feet.

Internal Inner side of wall of hollow structure.

Ipsilateral (ip-see-lat-uh-uhl) Structure on same side.

Lateral Area farther away from median plane.

Medial (me-dee-uhl) Area closer to median plane; considered mesial within dentition.

Median (me-dee-uhn) Structure at median plane.

Median plane Plane related to imaginary line dividing body into right and left halves.

Midsagittal section (mid-saj-i-tuhl) Section through median plane.

Posterior Back of area.

Proximal (prok-si-muhl) Area closer to median plane.

Sagittal plane (saj-i-tuhl) Planes of body related to any imaginary plane parallel to median plane.

Superficial Structure located toward surface.

Superior Area facing toward head and away from feet.

Transverse section (tranz-vurs) Section through any horizontal plane.

Ventral (ven-truhl) Front of area.

CLINICAL APPLICATIONS

The dental professional must have a thorough understanding of head and neck anatomy when performing patient examination procedures, both extraoral and intraoral procedures (Figure 1-1). This will help determine whether any abnormalities or pathologic lesions exist and possibly indicate their cause and degree of involvement. This will also provide a basis for the description of the lesion and its location for record-keeping purposes.

During examination of the patient, the dental professional may specifically note the presence of dental (or odontogenic) infection. It is

important to know the source of the infection as well as the areas to which it could spread by way of certain anatomic features of the head and neck. This background in anatomy will help the dental professional understand the spread of dental infection to reduce its risk.

A patient may also present with features of a temporomandibular joint disorder. A dental professional must understand the anatomy of the joint to understand the various disorders associated with it.

When taking radiographs, the dental professional uses surface landmarks for film placement and consistency. In addition to these landmarks, an understanding of anatomy is important in the mounting and analysis of the films.

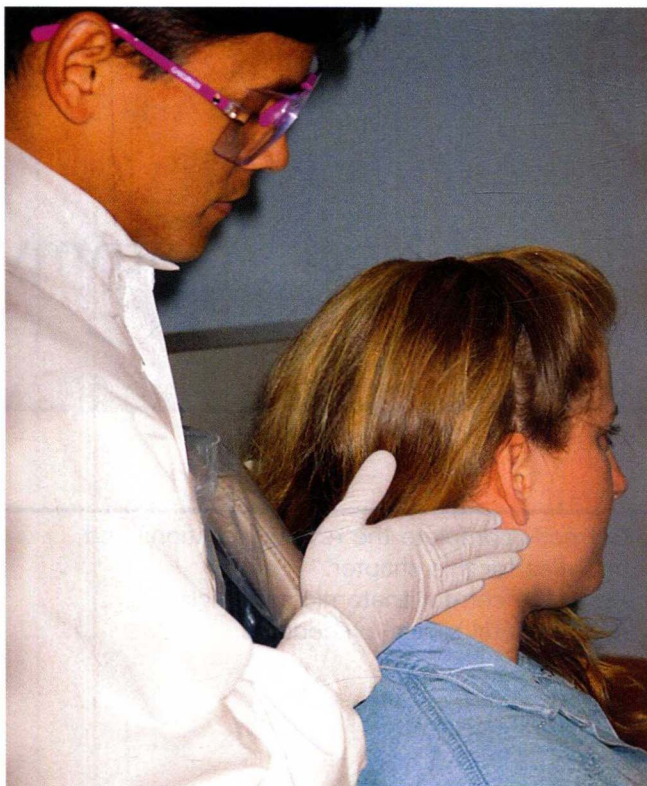


FIGURE 1-1 Examination of the patient is based on an understanding of head and neck anatomy. (Courtesy of Margaret J. Fehrenbach, RDH, MS.)

The administration of local anesthesia is also based on landmarks of the head and neck. Knowledge of anatomy helps the dental professional plan for use of a local anesthetic to reduce pain levels during various dental procedures. This knowledge also allows for correct placement of the syringe and its anesthetic agent, potentially avoiding complications.

To initially consider patient care through anatomic study, this text takes mainly a systemic approach to the study of head and neck anatomy after its two initial background chapters, **Chapters 1 and 2**. Through most of its chapters, **Chapters 3 to 10**, this approach takes a look at each system separately (e.g., skeletal, muscular). Another way to study anatomy for patient care integration is the regional approach, which is taken up later within **Chapter 11**, since it focuses on the fasciae and fascial spaces of the head and neck. Both approaches, when used in the order presented in this text, are complementary and effective ways to study head and neck anatomy and prepare for patient care considerations.

To reinforce the material already presented and make it readily useful for clinicians, **Chapter 9** also has an expanded clinical emphasis covering the anatomy of local anesthesia. The final chapter, **Chapter 12**, also emphasizes this important clinical approach to head and neck anatomy during the consideration of the spread of infection. In addition, all the other chapters include important clinical considerations when appropriate, such as related pathology.

