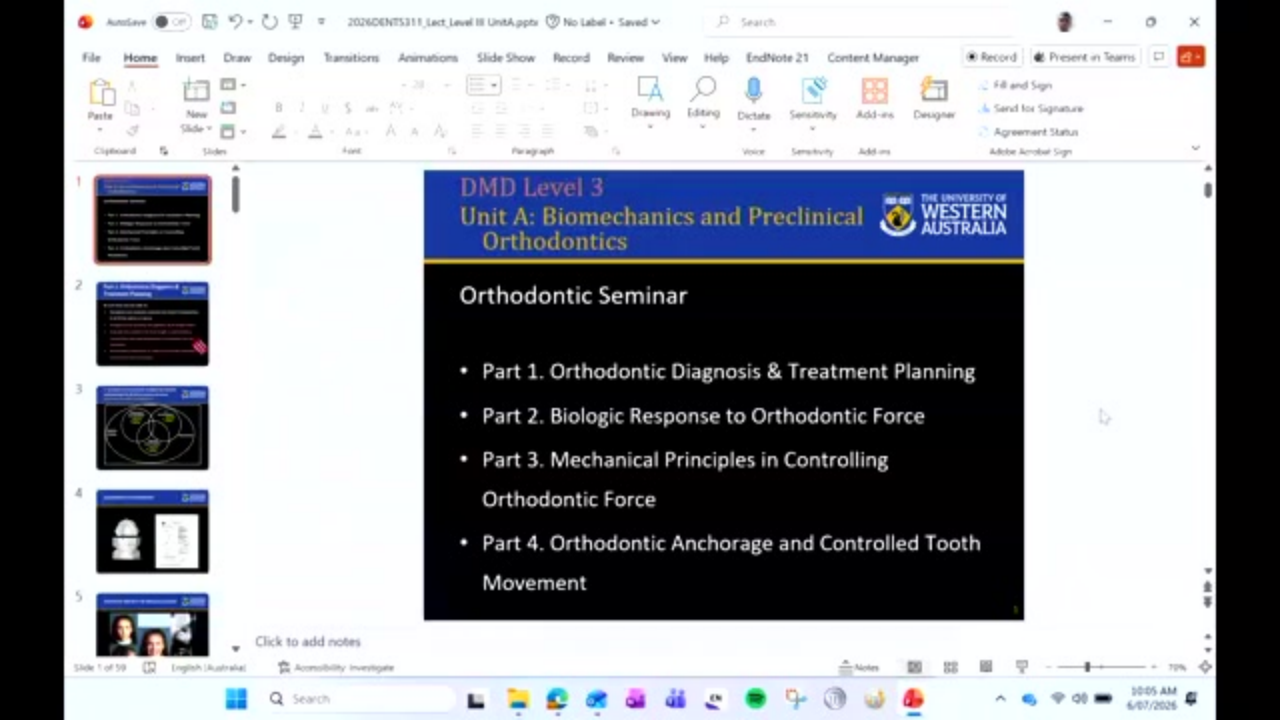

DMD Level 3
Unit A: Biomechanics and Preclinical Orthodontics
THE UNIVERSITY OF WESTERN AUSTRALIA
Orthodontic Seminar
• Part 1. Orthodontic Diagnosis & Treatment Planning
• Part 2. Biologic Response to Orthodontic Force
• Part 3. Mechanical Principles in Controlling Orthodontic Force
• Part 4. Orthodontic Anchorage and Controlled Tooth Movement
Click to add notes

THE UNIVERSITY OF WESTERN AUSTRALIA

Orthodontic Seminar

- Part 1. Orthodontic Diagnosis & Treatment Planning
- Part 2. Biologic Response to Orthodontic Force
- Part 3. Mechanical Principles in Controlling Orthodontic Force
- Part 4. Orthodontic Anchorage and Controlled Tooth Movement

Part 1. Orthodontic Diagnosis & Treatment Planning

THE UNIVERSITY OF WESTERN AUSTRALIA

Be sure that you are able to:

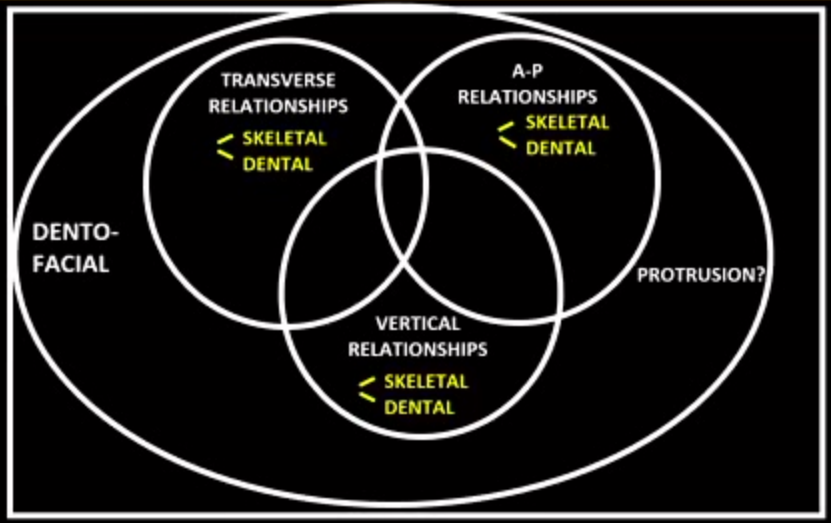
1. Recognize and evaluate skeletal and dental relationships in all three planes of space.
2. Recognize and quantify the patient's arch length status.
3. Evaluate the skeletal and arch length considerations, interactions and appropriateness of treatment or non-treatment.
4. Recommend treatment or referral of specific problems based upon case evaluation.

