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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

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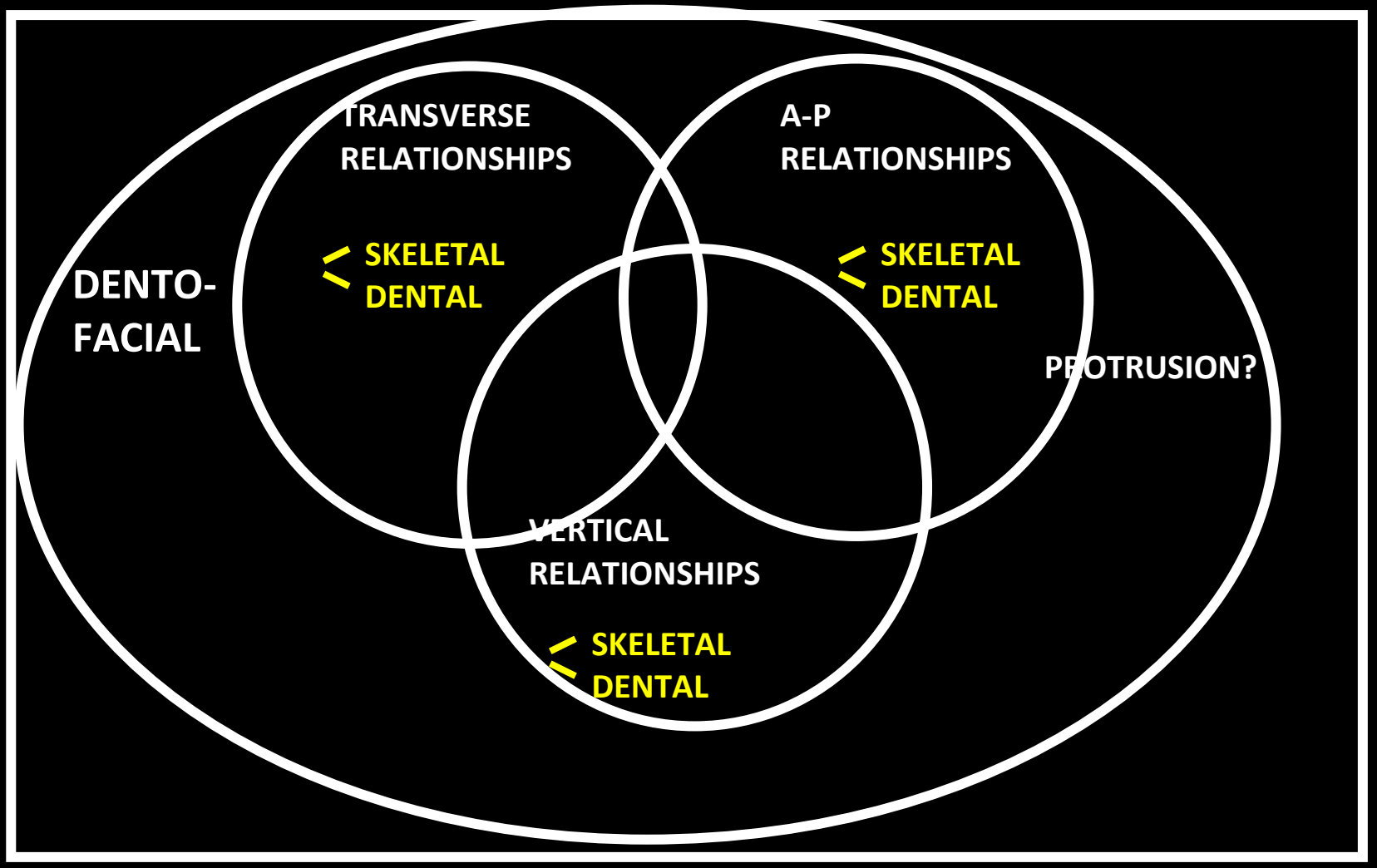
Be sure that you are able to:

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



ALIGNMENT/ASYMMETRY



X

UNIVERSITY OF NORTH CAROLINA AT CHAPEL HILL
SCHOOL OF DENTISTRY

SPACE ANALYSIS FORM

Patient's Name: _____ Date: _____

SECTION 1
AVAILABLE MANDIBULAR SPACE

Arch Segment Lengths

a. _____ mm
b. _____ mm
c. _____ mm
d. _____ mm
TOTAL: _____ mm

SECTION 2
MANDIBULAR INCISOR WIDTH

#23: _____ mm
#24: _____ mm
#25: _____ mm
#26: _____ mm
TOTAL: _____ mm

SECTION 3
AVAILABLE MAXILLARY SPACE

Arch Segment Lengths

e. _____ mm
f. _____ mm
g. _____ mm
h. _____ mm
TOTAL: _____ mm

SECTION 4
MAXILLARY INCISOR WIDTH

#7: _____ mm
#8: _____ mm
#9: _____ mm
#10: _____ mm
TOTAL: _____ mm

INTERPRETATION OF NUMERICAL RESULTS (based on observations in Section 7 — 10)

To estimate the size of the unerupted canine and premolars in each quadrant (method of Tanaka and Johnston, J Am Dent Assn 88:798, 1974):

Mandibular quadrant: ½ the sum of the widths of the mandibular incisors, plus 10.5 mm. _____ (ENTER ON LINE 5c and 6d ABOVE)

Maxillary quadrant: ½ the sum of the widths of the mandibular incisors, plus 11.0 mm. _____ (ENTER ON LINE 6c and 6d ABOVE)

SECTION 5
MANDIBULAR SPACE ANALYSIS

a. TOTAL SPACE AVAILABLE (from Section 1) _____
b. SUM OF MAND. INCISOR WIDTHS (from Section 2) _____
c. SUM OF LEFT CANINE & PREMOLARS (estimated below from mand. incisors) _____
d. SUM OF RIGHT CANINE & PREMOLARS (estimated below from mand. incisors) _____
e. TOTAL SPACE REQUIRED (b+c+d) _____
f. DISCREPANCY (a–e) _____

SECTION 6
MAXILLARY SPACE ANALYSIS

a. TOTAL SPACE AVAILABLE (from Section 3) _____
b. SUM OF MAX. INCISOR WIDTHS (from Section 4) _____
c. SUM OF RIGHT CANINE & PREMOLARS (estimated below from mand. incisors) _____
d. SUM OF LEFT CANINE & PREMOLARS (estimated below from mand. incisors) _____
e. TOTAL SPACE REQUIRED (b+c+d) _____
f. DISCREPANCY (a–e) _____

SECTION 7
SKELETAL JAW RELATIONSHIP (from Facial Profile Analysis)

☐ CLASS I ☐ CLASS II ☐ CLASS III

SECTION 8
OCCLUSION OF PERMANENT FIRST MOLARS

RIGHT SIDE ☐ ANGLE CLASS I ☐ LEFT SIDE
☐ END-TO-END ☐
☐ ANGLE CLASS II ☐
☐ ANGLE CLASS III ☐

SECTION 9
MOLAR SHIFT (From end-to-end to Class I)
For Skeletal Class I only

RIGHT SIDE + LEFT SIDE = TOTAL SHIFT
_____ mm + _____ mm = _____ mm TOTAL

SECTION 10
LIP POSTURE (from Facial Profile Analysis)