ANATOMIC NOMENCLATURE

Before beginning the study of head and neck anatomy, the dental professional may need to review **anatomic nomenclature**, which is

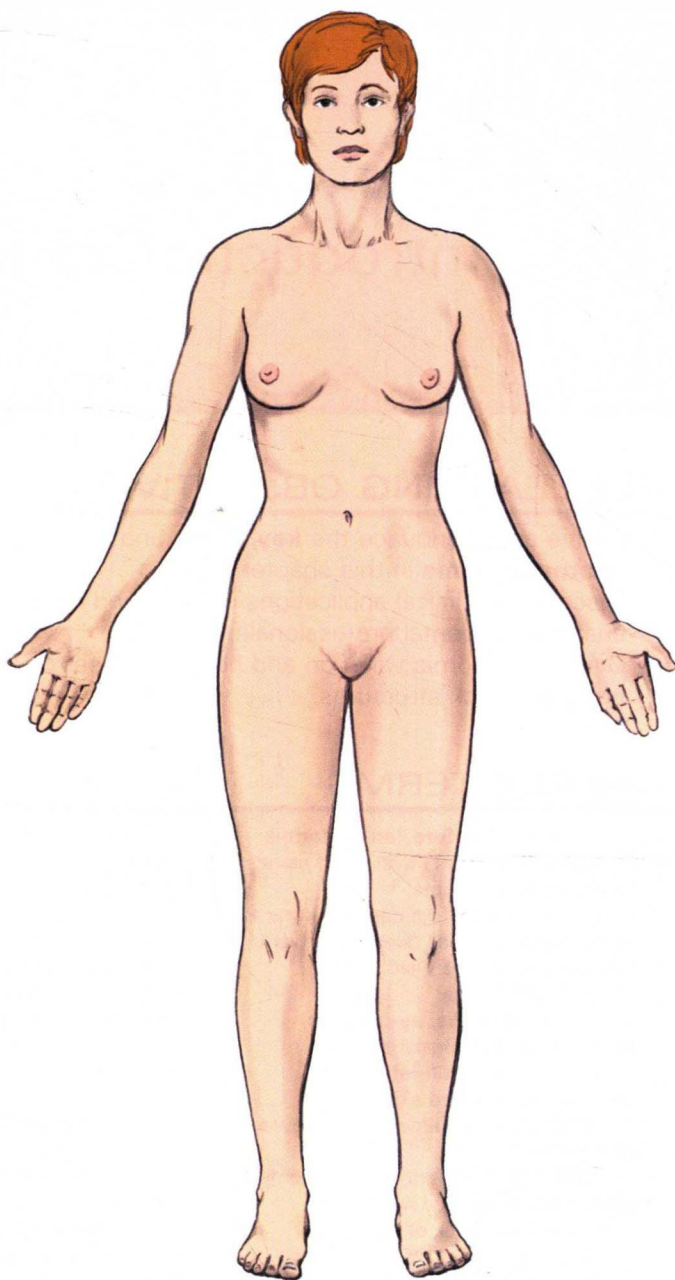


FIGURE 1-2 Body in anatomic position.

the system of names for anatomic structures. This review will allow for easy application of these terms to the head and neck area when examining a patient, for use in the patient's record, or during related clinical procedures.

The nomenclature of anatomy is based on the body being in **anatomic position** (Figure 1-2). In anatomic position, the body can be standing erect. The arms are at the sides with the palms and toes directed forward and the eyes looking forward. This position is assumed even when the body may be supine (on the back) or prone (on the front) or even with respect to the position of the patient's head and neck when sitting upright in a dental chair.

When studying the body in anatomic position, certain terms are used to refer to areas in relationship to other areas (Figure 1-3). The front of an area in relationship to the entire body is its **anterior** part.