REVIEW PREVIOUS SEMINARS

1. Recognize and evaluate skeletal and dental relationships in all three planes of space.

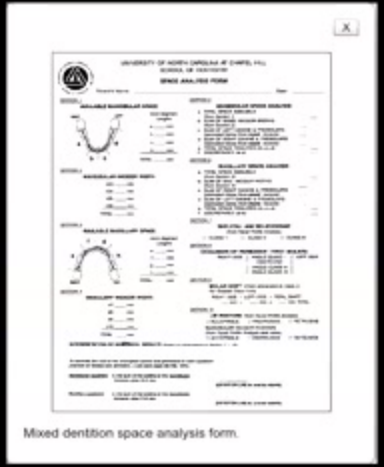
Ackerman-Proffit Classification

THE UNIVERSITY OF WESTERN AUSTRALIA



ALIGNMENT/ASYMMETRY

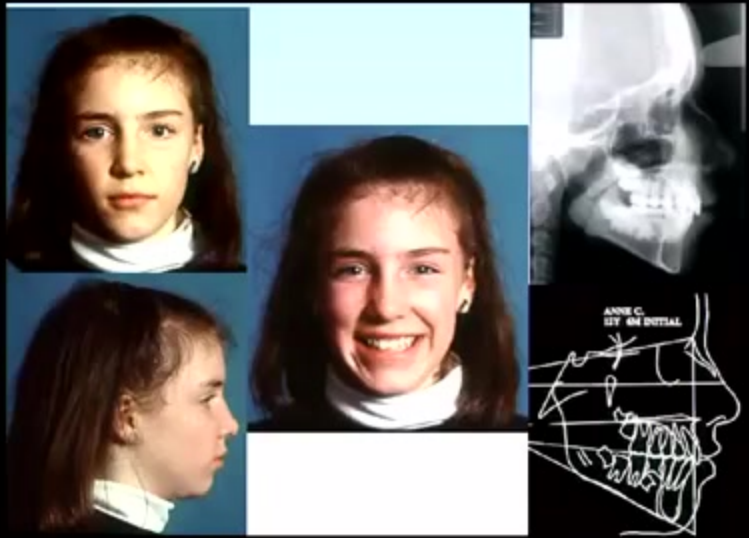
THE UNIVERSITY OF WESTERN AUSTRALIA



Mixed dentition space analysis form.

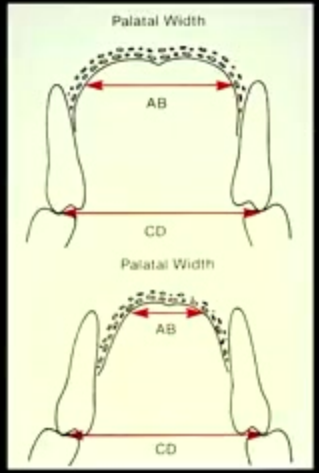
ESTHETIC IMPACT OF MALOCCLUSION

THE UNIVERSITY OF WESTERN AUSTRALIA



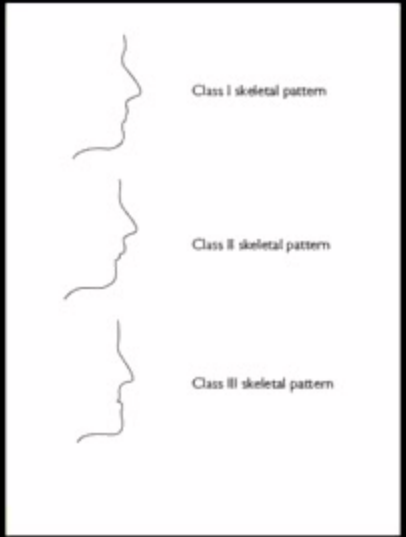
TRANSVERSE RELATIONSHIPS

THE UNIVERSITY OF WESTERN AUSTRALIA



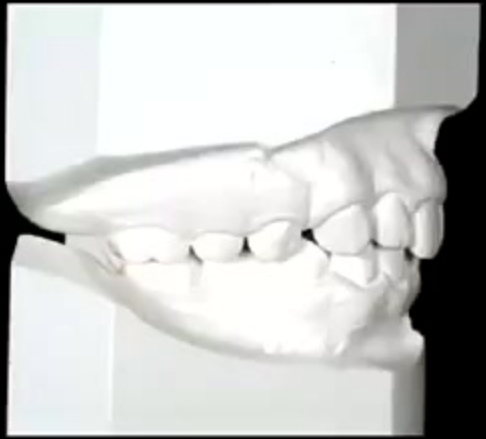
A-P RELATIONSHIPS

THE UNIVERSITY OF WESTERN AUSTRALIA



VERTICAL RELATIONSHIPS

THE UNIVERSITY OF WESTERN AUSTRALIA



Part 2. Biologic Response to Orthodontic Force

THE UNIVERSITY OF WESTERN AUSTRALIA

Be sure that you are able to:

1. Describe the histologic/cellular/vascular response of the supporting structures to force applied to teeth.
2. Discuss the role of biologic electricity in maintenance and turnover of alveolar bone.
3. Describe the relationship of orthodontic force levels to anchorage.

Biologic Response to Orthodontic Force

1. Describe the histologic/cellular/vascular response of the supporting structures to force applied to teeth.

TIME SEQUENCE –LIGHT CONTINUOUS PRESSURE

1.MILLISECONDS	-	FLUID PRESSURE UP PIEZO-ELECTRIC EFFECT
2.SECONDS	-	FLUID PRESSURE BALANCED
3.MINUTES	-	BLOOD FLOW AFFECTED
4. HOURS	-	CELLULAR DIFFERENTIATION BEGINS
5. DAYS	-	APPOSITION/RESORPTION TOOTH MOVEMENT

FORCE AGAINST TOOTH

BLOOD FLOW CHANGE
MECHANICAL DEFORMATION?

