Introduction—Objectives

1. Describe the structure of a typical tooth.
2. Compare and contrast permanent and deciduous human dentition.
3. Recognize the value of odontology in forensic investigations.
4. Explain how teeth and craniofacial features are helpful in estimating age, ancestry, and sex.
5. Differentiate between the dentition of humans and other animals.
Ted Bundy

• In the spring of 1974, a serial killer was on the loose in the Northwest United States.

• Young women were disappearing from college campuses at the rate of one per month.

• Soon after each disappearance, the woman was found bludgeoned and strangled to death.

• The killer left no fingerprints, body fluids, or hair, so the cases remained unsolved.
• Soon, women began vanishing in Colorado and Utah. Again, police had few leads on the identity of the killer.

• Then, on August 16, 1975, a man named Theodore Bundy was arrested outside of Salt Lake City for failure to stop for a police officer.

• The arresting officer found a ski mask, another mask made from pantyhose, a crowbar, and cuffs, trash bags, a rope, and an ice pick in Bundy’s car.
Ted Bundy

• A search of Bundy’s apartment revealed evidence connecting him to two murdered women.
• While in jail awaiting his trials, Bundy escaped to Florida.
• Early on the morning of January 15, 1978, Bundy broke into the dorm room of two Florida State University women and bludgeoned and strangled them to death.
• Bundy left two bite marks on one of the women—Lisa Levy.
• These bite marks would be the evidence that finally brought Bundy’s murder spree to an end.
• A month later, a police officer pulled Bundy over for a routine traffic stop. When the officer checked the license plate of the car Bundy was driving, he learned that the car had been stolen.

• Bundy was arrested. His fingerprints revealed that he was an escaped murder suspect.
• Florida police quickly realized that Bundy likely also committed the Florida State murders.

• Forensic odontologist Dr. Richard Souviron was able to match the bite marks on Levy to Bundy’s teeth.

• Bundy was convicted of the murders.

• Overall, police think Bundy murdered between 30 and 100 women.
YouTube link

• http://www.youtube.com/watch?v=uJQm2QEpIjo
• https://www.youtube.com/watch?v=W0s-H_fbm_g
• (Give worksheets)
Introduction

• **Odontology**—the study of the anatomy and growth of teeth and diseases associated with the teeth and gums.

• Forensic Odontologist uses knowledge of the teeth to:
  – Identify victims of mass disasters
  – Help police in criminal investigations
  – Verify signs of abuse
• Digestion begins in the mouth
• Enzymes in the saliva chemically break down complex carbohydrates into simpler molecules
• Teeth mechanically grind and crush food
• Tooth is divided into three regions
  – Crown—above the gum line
  – Neck—where crown and root meet
  – Root—embedded in in bony socket
Structure & Function of Teeth (Obj 11.1, 11.2)

- **crown** - the portion of the tooth that is covered in enamel and is situated above the gum
**Structure & Function of Teeth** (Obj 11.1, 11.2)

- **neck** - area between the root and the crown of the tooth; also known as the *cementoenamel* junction (where the enamel and cementum meet)

  ![Diagram of a tooth](http://intranet.tdmu.edu.ua/data/kafedra/internal/stomat_ortop/classes_stud/en/stomat/ptn/Propaedeutics%20of%20orthopedic%20stomatology/2/02.%20Teeth.%20tooth.%20rows.%20Grou.../image032.jpg)
• **root** - the portion of the tooth that extends into the tooth socket and is covered with cementum.
Structure & Function of Teeth (Obj 11.1, 11.2)

- **dentin** - hardened connective tissue that makes up the majority of a tooth; surrounds the pulp cavity and is covered by enamel in the crown and by cementum in the root.
Structure & Function of Teeth (Obj 11.1, 11.2)

- **pulp** - softer connective tissue that composes the innermost portion of the tooth; contains nerves and blood vessels
Structure & Function of Teeth (Obj 11.1, 11.2)

- **enamel** - the outer covering of the crown of a tooth, made up of calcium carbonate and calcium phosphate
Structure & Function of Teeth (Obj 11.1, 11.2)

- **cementum** - bonelike covering of the portion of the tooth that extends into the bone (the root); attaches the tooth to the periodontal ligament, a connective tissue that anchors the tooth to the bone
• **Periodontal ligament**—anchors the tooth to the bone, keeps teeth in alignment, and acts as shock absorber.
Structure & Function of Teeth (Obj 11.1, 11.2)