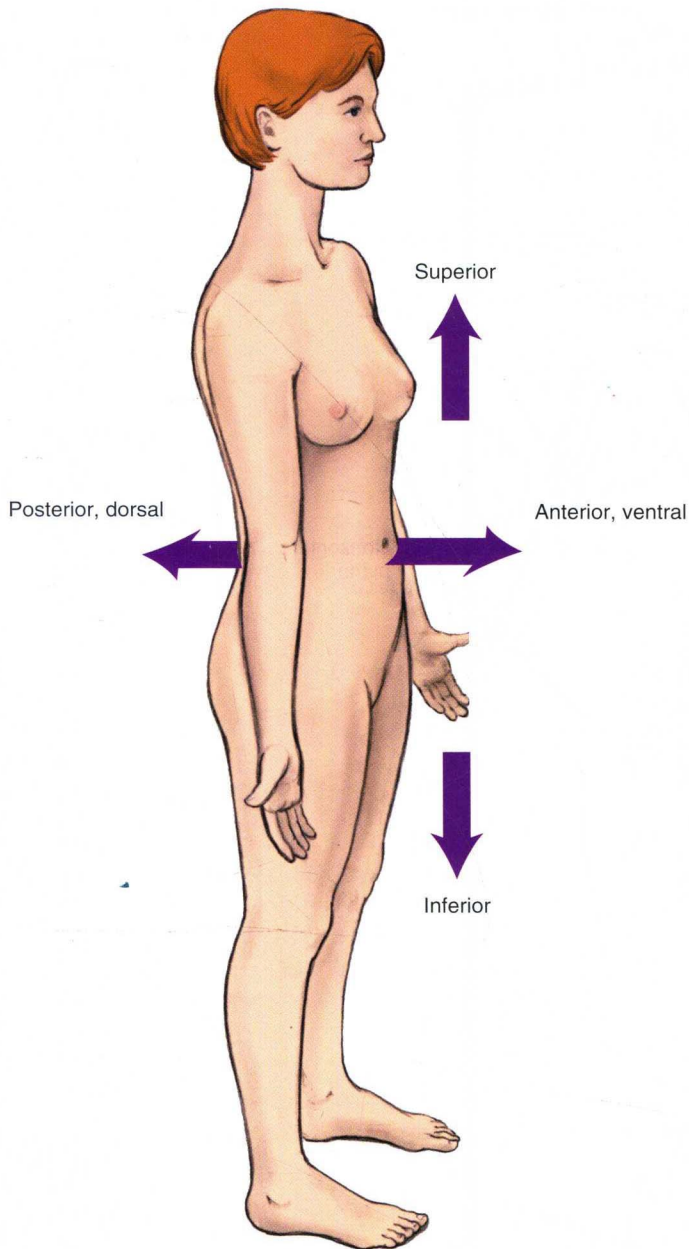


FIGURE 1-3 Body in anatomic position with the anterior (or ventral), posterior (or dorsal), superior, and inferior areas noted.

The back of an area is its **posterior** part. The **ventral** part is directed toward the anterior and is the opposite of the **dorsal** part or part directed toward the posterior when considering the entire body.

Other terms can be used to refer to areas in relationship to other areas of the body. An area that faces toward the head and away from the feet is its **superior** part. An area that faces away from the head and toward the feet is its **inferior** part. As an example, the face is on the anterior side of the head, and the hair is superior and posterior to the face. The **apex** or tip is the pointed end of a conical structure such as the apex or tip of the tongue.

The body in anatomic position can be divided into areas by planes or flat surfaces (Figure 1-4). The **median plane** or *midsagittal plane* (mid-saj-i-tuhl) is related by an imaginary line dividing the body into equal right and left halves. On the surface of the body, these halves

are generally symmetric, yet the same symmetry does not apply to all internal structures.

Differing imaginary lines related to other planes can divide the body into areas too. A **sagittal plane** is a plane related to any imaginary line dividing the body that is parallel to the median plane just discussed. A **frontal plane** or *coronal plane* (kor-o-nuhl) is related to an imaginary line dividing the body at any level into anterior and posterior parts. A **horizontal plane** is related to an imaginary line dividing the body at any level into superior and inferior parts and is always perpendicular to the median plane.

Parts of the body in anatomic position can also be described in relationship to these planes (Figure 1-5). A structure located at the median plane (e.g., the nose) is considered **median**. An area closer to the median plane of the body or structure is considered **medial** or *mesial* within the dentition. An area farther from the median plane of the body or structure is considered **lateral**. For example, the eyes are medial to the ears and the ears are lateral to the eyes.

Terms can be used to describe the relationship of parts of the body in anatomic position. An area closer to the median plane is considered to be **proximal**, and an area farther from the median plane is **distal** even within the dentition. For example, in the upper limb the shoulder is proximal and the same side fingers are distal.

Additional terms can be used to describe relationships between structures. A structure on the same side of the body is considered **ipsilateral**. A structure on the opposite side of the body is considered **contralateral**. For example, the right leg is ipsilateral to the right arm but contralateral to the left arm.

Certain terms can be used to give information about the depth of a structure in relationship to the surface of the body. A structure located toward the surface of the body is **superficial**. A structure located inward, away from the body surface, is **deep**. For example, the skin is superficial and the bones are deep.

Terms also can be used to give information about location in hollow structures such as the braincase of the skull. The inner side of the wall of a hollow structure is referred to as **internal**. The outer side of the wall of a hollow structure is **external**.

The body or parts of it in anatomic position can also be divided into sections along various planes in order to study the specific anatomy of a region (Figure 1-6). The **midsagittal section** or *median section* is a division through the median plane. The **frontal section** or *coronal section* is a division through any frontal plane. The **transverse section** or *horizontal section* is a division through a horizontal plane.

It is important to keep in mind when studying diagrams or associated photographs especially those of dissections, to first note any overall descriptions (e.g., view, section) as well as any nearby directional pointers. Then note any familiar structures (e.g., apex of tongue or nose, maxilla, or mandible) to allow for basic orientation. Next look to the areas highlighted, if noted, and of course those structures that are labeled. This process will help overall in the study of the head and neck.

ANATOMIC VARIATION

When studying anatomy, the dental professional must understand that there can be anatomic variations of head and neck structures. The number of bones and muscles in the head and neck is usually constant, but specific details of these structures can vary from patient to patient. Bones may have different sizes of processes. Muscles may differ in size and details of their attachments. Joints, vessels, nerves, glands, lymph nodes, fasciae, and spaces of an individual can vary in size, location, and even presence. The most common variations of the head and neck that affect dental treatment are discussed in this text.