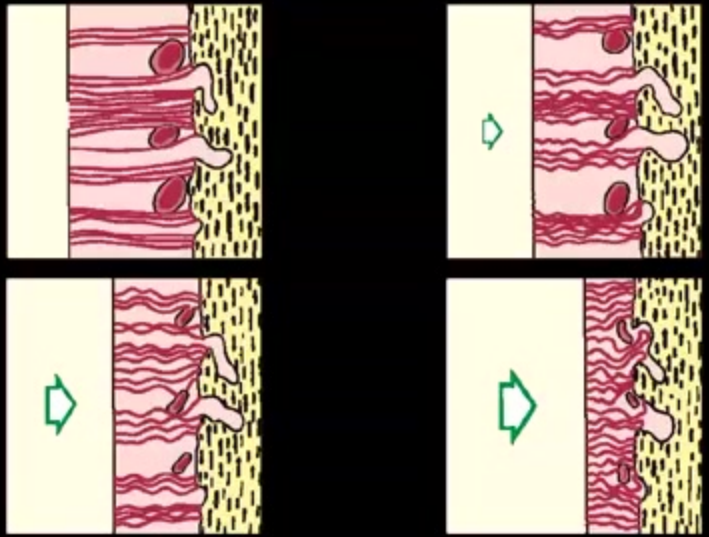
PROSTOGLANDIN
RELEASE

STIMULUS TO FORM
OSTEOCLASTS/OSTEOBLASTS

REMODELLING

1. Describe the histologic/cellular/vascular response of the supporting structures to force applied to teeth.

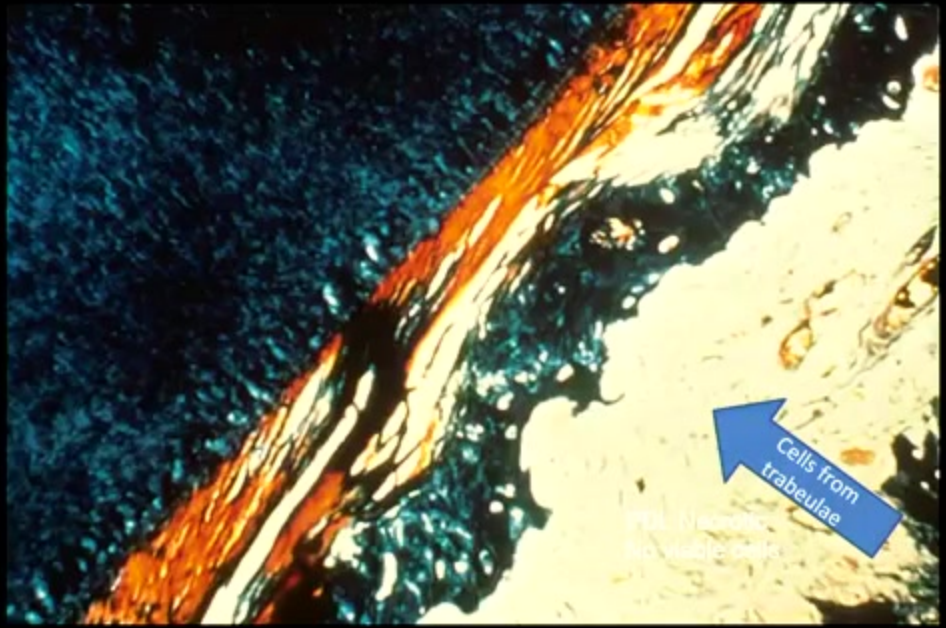
THE UNIVERSITY OF WESTERN AUSTRALIA

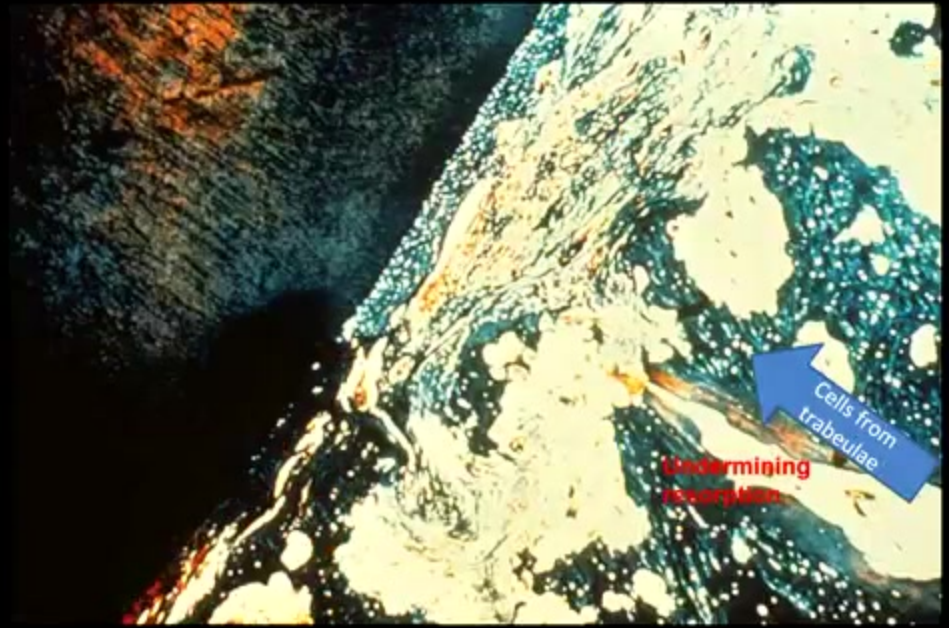


HEAVY PRESSURE

TOTAL SHUT-OFF OF BLOOD FLOW

STERILE NECROSIS = HYALINIZATION


Cells from trabeulae


Cells from trabeulae
Undermining resorption

THE PIEZO-ELECTRIC EFFECT

Changing the shape of a crystalline material causes an electrical current flow

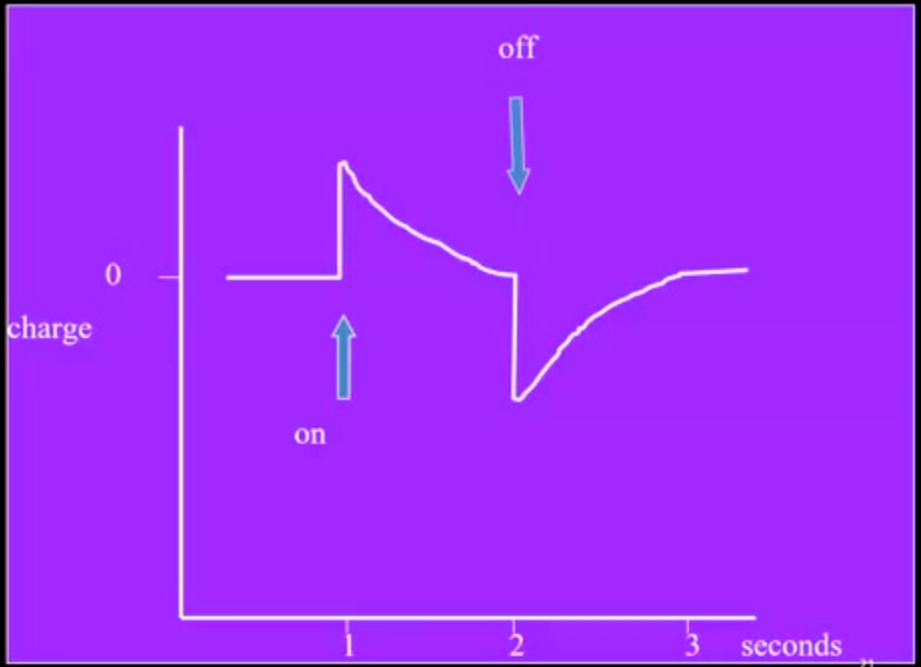
PIEZO-ELECTRICITY IN BONE

SOURCE

- Bone Mineral
- Collagen

EFFECT:

- Rhythmic pulses of electric pulses during function (chewing, walking etc.)
- Important in order to maintain mineralisation