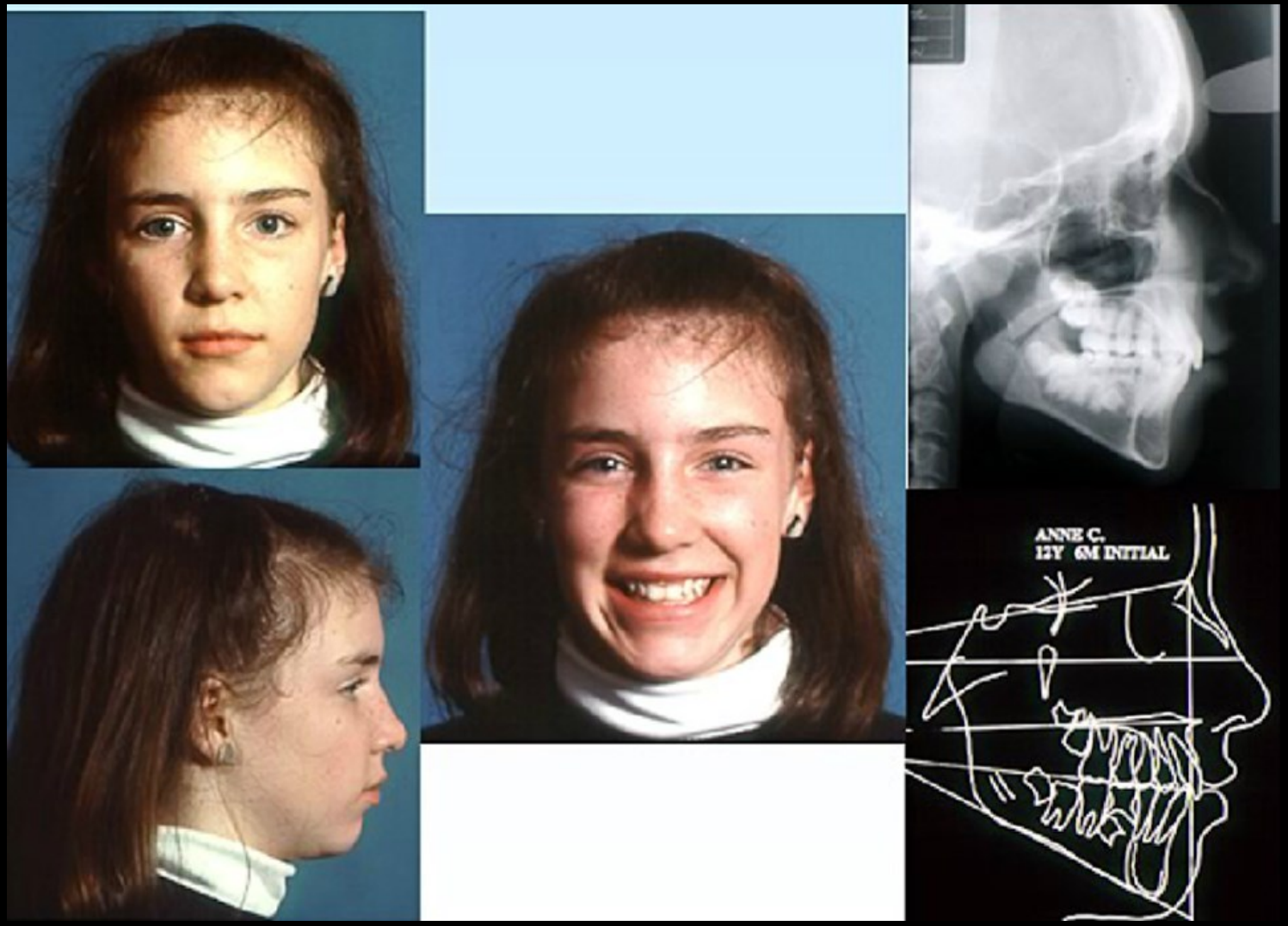
☐ ACCEPTABLE: ☐ PROTRUSIVE: ☐ RETRUSIVE

MANDIBULAR INCISOR POSITION
(from Facial Profile Analysis and cast)

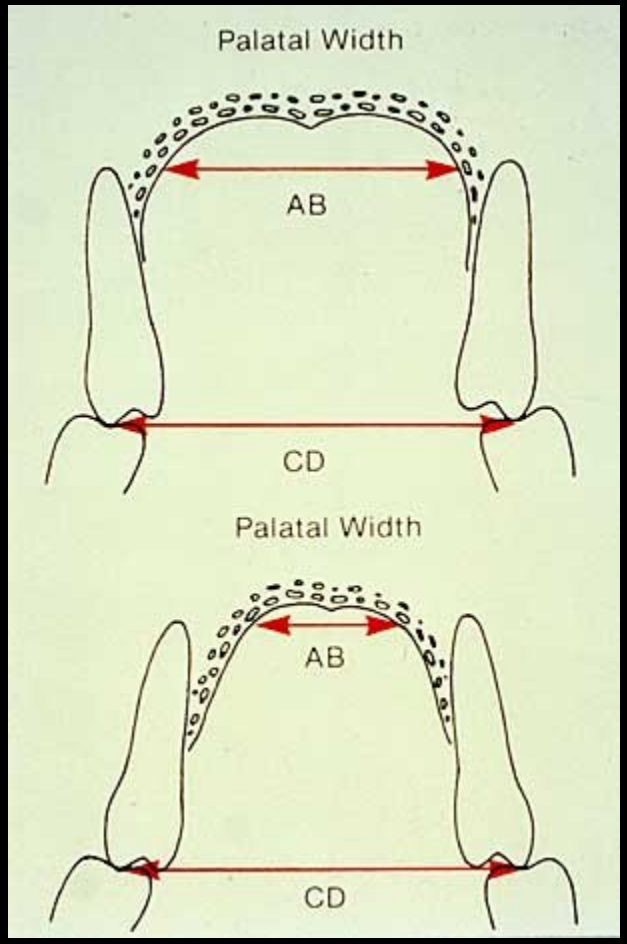
☐ ACCEPTABLE: ☐ PROTRUSIVE: ☐ RETRUSIVE

Mixed dentition space analysis form.