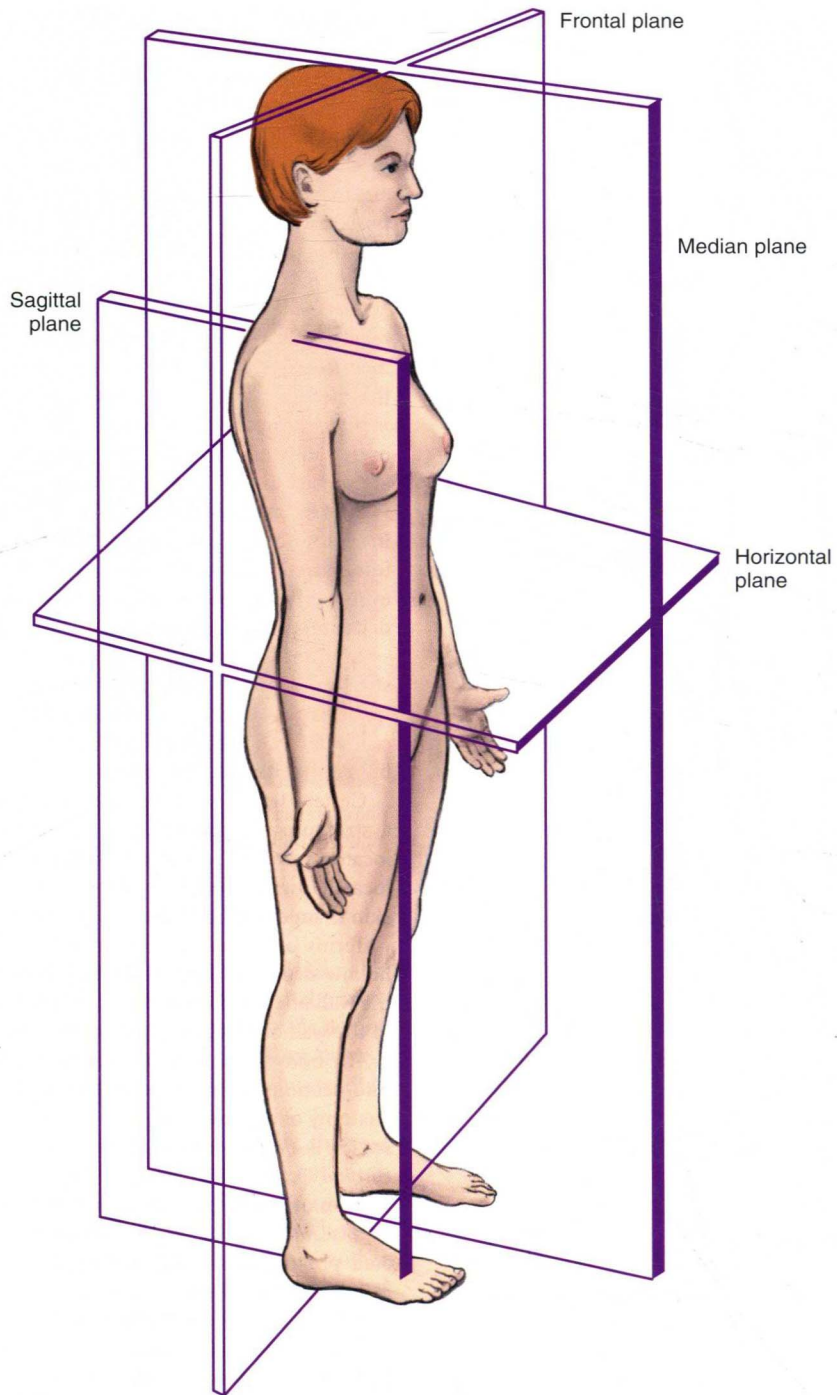


FIGURE 1-4 Body in anatomic position with the median, sagittal, horizontal, and frontal planes noted.