off
0
charge
on
1
2
3
seconds

Time course of events: Heavy biting pressure

Milliseconds
Fluid incompressible in periodontal ligament

Seconds
Fluid leaking out

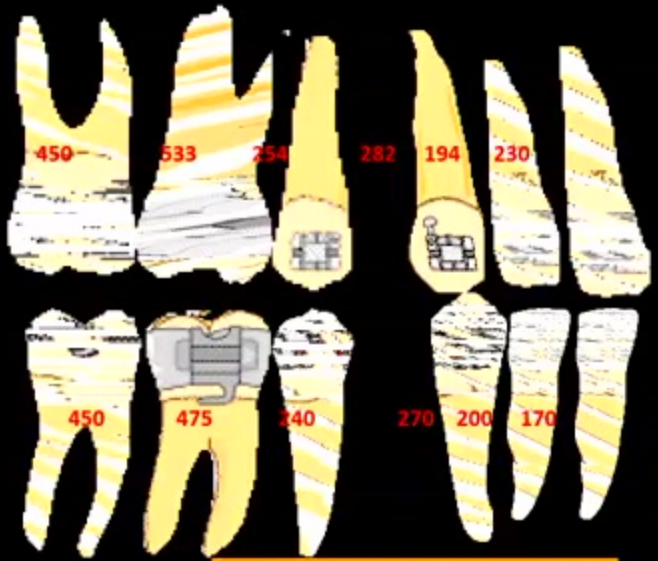
<Minute
Fluid gone: Pain

Biologic Response to Orthodontic Force

3. Describe the relationship of orthodontic force levels to anchorage.

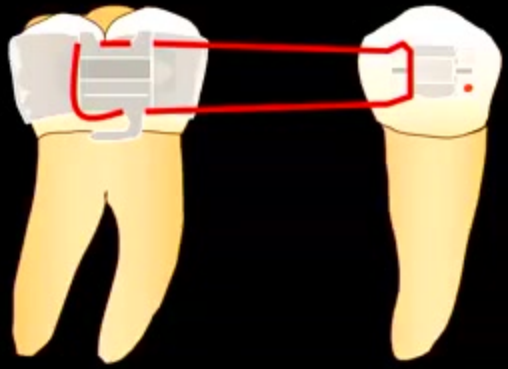
Anchorage

Resistance to
Unwanted
Tooth movement


450
533
254
282
194
230
450
475
240
270
200
170
Relative Anchorage values

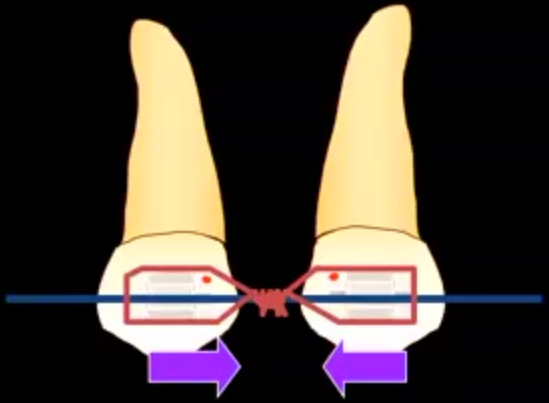
Types of anchorage

Simple
Reciprocal
Reinforced
Stationary

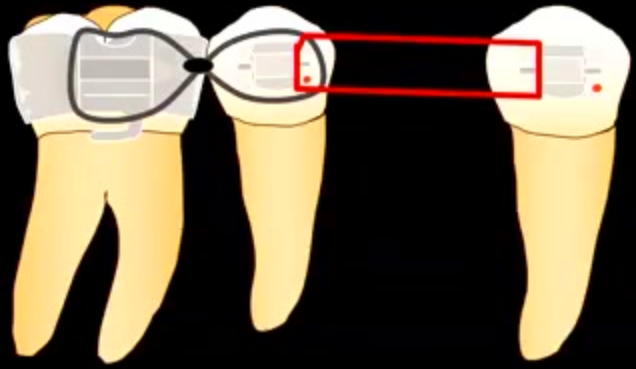


Simple anchorage

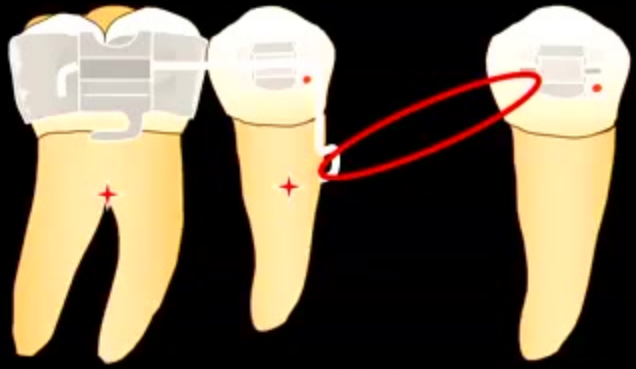
Simple anchorage



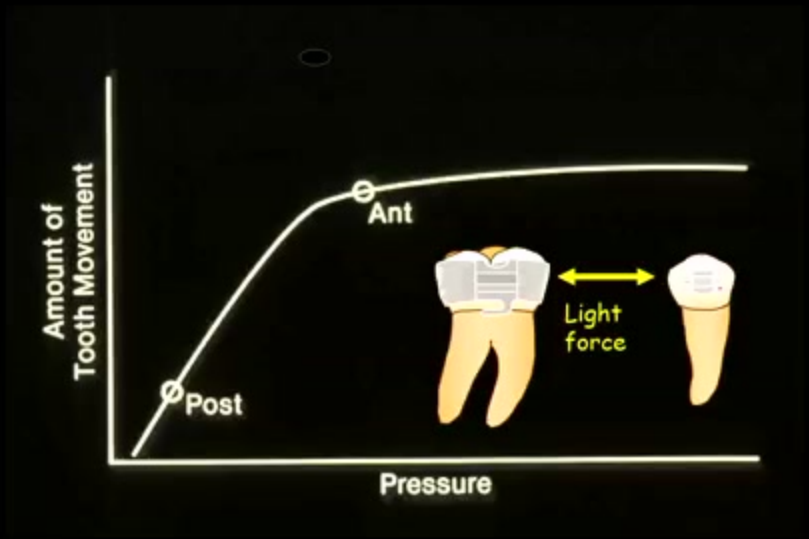
Reciprocal anchorage

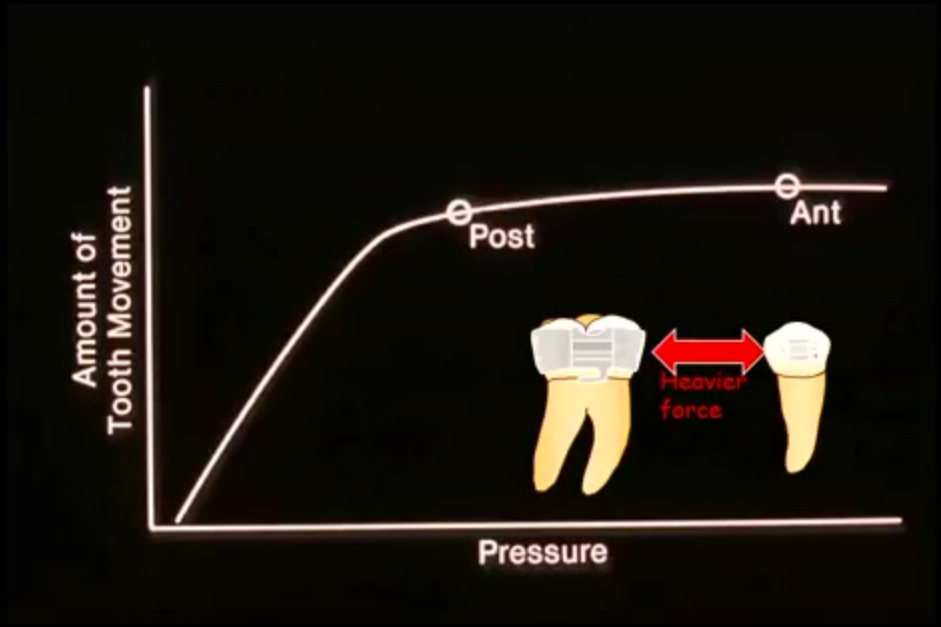


Reinforced anchorage



Stationary anchorage


Amount of
Tooth Movement
Ant
Post
Light
force
Pressure


Amount of Tooth Movement
Post
Ant
Heavier force
Pressure

2. Describe and recognize different types of removable orthodontic appliances in the following categories: (a) functional appliances; (b) Crozat; (c) Hawley type; and (d) Clear Aligner Therapy.