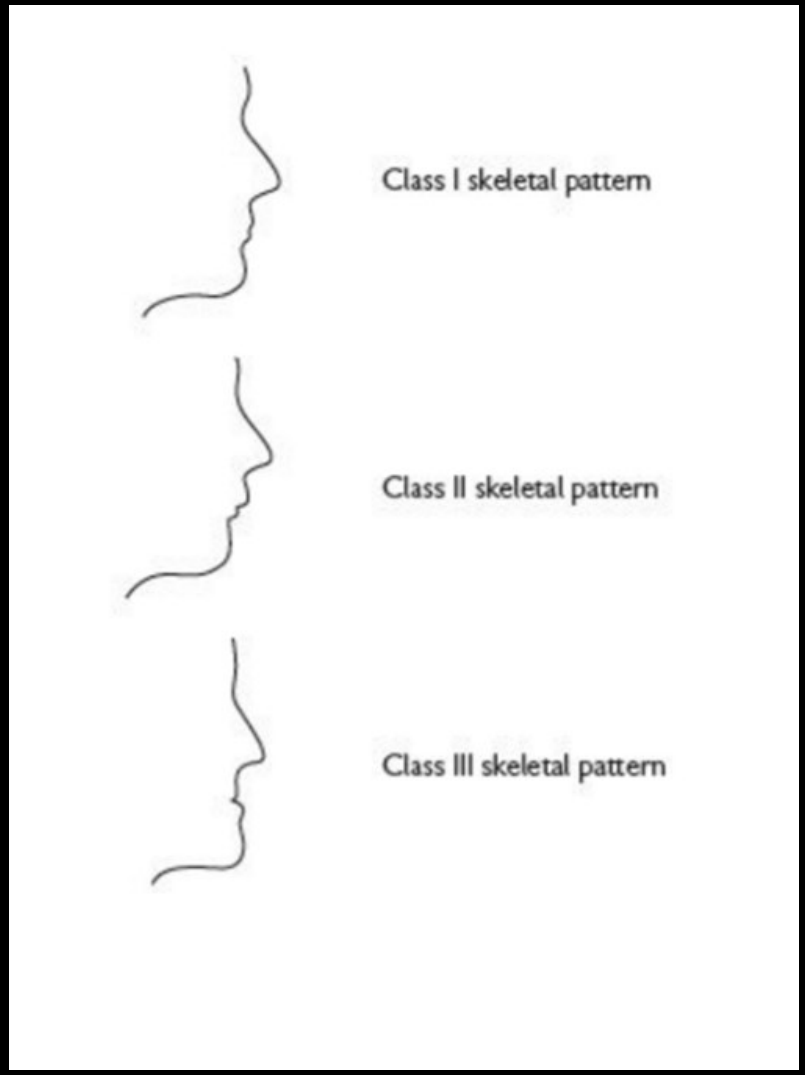
ESTHETIC IMPACT OF MALOCCLUSION



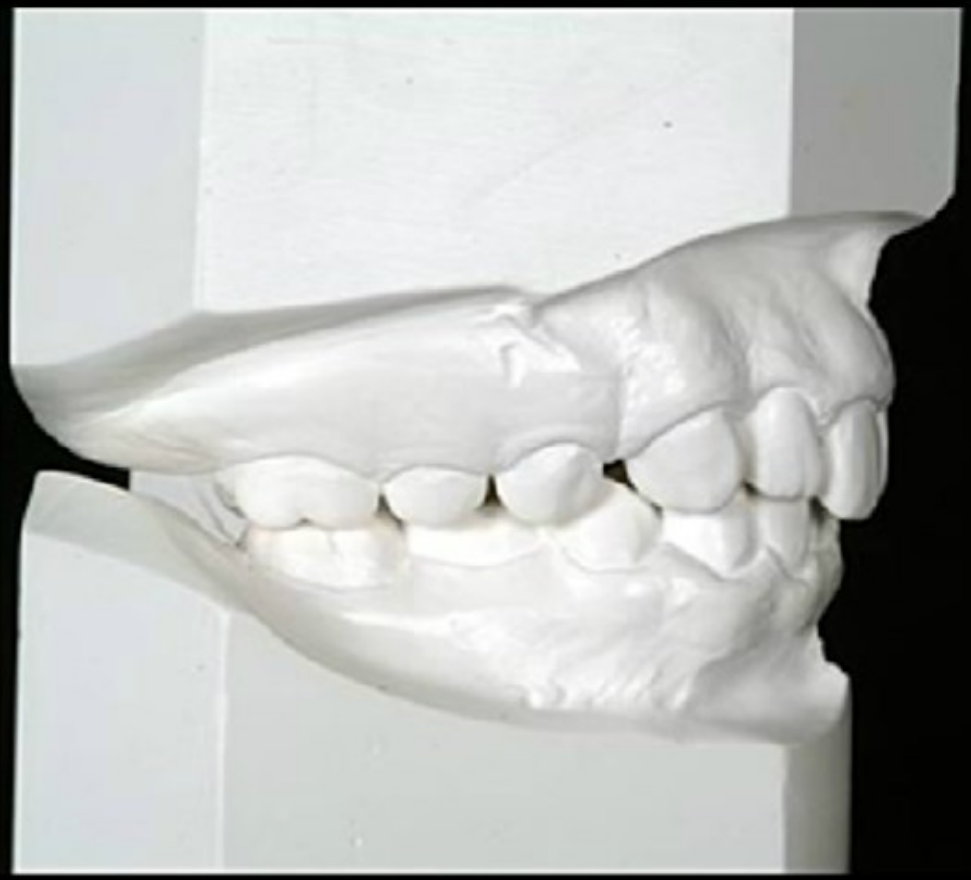
TRANSVERSE RELATIONSHIPS



A-P RELATIONSHIPS



VERTICAL RELATIONSHIPS





Part 2. Biologic Response to Orthodontic Force

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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

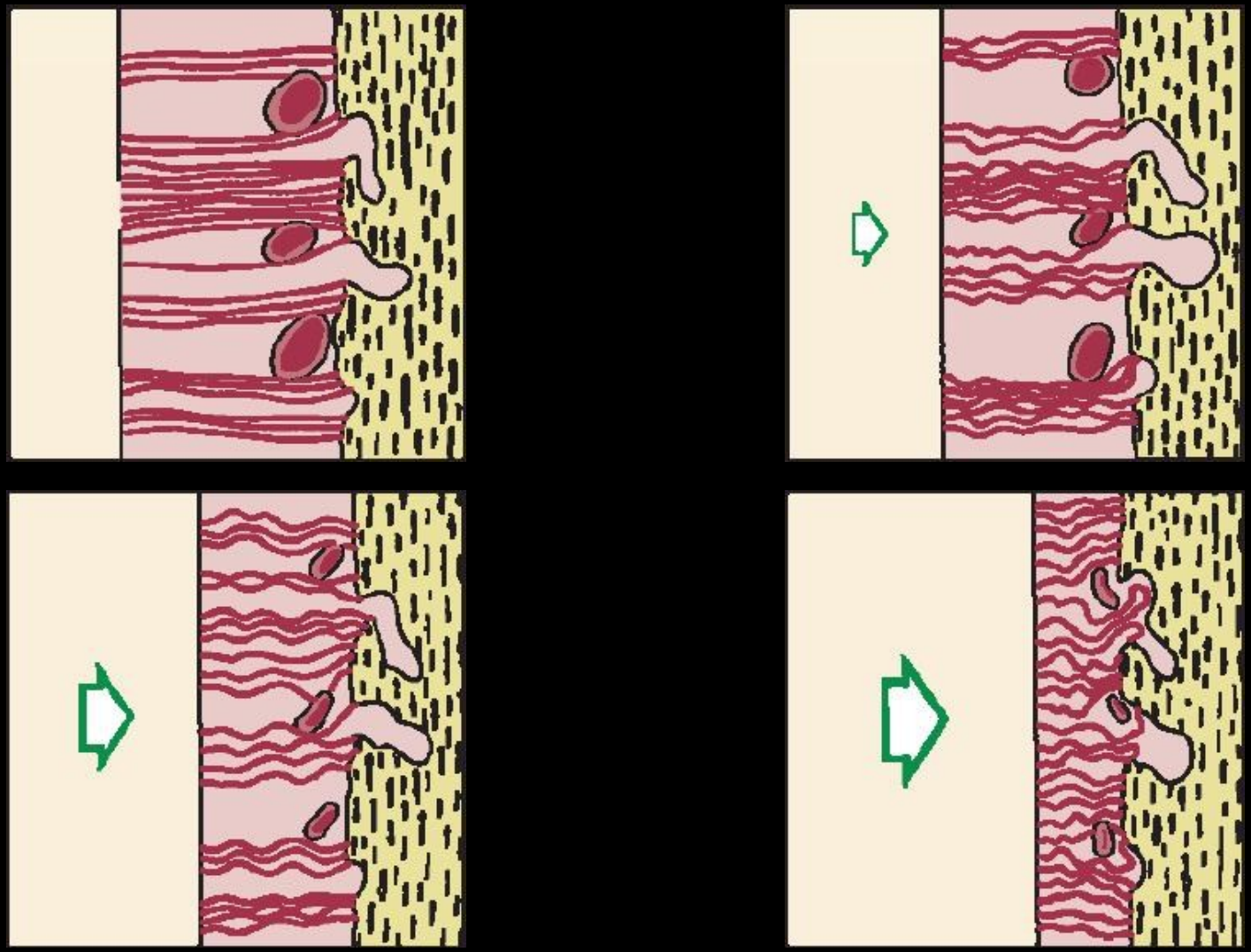
BLOOD FLOW CHANGE
MECHANICAL DEFORMATION?