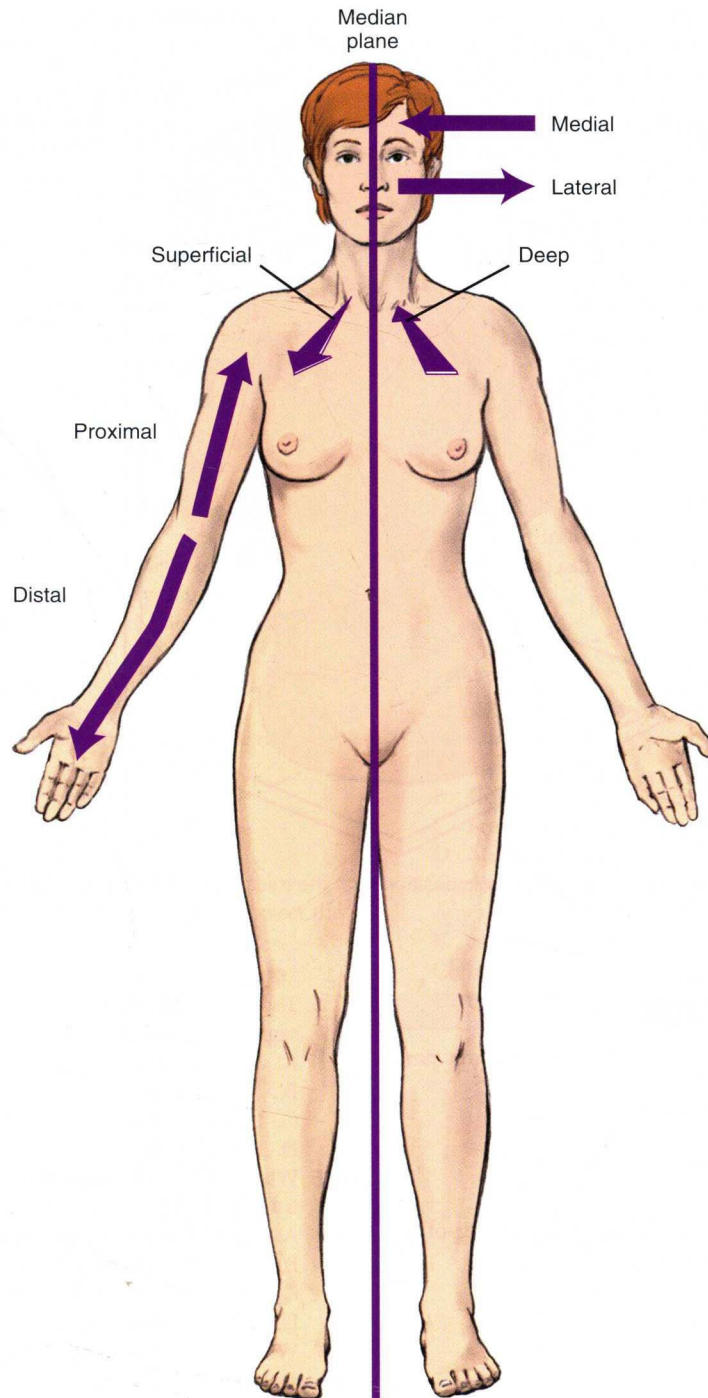


FIGURE 1-5 Body in anatomic position with the medial (or proximal), lateral (or distal), and superficial (or deep) areas noted.

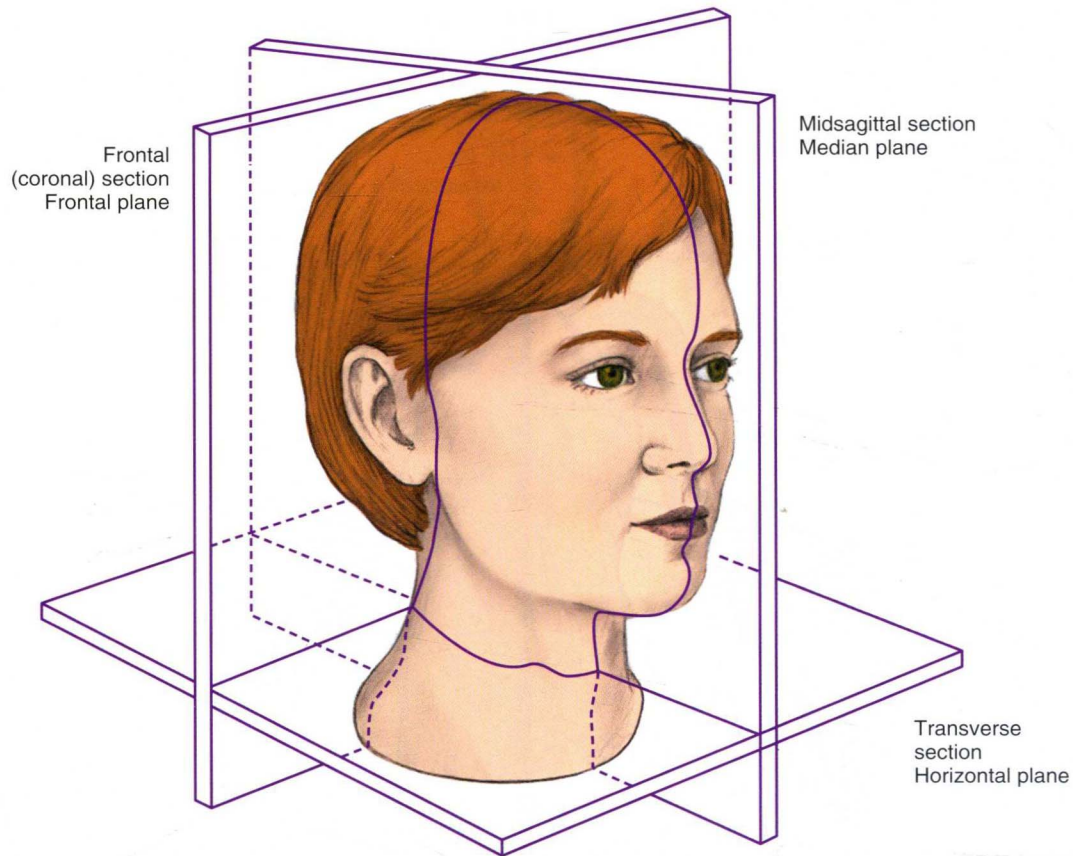


FIGURE 1-6 Head and neck in anatomic position with the midsagittal, transverse, and frontal sections as well as related planes noted.

REVIEW QUESTIONS

- Which of the following planes divides the body in anatomic position into right and left halves?
 - Horizontal plane
 - Median plane
 - Coronal plane
 - Frontal plane
- Which of the following terms is used to describe an area of the body that is farther from the median plane?
 - Proximal
 - Lateral
 - Medial
 - Ipsilateral
 - Contralateral
- Structures on the same side of the body are considered
 - proximal.
 - lateral.
 - medial.
 - ipsilateral.
 - contralateral.
- An area of the body in anatomic position that faces toward the head is considered
 - inferior.
 - superior.
 - proximal.
 - distal.
 - dorsal.
- Through which plane of the body in anatomic position is a midsagittal section taken?
 - Horizontal plane
 - Median plane
 - Coronal plane
 - Frontal plane
- Which of the following statements concerning anatomic position is CORRECT?
 - Body is erect with eyes looking forward.
 - Arms are at sides with palms directed backward.
 - Arms are behind the head with toes directed forward.
 - Body is supine with eyes closed.
- Which of the following sections is considered also a horizontal section?
 - Midsagittal section
 - Transverse section
 - Frontal section
 - Median section
- Structures that are located inward, away from the body surface, are considered
 - distal.
 - superficial.
 - deep.
 - contralateral.
 - external.