THE UNIVERSITY OF WESTERN AUSTRALIA

a

b

c

d

3. Describe and make correct appliance designs of the active Hawley type with specific recommendations for these components: (a) active; (b) retention; (c) connector; and (d) reactive or anchorage.

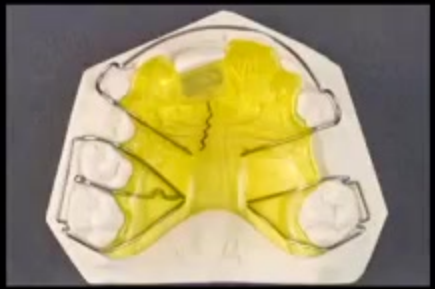
4. Select the correct wire size for active and retentive elements of active Hawley type appliances.

THE UNIVERSITY OF WESTERN AUSTRALIA

- Lab Bow 0.7—0.8mm
- Adams molars 0.7 mm

  premolars 0.6 mm
- Finger spring guarded

  0.6mm unguarded 0.7mm
- Ball clasp 0.7 mm
- C clasp 0.7mm

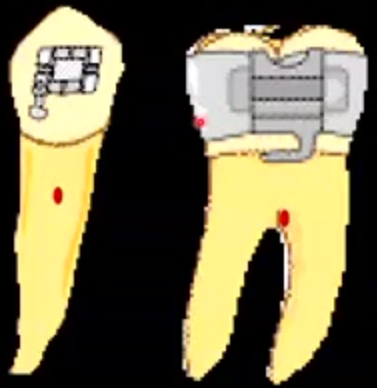


5. Define and explain the biomechanical principles that pertain to orthodontics, specifically the meaning of terms such as "force", "moment", "fulcrum", "center of rotation", and "anchorage" as applied to biomechanics.

THE UNIVERSITY OF WESTERN AUSTRALIA

Centre of Resistance

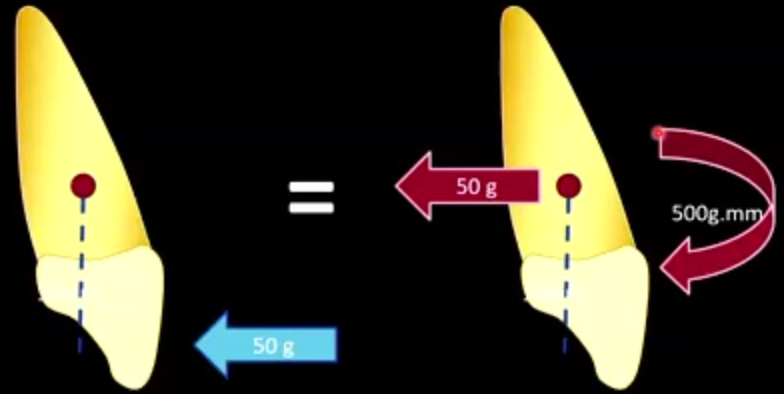
- To complete the description of a force
  - need to define it in relation to the centre or resistance of the tooth
- Burstone –from apex usually 2/3 root and just above furcation on molars



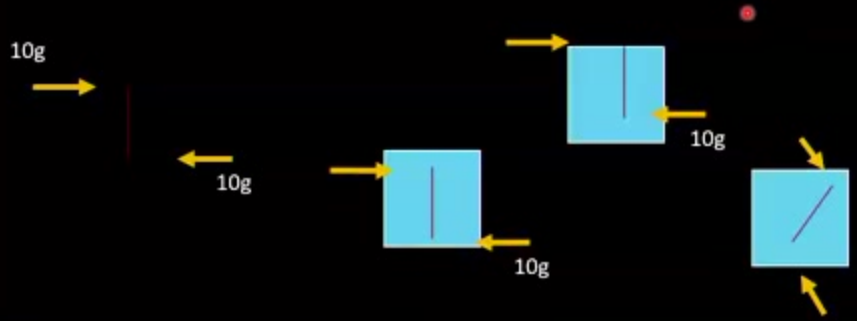
5. Define and explain the biomechanical principles that pertain to orthodontics, specifically the meaning of terms such as "force", "moment", "fulcrum", "center of rotation", and "anchorage" as applied to biomechanics.

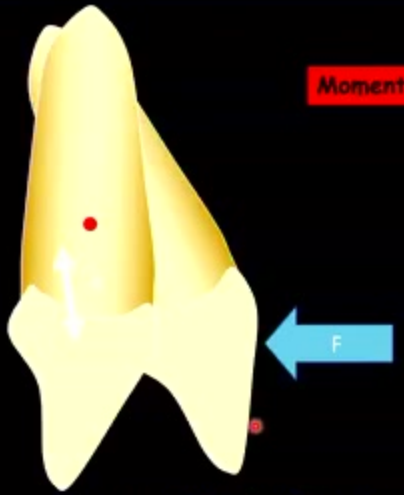
THE UNIVERSITY OF WESTERN AUSTRALIA

- Moment = Tendency to rotate



- Couple = Two equal and opposite, non colinear, parallel forces
  - Pure rotation around center of rotation (CR)