PROSTOGLANDIN RELEASE

STIMULUS TO FORM
OSTEOCLASTS/OSTEOBLASTS

REMODELLING

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

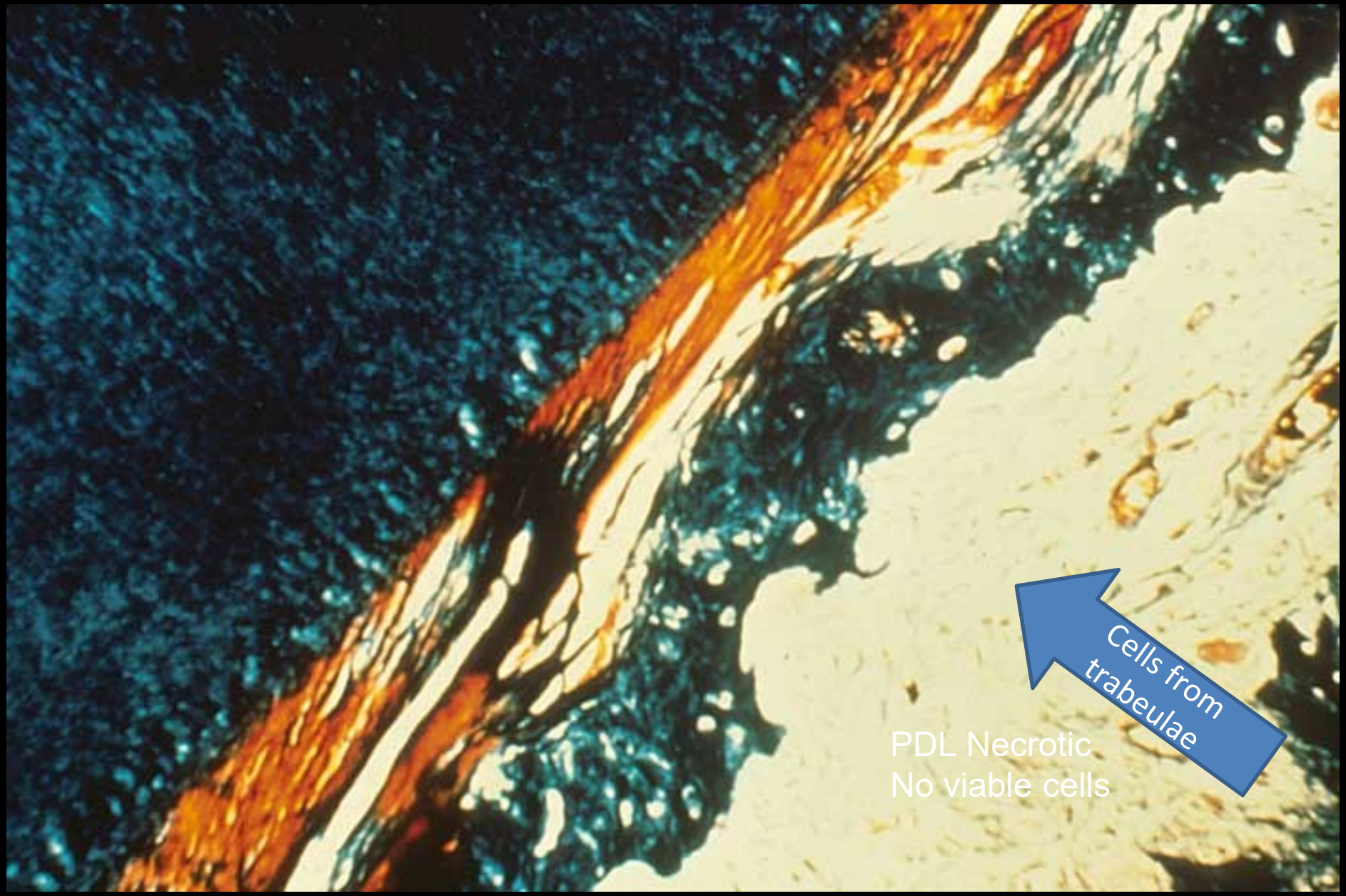


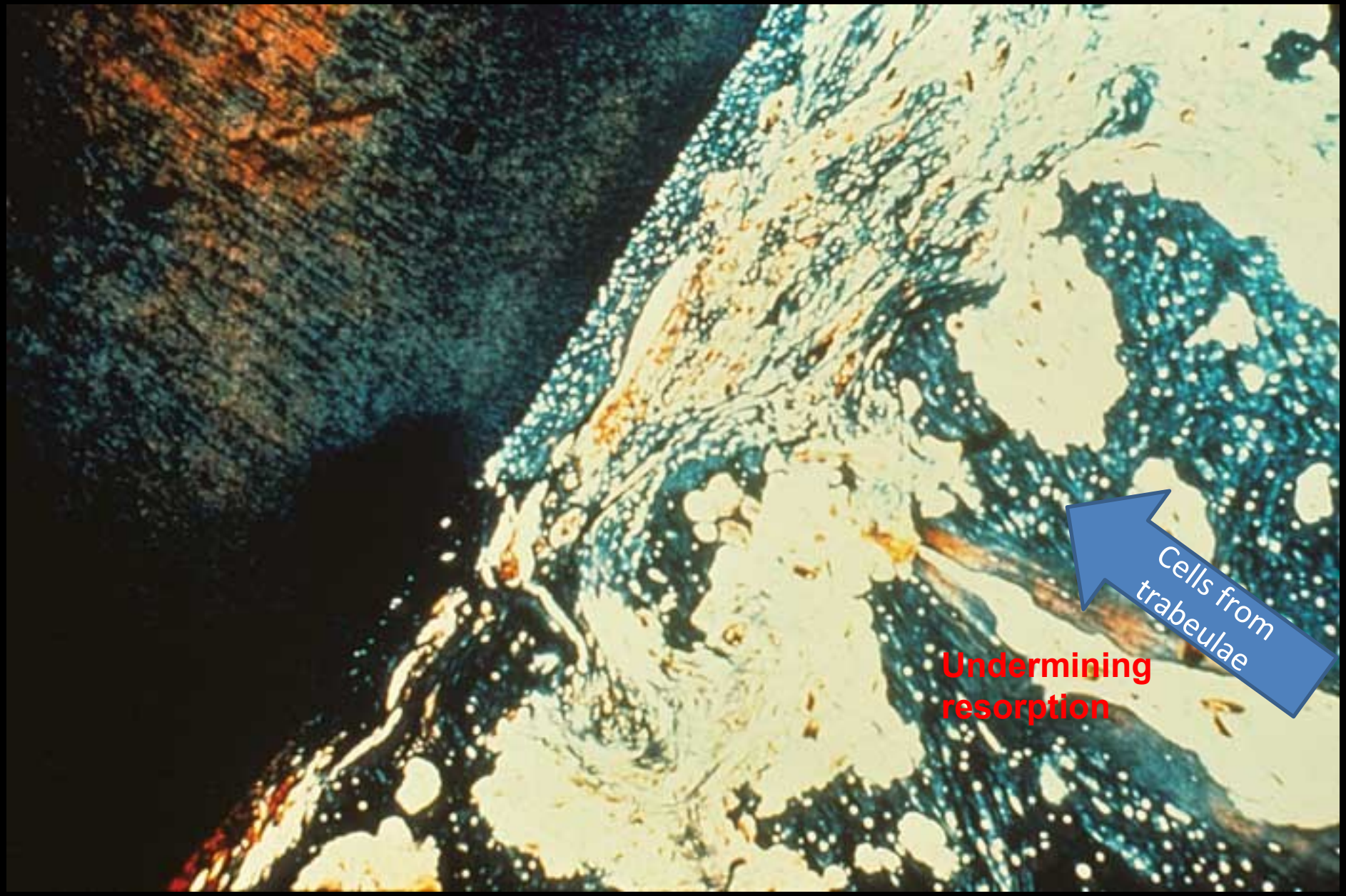
HEAVY PRESSURE

TOTAL SHUT-OFF OF BLOOD FLOW

STERILE NECROSIS = HYALINIZATION




Cells from trabeulae
PDL Necrotic
No viable cells


Cells from trabeulae
Undermining resorption

Biologic Response to Orthodontic Force

2. Discuss the role of biologic electricity in maintenance and turnover of alveolar bone.

THE PIEZO-ELECTRIC EFFECT

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