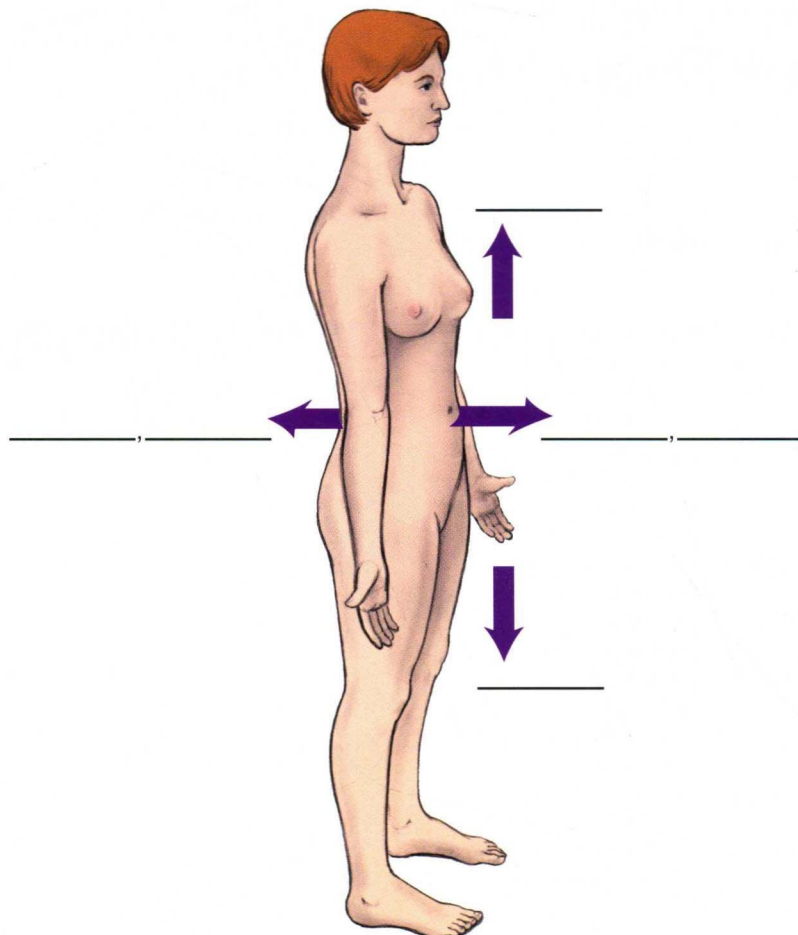


9. Which of the following planes divides any part of the body further into anterior and posterior parts?
 - A. Sagittal plane
 - B. Horizontal plane
 - C. Frontal plane
 - D. Median plane
10. Which of the following is a CORRECT statement concerning human anatomy?
 - A. Apex of a conical structure is the flat base.
 - B. Two halves of the body are always symmetric.
 - C. External surface is the inner wall of a hollow structure.
 - D. Joints, vessels, nerves, glands, and nodes vary in size.
11. Which of the following is a CORRECT statement when considering facial features?
 - A. Ears are medial to the nose.
 - B. Ears are lateral to the nose.
 - C. Ears are medial to the eyes.
 - D. Mouth is lateral to the nose.
12. Proximal refers to a body part that is
 - A. closer to the medial plane of the body than another part.
 - B. farther from the medial plane of the body than another part.
 - C. farther from the point of attachment to the body than another part.
 - D. closer to the point of attachment to the body than another part.
13. The median plane placed through the body will divide the right arm and the
 - A. right leg.
 - B. brain.
 - C. nose.
 - D. left leg.
14. A frontal plane placed through the body will ALWAYS bisect the
 - A. nose.
 - B. mouth.
 - C. arms.
 - D. eyes.
15. If a transverse plane occurs through the navel, which of the following statements is CORRECT?
 - A. Chest and ears will be on different parts of the body.
 - B. Chest and knees will be on the same part of the body.
 - C. Feet and knees will be on different parts of the body.
 - D. Thighs and feet will be on the same part of the body.
16. Which of the following statements is CORRECT concerning anatomic variation within the head and neck?
 - A. Number of bones and muscles usually varies.
 - B. Bones can vary in the size of processes.
 - C. Lymph nodes never vary in placement.
 - D. Variations of anatomy do not impact dental treatment.
17. If the shoulder of the upper limb is considered proximal, then the ipsilateral fingers are considered
 - A. proximal.
 - B. medial.
 - C. distal.
 - D. superficial.
18. If the skin in a region is considered superficial, then the related bones in the same region are considered
 - A. deep.
 - B. superficial.
 - C. superior.
 - D. inferior.
19. Which of the following sections is considered also a coronal section?
 - A. Sagittal plane
 - B. Horizontal plane
 - C. Frontal plane
 - D. Median plane
20. The outer side of the wall of a hollow structure is
 - A. external.
 - B. exterior.
 - C. internal.
 - D. interior.