Figure 11-3. Typical dental X-rays.
Structure & Function of Teeth (Obj 11.1, 11.2)

- 20 deciduous (baby) teeth
- 32 permanent (adult) teeth
  - Incisors
  - Canines
  - Molars
- dentition pattern - the pattern made by a particular set of teeth

*Figure 11-5. Full sets of deciduous and permanent teeth.*
Estimating Physical Characteristics (Obj 11.3, 11.4)

- A forensic odontologist compares dentals records with the victim’s remains
A forensic odontologist uses:

- Dental alterations — fillings, caps, bridgework, and dentures
- Teeth—size, shape, gaps, cracks, alignment, missing or extra one, wears, stains
- Dentition—the pattern made by a particular set of teeth
Figure 11-7. Ubelaker's Chart of Dental Development shows the emergence pattern of human teeth.
Ancestry Estimation

- Examining physical characteristics CANNOT absolutely determine an unidentified person’s ancestry.
- Certain characteristics are more common within certain population groups.

Figure 11-8. The nasal spine is usually much more prominent in people of European descent than in people of African descent.
Ancestry Estimation

- The shape of the decedent’s incisors can be a useful feature.
- Fewer than 10% of European and African decent have this feature.

Figure 11.9. Australian aborigines and some South Pacific islanders often exhibit rocker jaw.

Figure 11.10. Forensic odontologists are able to use the shape of the decedent’s incisors to estimate ancestry.
Sex Estimation

• Difficult to determine with teeth
• Male teeth—generally larger
• Female teeth—canines tend to be more pointed
• Craniofacial differences make sex determination more accurate
Male

Female

A
B
C
D
E
G
F
I
J
Determining Positive Identification (Obj 11.3, 11.5)

- Presumptive identification
  - Personal effects
  - Family ID
  - Location of the body
- Positive identification
  - Fingerprints
  - DNA
  - Medical and dental records
Dental Records

• Forensic Odontologist compares
  – The antemortem records (take during life)
  – The postmortem records (recorded after death)

• Especially helpful
  – Fillings
  – Bridgework
  – Dental implants

Figure 11-12. The serial numbers of the dental implants are circled in red.
Human Bite Marks

• Bite marks look different in soft and stretchy substances like skin versus hard substances like cheese or a pencil
• When the bite occurs antemortem
  – The area bruises and swells
• When the bite occurs postmortem
  – The area does not bruise or swell
• Typical bite has a double horseshoe pattern
**Human Bite Marks**

*Figure 11-13.* Odontologists review color and black-and-white photos of each bite mark. They also make careful dimensional measurements.
Human Bite Marks

• Swelling and inflammation can deform the bite mark
• Trace bite marks-left of a victim
• Cast deep bites-an impression taken for a working cast
• Compare casts or traces with impressions from a suspect

Figure 11-14. A casting of human teeth that can be compared to a bite mark.

Figure 11-15. Overlay of a bite mark.
Animal Bite Marks

- Very different dentition patterns
- Compare DNA and bite patterns just like with humans

*Figure 11-16.* A dog's jaws have a long, narrow arch.
Chapter Summary

• A forensic odontologist—a dentist using knowledge of teeth to identify unknown decedents, help police in criminal investigations, and verify signs of abuse.
• Teeth are used in the mechanical digestion of food.
• A human has two sets of teeth in a lifetime. The shape of teeth varies depending on function.
• A typical tooth consists of the crown, the neck, and the root. The crown is the portion of the tooth that is above the gum line.
Chapter Summary

• Family identification, personal effects, and location of the body may provide information for a presumptive identification of a body.
• Fingerprints, DNA analysis, or comparison of medical or dental X-rays are necessary for a positive identification.
• Teeth and craniofacial features provide clues to a person’s age, ancestry, and sex.
Chapter Summary

• Teeth and dental alterations are more resistant to the forces of decomposition than other tissues of the body, making teeth an important tool in identification of burned or badly decomposed remains.

• Bite marks alone are not conclusive evidence, but useful in narrowing a list of suspects.

• Traces of DNA from saliva in a bite mark may lead to a positive identification of the perpetrator.
Chapter Summary

• A typical human bite mark has a double horseshoe pattern. The marks left by the six most central teeth of the upper and lower jaws are the most evident.

• Nonhuman bite marks have very different dentition patterns than those of humans.