PIEZO-ELECTRICITY IN BONE

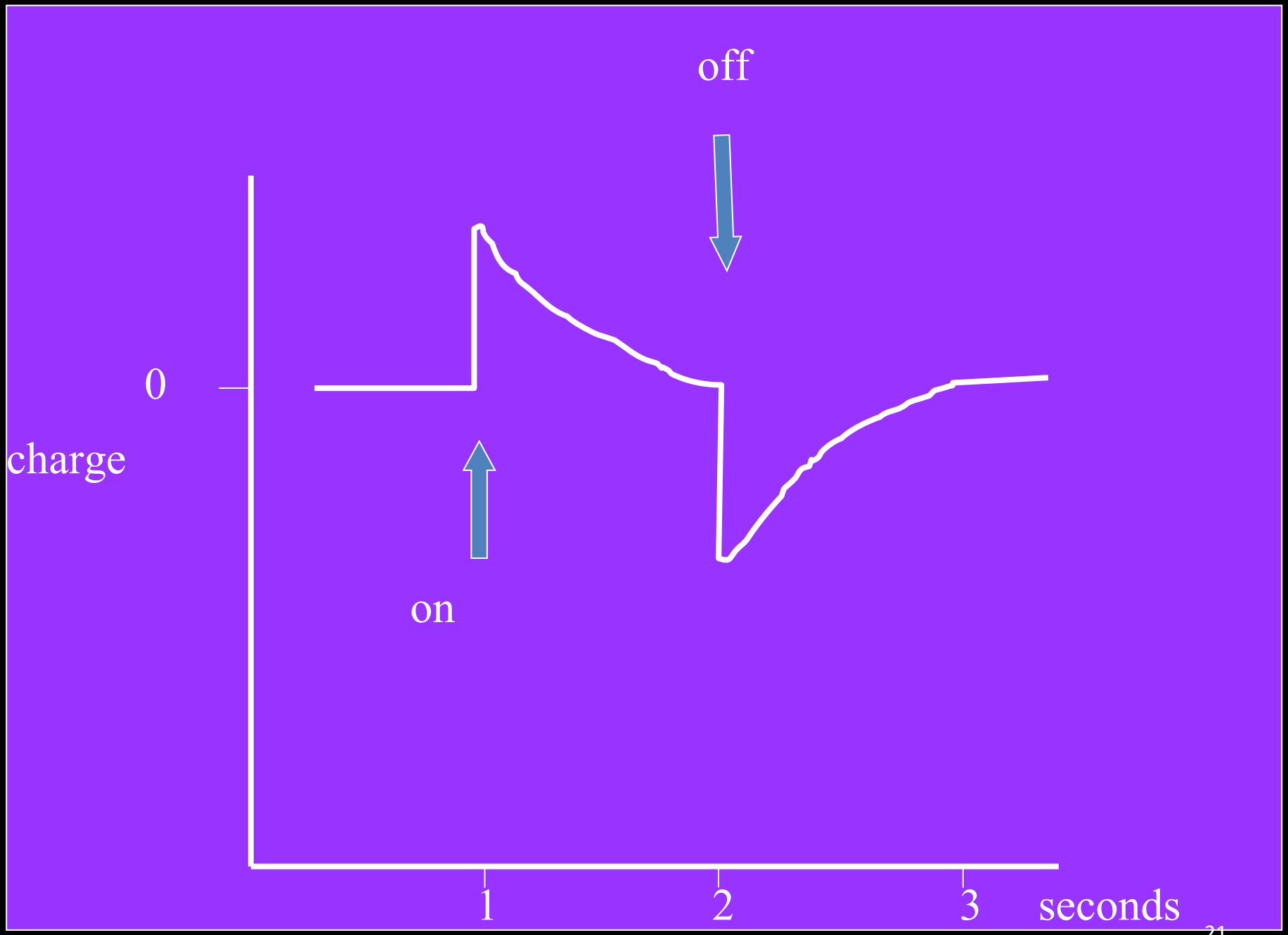


SOURCE

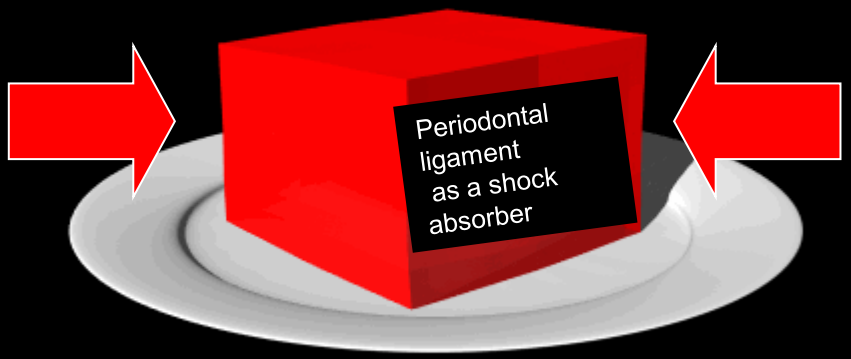
- Bone Mineral
- Collagen

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**

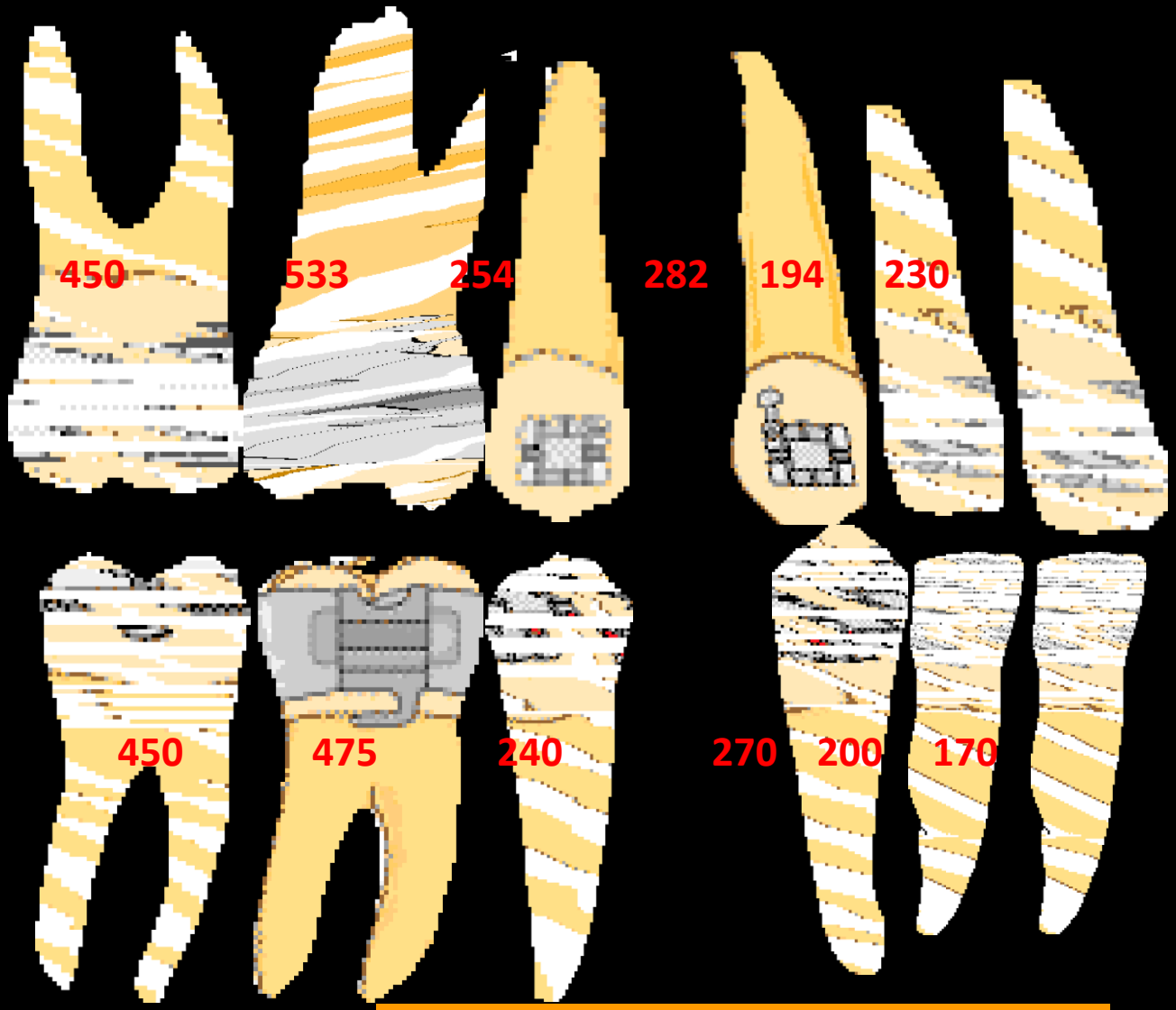
Biologic Response to Orthodontic Force

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

Anchorage

Resistance to
Unwanted
Tooth movement



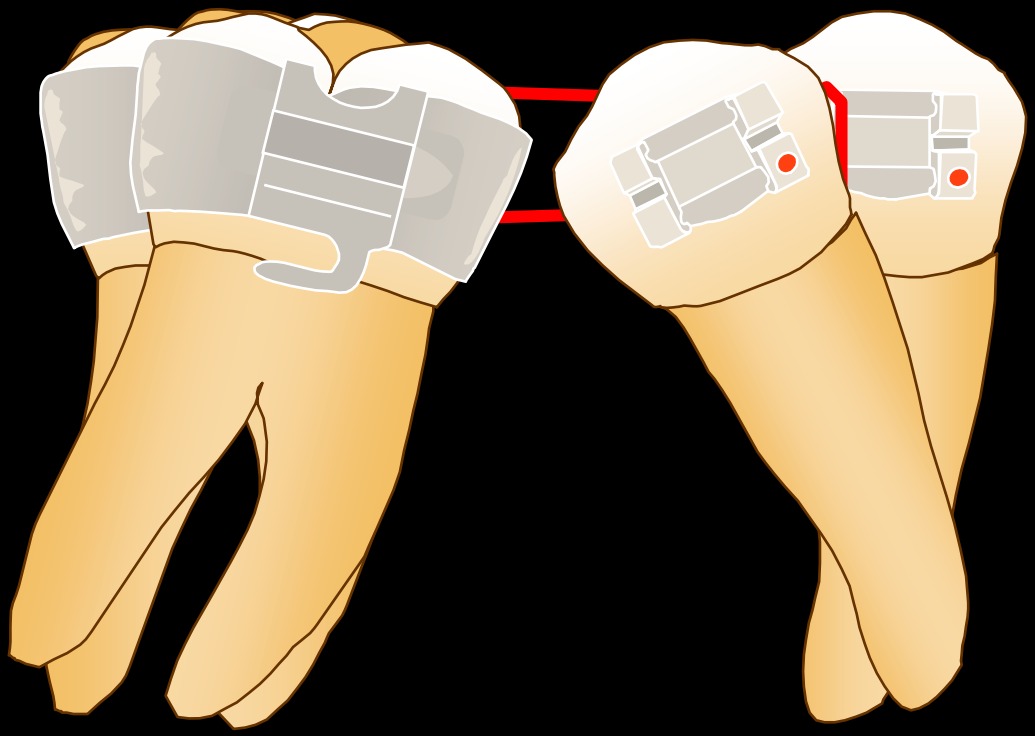


Relative Anchorage values

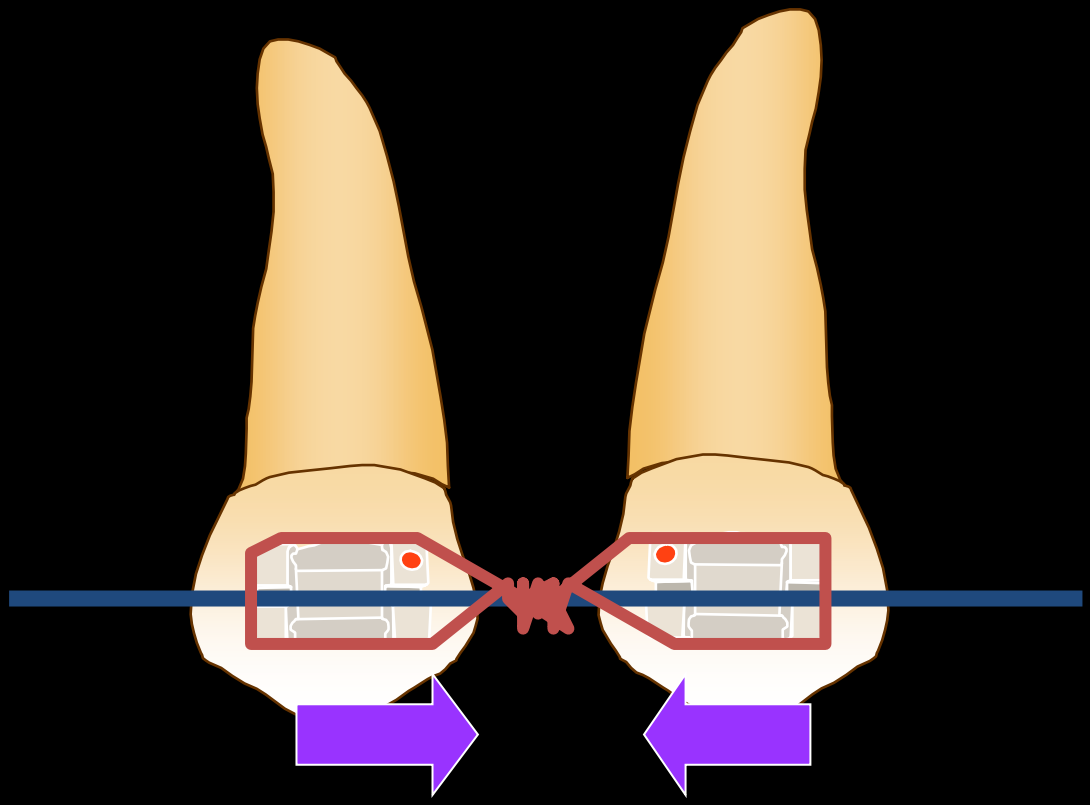
Types of anchorage

Simple
Reciprocal
Reinforced
Stationary