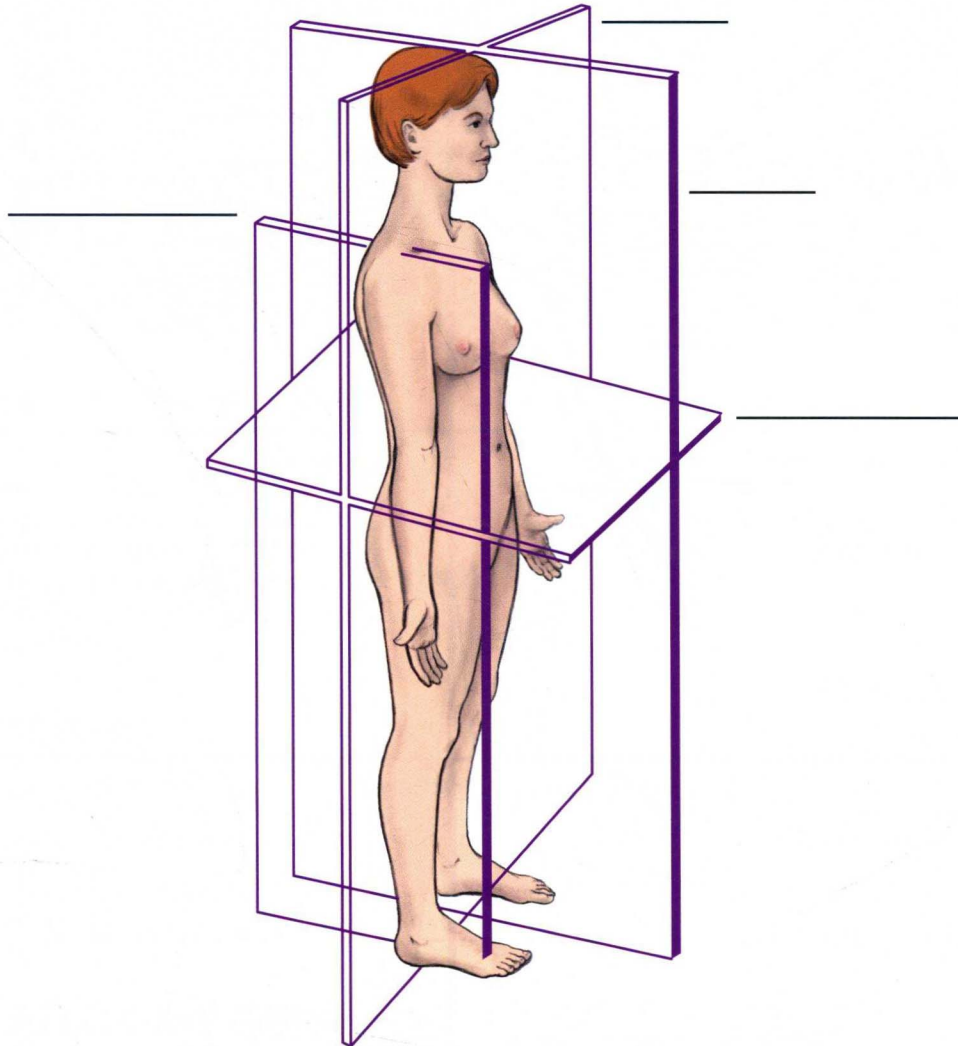
Identification Exercises

Identify the structures on the following diagrams by filling in each blank with the correct anatomic term. You can check your answers by looking back at the figure indicated in parentheses for each identification diagram.

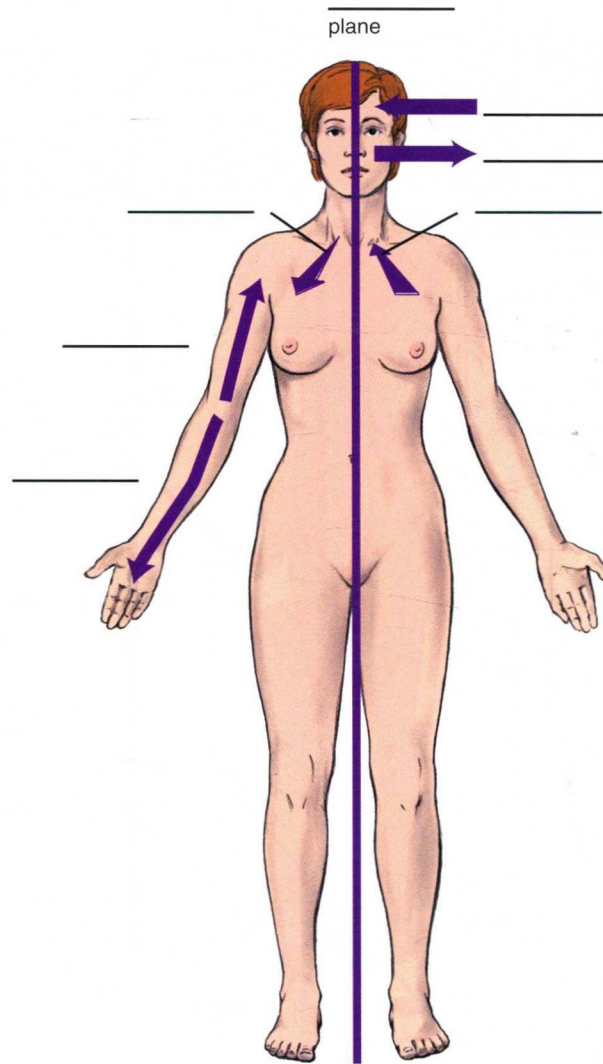
1. (Figure 1-3)