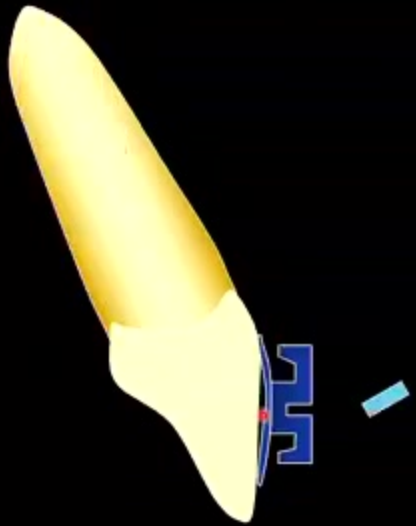


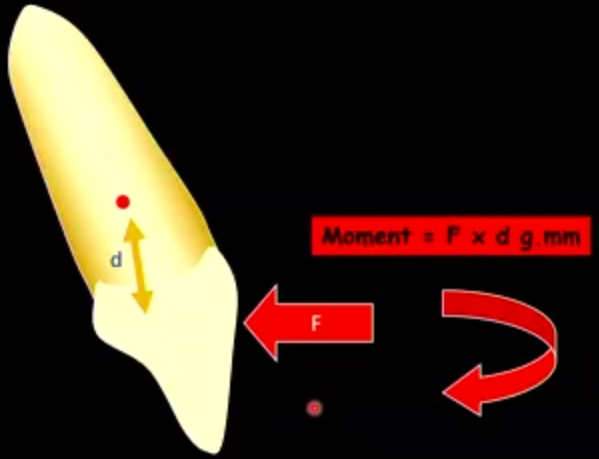


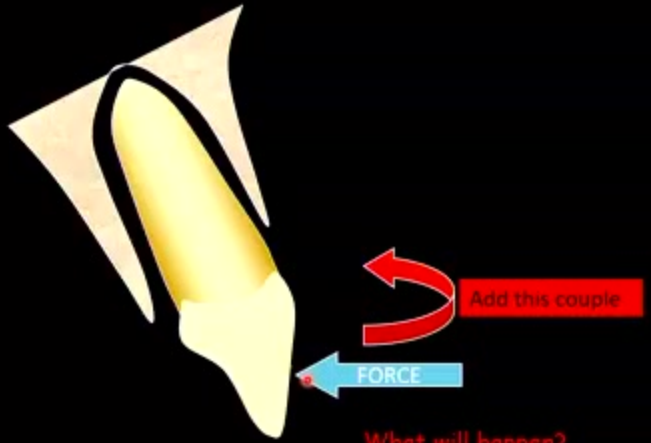
Uncontrolled Tipping

How do we apply couples?

THE UNIVERSITY OF WESTERN AUSTRALIA



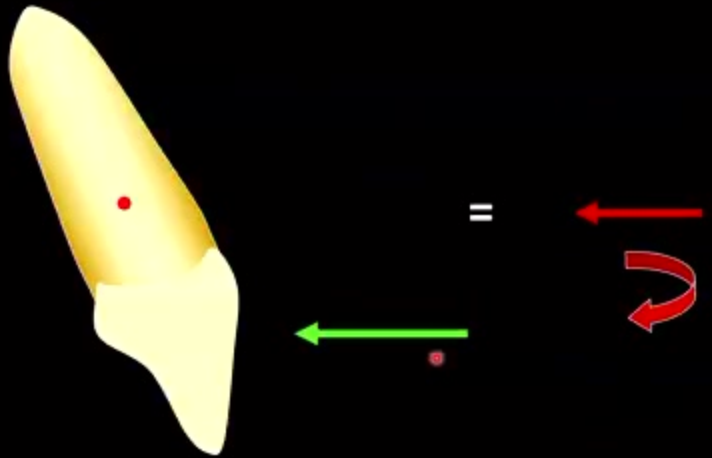

d
F
Moment = F x d g.mm



What will happen?

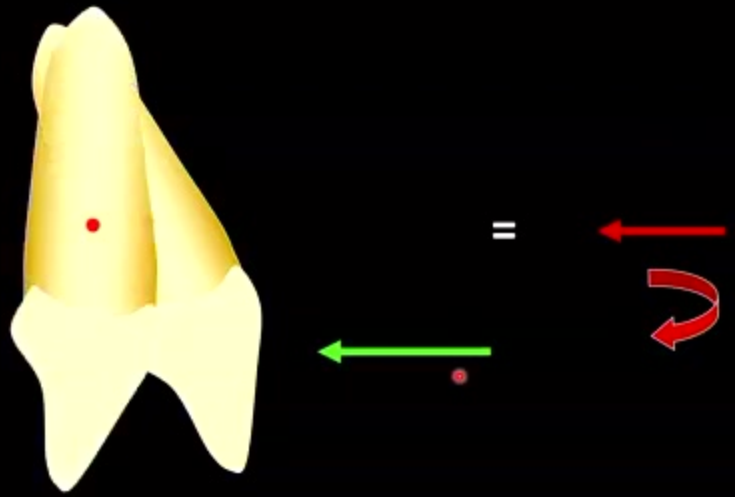
Uncontrolled Tipping

THE UNIVERSITY OF WESTERN AUSTRALIA



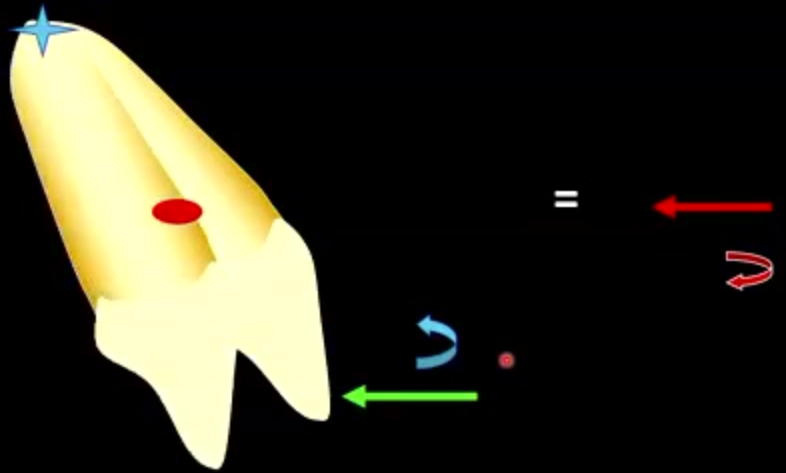
Uncontrolled Tipping

THE UNIVERSITY OF WESTERN AUSTRALIA



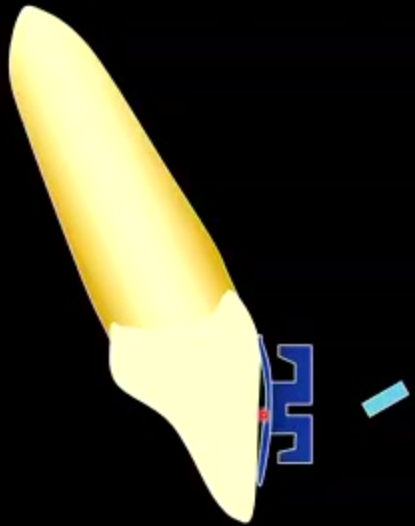
Controlled Tipping

THE UNIVERSITY OF WESTERN AUSTRALIA



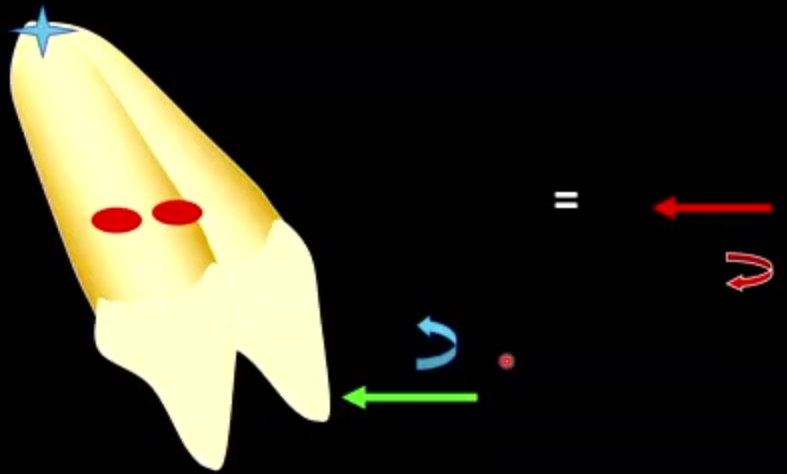
How do we apply couples?