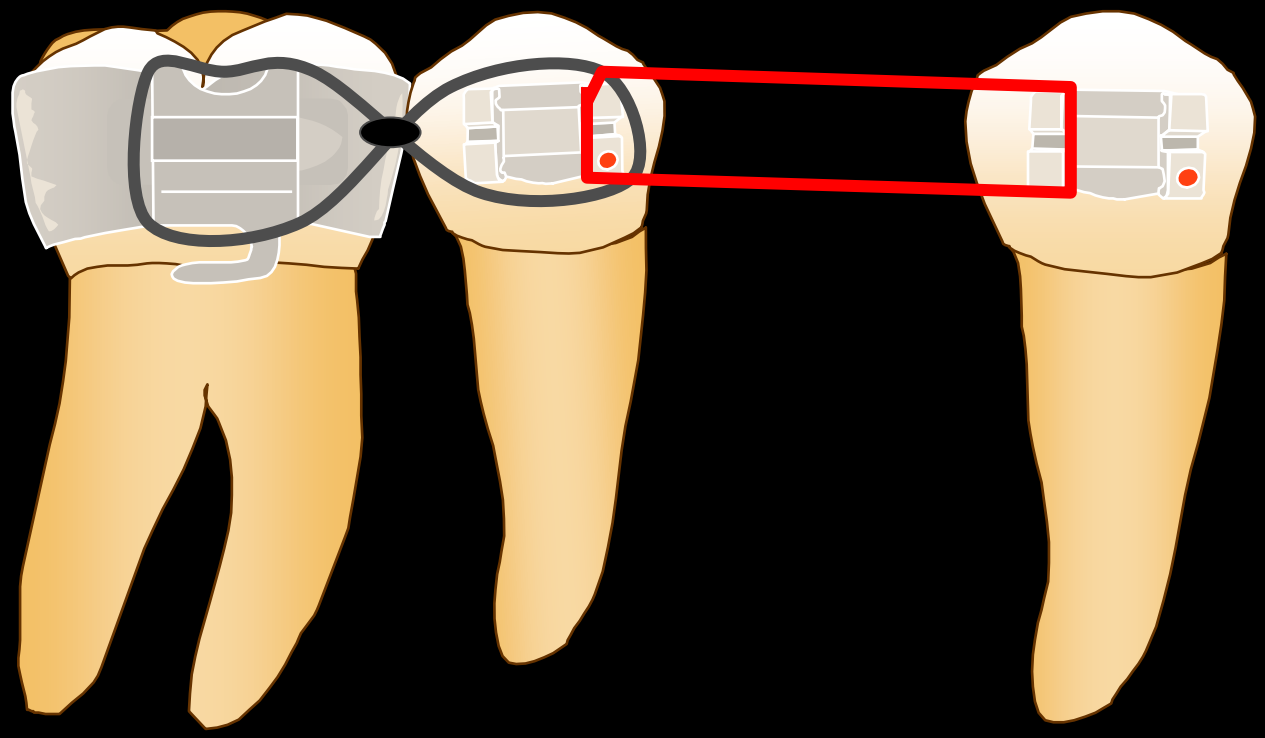




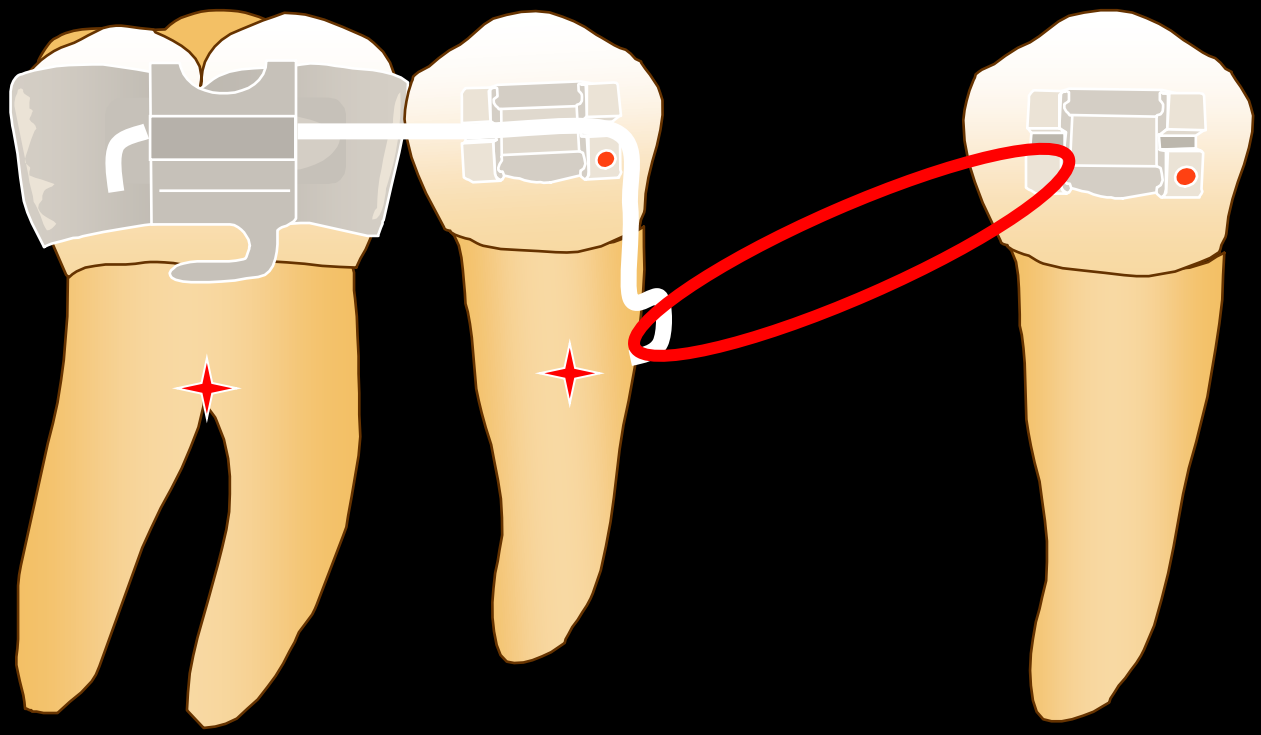
Simple anchorage



Reciprocal anchorage

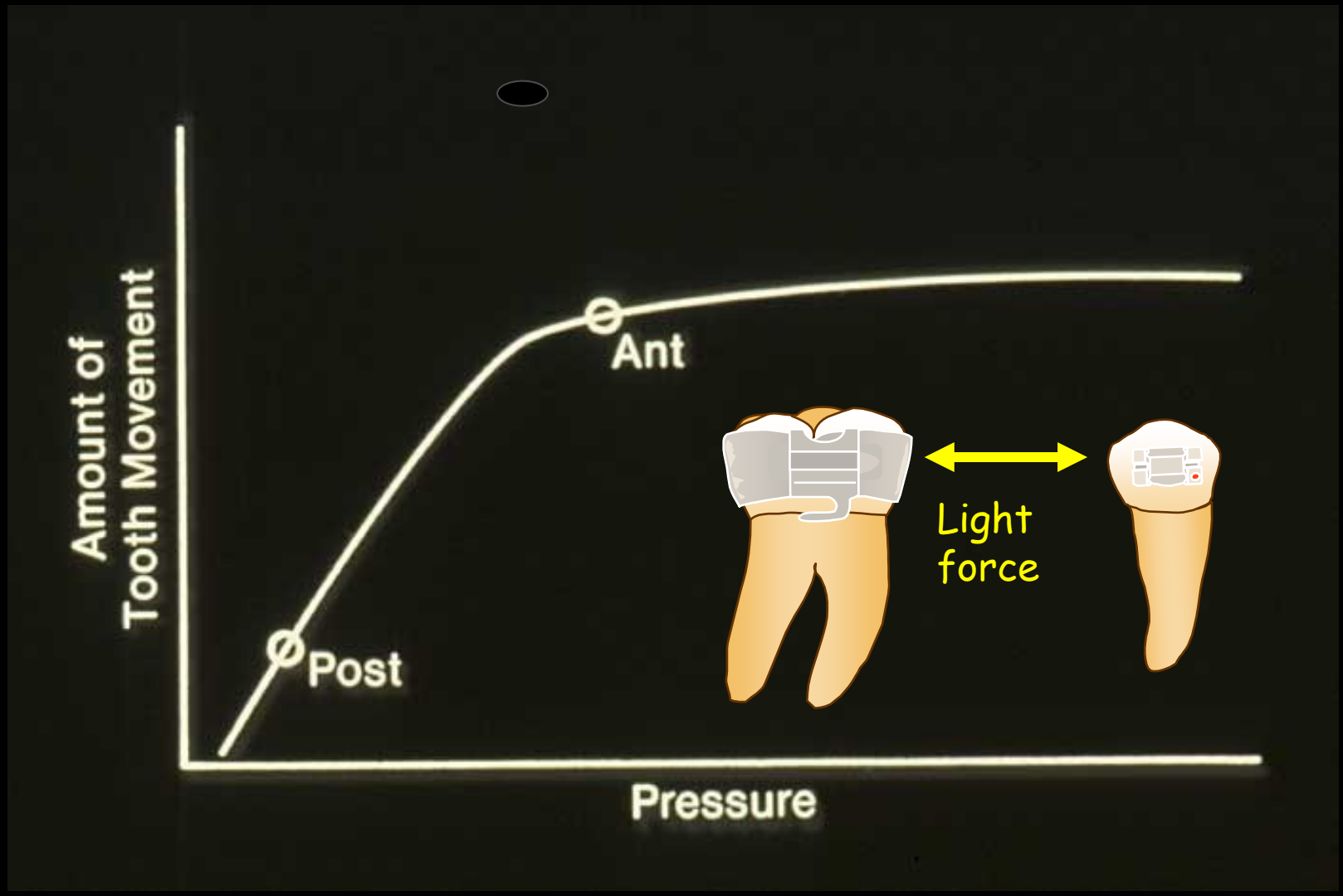


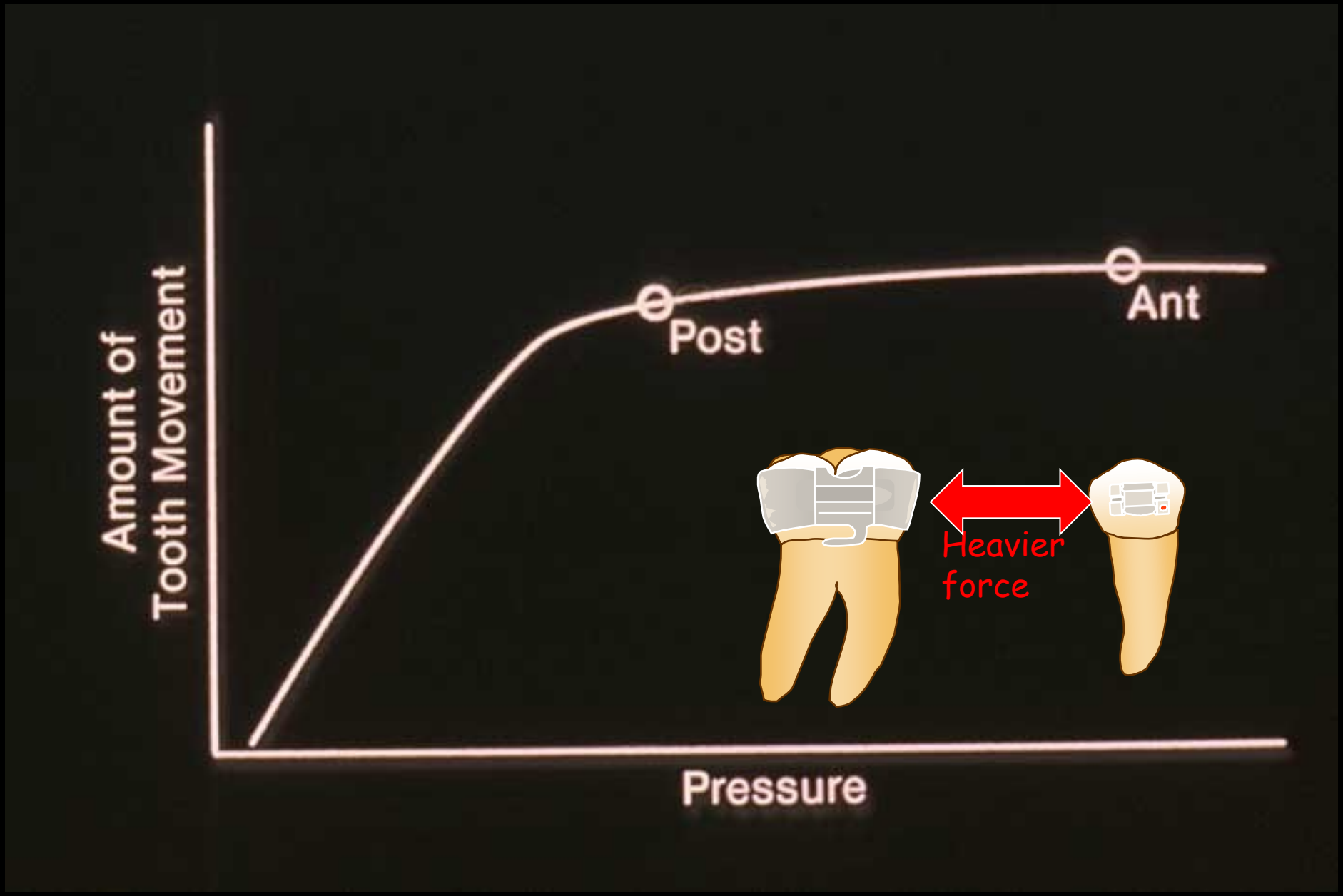
Reinforced anchorage



Stationary anchorage




Amount of Tooth Movement
Ant
Post
Light force
Pressure


Amount of Tooth Movement
Post
Ant
Heavier force
Pressure

Part 3. Mechanical Principles in Controlling Orthodontic Force

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DONE

Be sure that you are able to:

1. Define and apply the principles of anchorage in appliance design to control and minimize unwanted tooth movement.