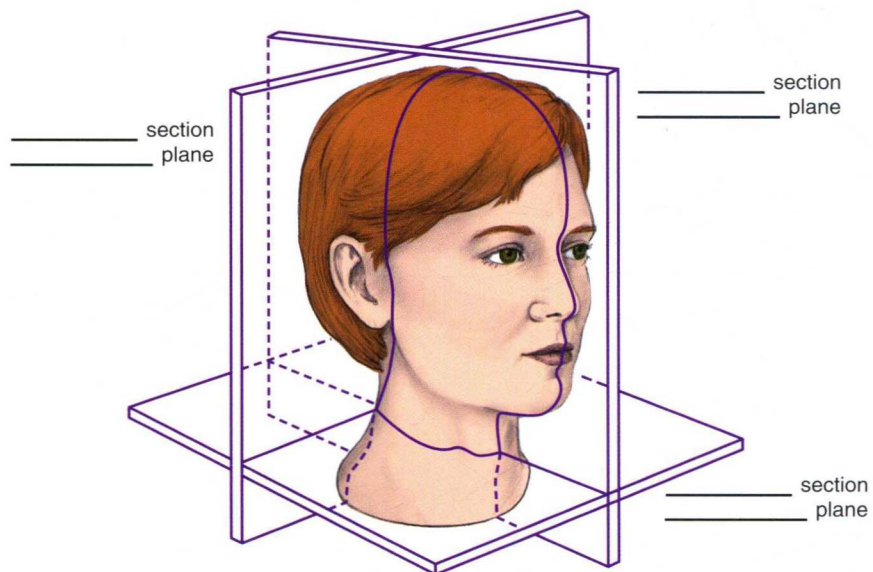
2. (Figure 1-4)



3. (Figure 1-5)



4. (Figure 1-6)



Surface Anatomy

LEARNING OBJECTIVES

1. Define and pronounce the **key terms** and **anatomic terms** in this chapter.
2. Discuss how the surface anatomy of the face and neck may impact dental clinical procedures.
3. Locate and identify the regions and associated surface landmarks of the head and neck on a diagram and a patient.
4. Correctly complete the review questions and activities for this chapter.
5. Integrate an understanding of surface anatomy into the clinical practice of dental procedures.

KEY TERMS

Buccal (buk-uhl) Structures closest to inner cheek.

Facial Structure closest to facial surface.

Golden Proportions Guidelines for considering vertical dimensions of face to create pleasing proportion.

Labial (lay-be-uhl) Structures closest to lips.

Lingual (ling-gwuhl) Structures closest to tongue.

Palatal (pal-uh-tuhl) Structures closest to palate.

Surface anatomy Study of structural relationships of external features to internal organs and parts.

Vertical dimension of the face Face divided into thirds.

SURFACE ANATOMY OVERVIEW

The dental professional must be comfortably familiar with the surface anatomy of the head and neck in order to examine patients. **Surface anatomy** is the study of the structural relationships of the external features of the body to the internal organs and parts. The features of the surface anatomy provide essential landmarks for the deeper anatomic structures that will be examined and discussed in subsequent chapters. Thus the examination of these accessible surface features by visualization and palpation can give vital information about the health of deeper tissue (**Appendix B**). In addition, procedures in dental practice are related to the anatomic features of the head and neck (see **Chapter 1**).

Some degree of variation in surface features can be possible as was discussed in the last chapter. However, a change in surface features in a given person may signal a condition of clinical significance and must be noted in the patient record, as well as thoroughly followed up by the examining dental professional. Thus it is not variations among individuals but changes in a particular individual that should be noted. In addition, the underlying histologic and embryologic concerns may also help when examining a patient's head and neck; therefore, related reference materials may need to be reviewed (**Appendix A**).

The study of anatomy of the head and neck begins with the division of the surface into regions. Within each region are certain surface

landmarks. To improve the skills of examination, practice finding these surface landmarks in each region of the face and neck using a mirror. Later, locating them on peers and then on patients in a clinical setting adds a real world level of competence.

In this text, the illustrations of the head and neck, as well as any structures associated with them, are oriented to show the patient's head and neck in anatomic position unless otherwise noted (see **Chapter 1**). This is the same as if the patient is viewed straight on while sitting upright in the dental chair.

Within each of these various regions are certain significant underlying structures for the dental professional. The underlying bony structure of the head and neck is covered in **Chapter 3**. The underlying muscles of the head and neck are covered in **Chapter 4**. In addition, **Chapter 5** discusses the temporomandibular joint. The underlying glandular tissue, such as the lacrimal, salivary, and thyroid glands, is covered in **Chapter 7**. Lymph nodes that are within the tissue of the head and neck are covered in **Chapter 10**, with the related vascular and nervous systems covered in **Chapters 6 and 8**, respectively.

REGIONS OF HEAD

The **regions of the head** include: the frontal, parietal, occipital, temporal, auricular, orbital, nasal, infraorbital, zygomatic, buccal, oral, and mental regions (Figure 2-1). These regions are used as a basis for