THE UNIVERSITY OF WESTERN AUSTRALIA



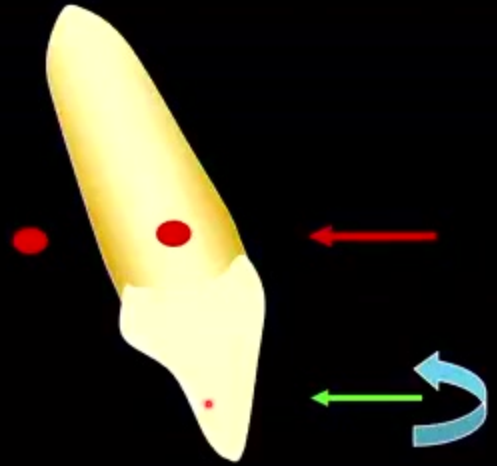
Controlled Tipping

THE UNIVERSITY OF WESTERN AUSTRALIA



Translation

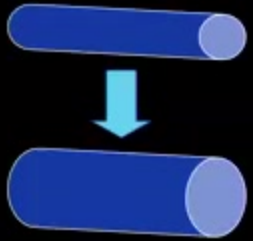
THE UNIVERSITY OF WESTERN AUSTRALIA



6. Demonstrate the relationship between wire size, strength, stiffness and the force produced for a given deflection.

THE UNIVERSITY OF WESTERN AUSTRALIA

- Effect of changing wire size
- If you double the diameter of the wire
  - 8 times as STRONG
  - 16 times as STIFF
  - Will bend ½ as Far



6. Demonstrate the relationship between wire size, strength, stiffness and the force produced for a given deflection.

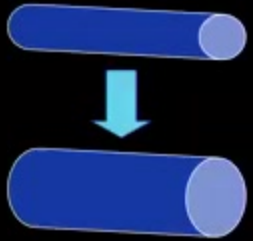
THE UNIVERSITY OF WESTERN AUSTRALIA

- Effect of changing wire length
- If you make a finger spring twice as long
  - 1/2 as STRONG
  - 8 times as springy
  - Will bend 4 times as Far

6. Demonstrate the relationship between wire size, strength, stiffness and the force produced for a given deflection.

THE UNIVERSITY OF WESTERN AUSTRALIA

- Effect of changing wire size
- If you double the diameter of the wire
  - 8 times as STRONG
  - 16 times as STIFF
  - Will bend ½ as Far



6. Demonstrate the relationship between wire size, strength, stiffness and the force produced for a given deflection.

THE UNIVERSITY OF WESTERN AUSTRALIA

- Effect of changing wire length
- If you make a finger spring twice as long
  - 1/2 as STRONG
  - 8 times as springy
  - Will bend 4 times as Far

Part 4. Orthodontic Anchorage and Controlled Tooth Movement

THE UNIVERSITY OF WESTERN AUSTRALIA

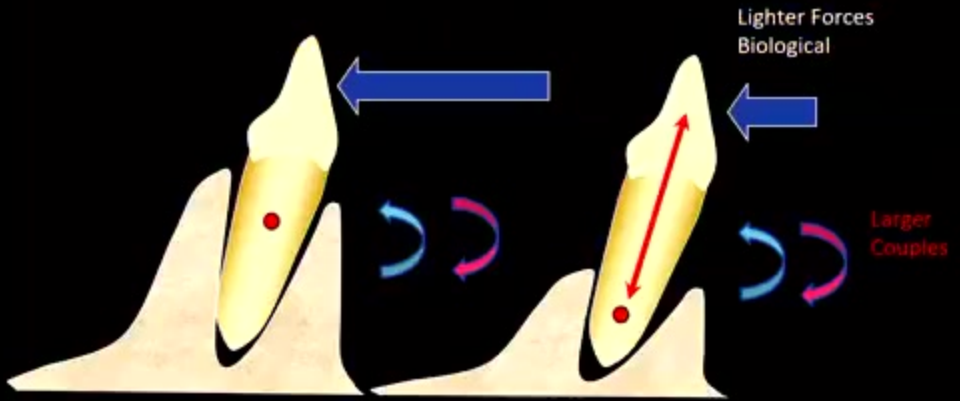
Be sure that you are able to:

1. Describe the reaction of a tooth to a single force placed against the crown.
2. Describe the reaction of a tooth to a two-force system placed against the crown a… a function of the moment-to-force ratio.
3. Indicate the changes in orthodontic forces and moments needed for successful movement of a tooth that has lost alveolar bone support (as from previous periodontal disease).
4. Describe the adaptations in the contemporary edgewise appliance to reduce in-out (first order) bends in arch wires.
5. Describe the adaptations in the contemporary edgewise appliance to reduce angulation (second order) bends in arch wires.
6. Describe the adaptations in the contemporary edgewise appliance to reduce torque (third order) bends in rectangular arch wires.

DONE

3. Indicate the changes in orthodontic forces and moments needed for successful movement of a tooth that has lost alveolar bone support (as from previous periodontal disease).

THE UNIVERSITY OF WESTERN AUSTRALIA



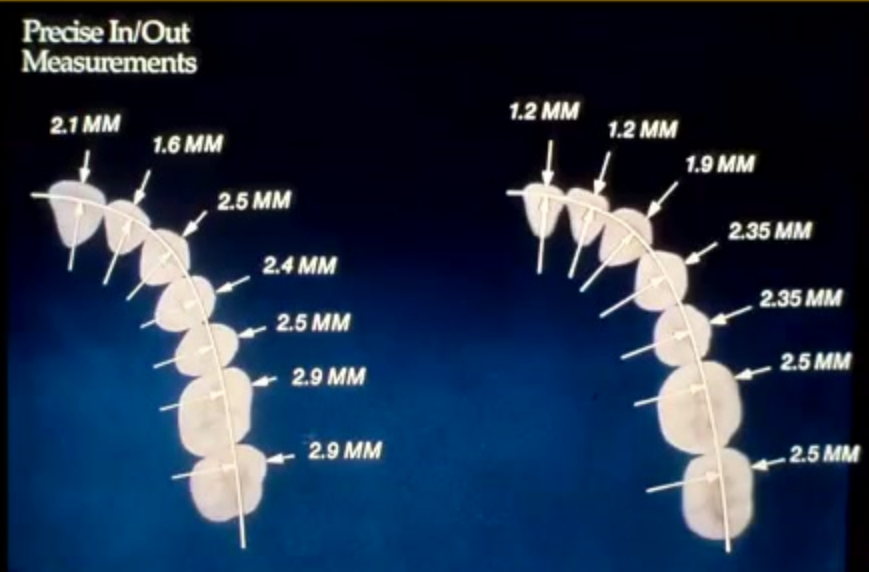
Design of the Staightwire Appliance

THE UNIVERSITY OF WESTERN AUSTRALIA

4. Describe the adaptations in the contemporary edgewise appliance to reduce in-out (first order) bends in arch wires.
5. Describe the adaptations in the contemporary edgewise appliance to reduce angulation (second order) bends in arch wires.
6. Describe the adaptations in the contemporary edgewise appliance to reduce torque (third order) bends in rectangular arch wires.

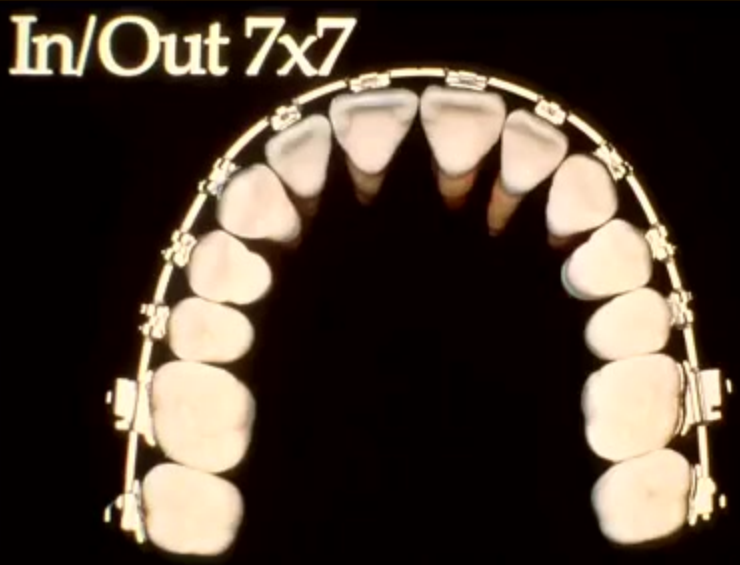
4. Describe the adaptations in the contemporary edgewise appliance to reduce in-out (first order) bends in arch wires.

THE UNIVERSITY OF WESTERN AUSTRALIA



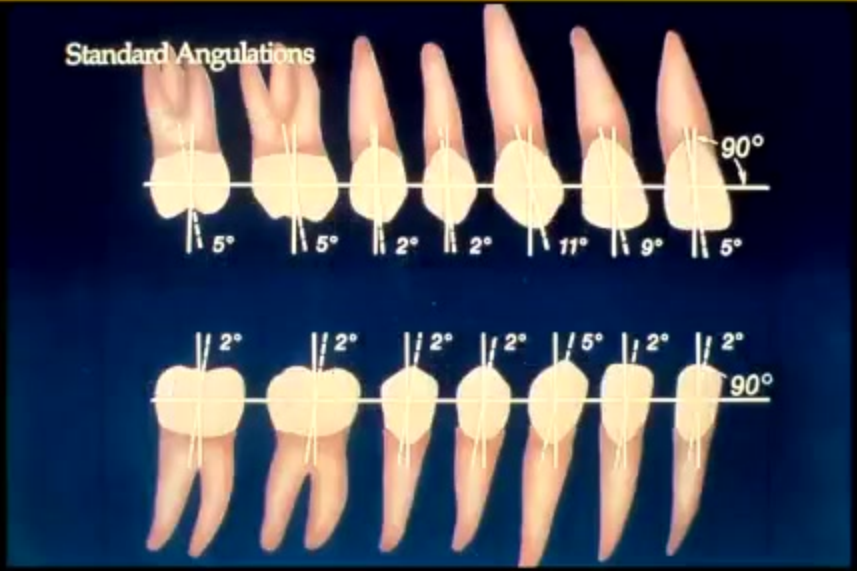
4. Describe the adaptations in the contemporary edgewise appliance to reduce in-out (first order) bends in arch wires.

THE UNIVERSITY OF WESTERN AUSTRALIA



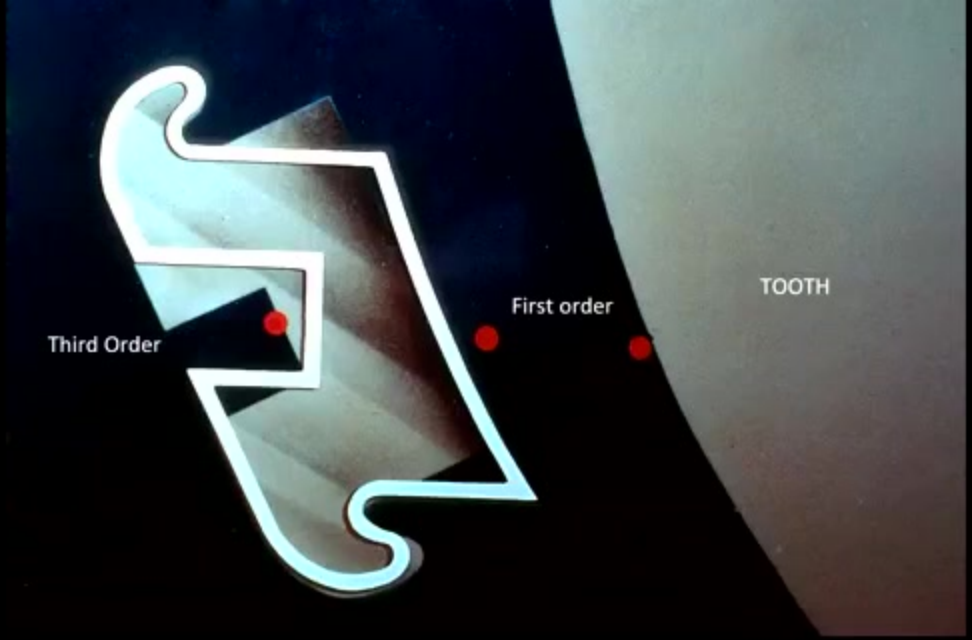
5. Describe the adaptations in the contemporary edgewise appliance to reduce angulation (second order) bends in arch wires.

THE UNIVERSITY OF WESTERN AUSTRALIA



6. Describe the adaptations in the contemporary edgewise appliance to reduce torque (third order) bends in rectangular arch wires.

THE UNIVERSITY OF WESTERN AUSTRALIA


Third Order
First order
TOOTH