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.
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.
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.
6. Demonstrate the relationship between wire size, strength, stiffness and the force produced for a given deflection.
7. Explain the difference between tipping and bodily tooth movement, and how an applied force can produce either.

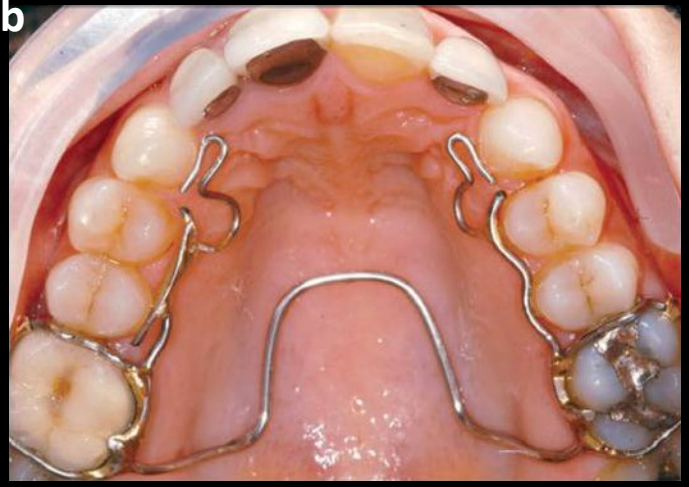
2. Describe and recognize different types of removable orthodontic appliances in the following categories:
(a) functional appliances; (b) Crozat; (c) Hawley type; and (d) Clear Aligner Therapy.

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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.

- 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.

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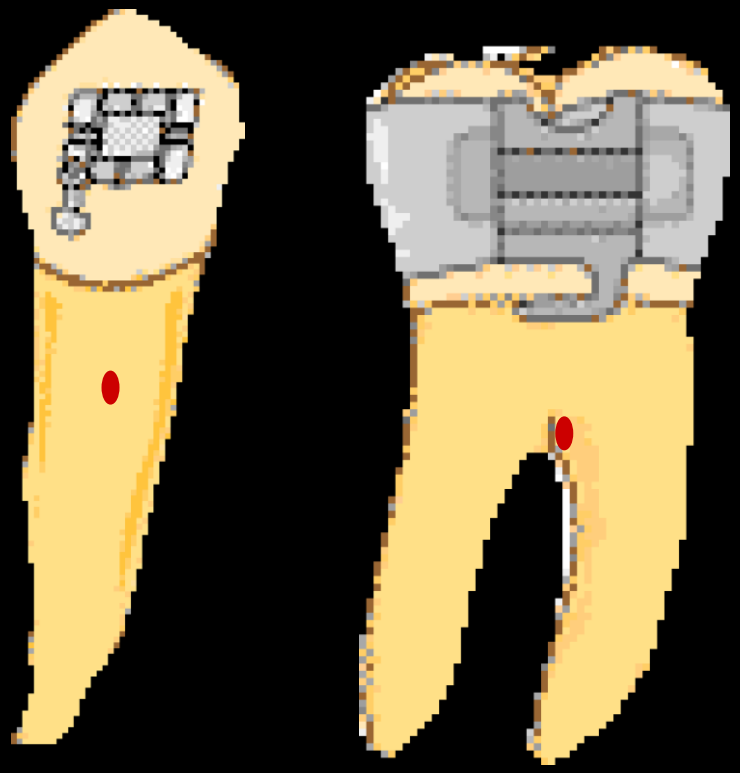
- Force
  - ...that action of one body on another body which causes or tends to cause a change in shape or motion or both of the second body
  - G or g/cm²
- Point of application (were)
- Magnitude (size, Newtons)
- Sense (direction)



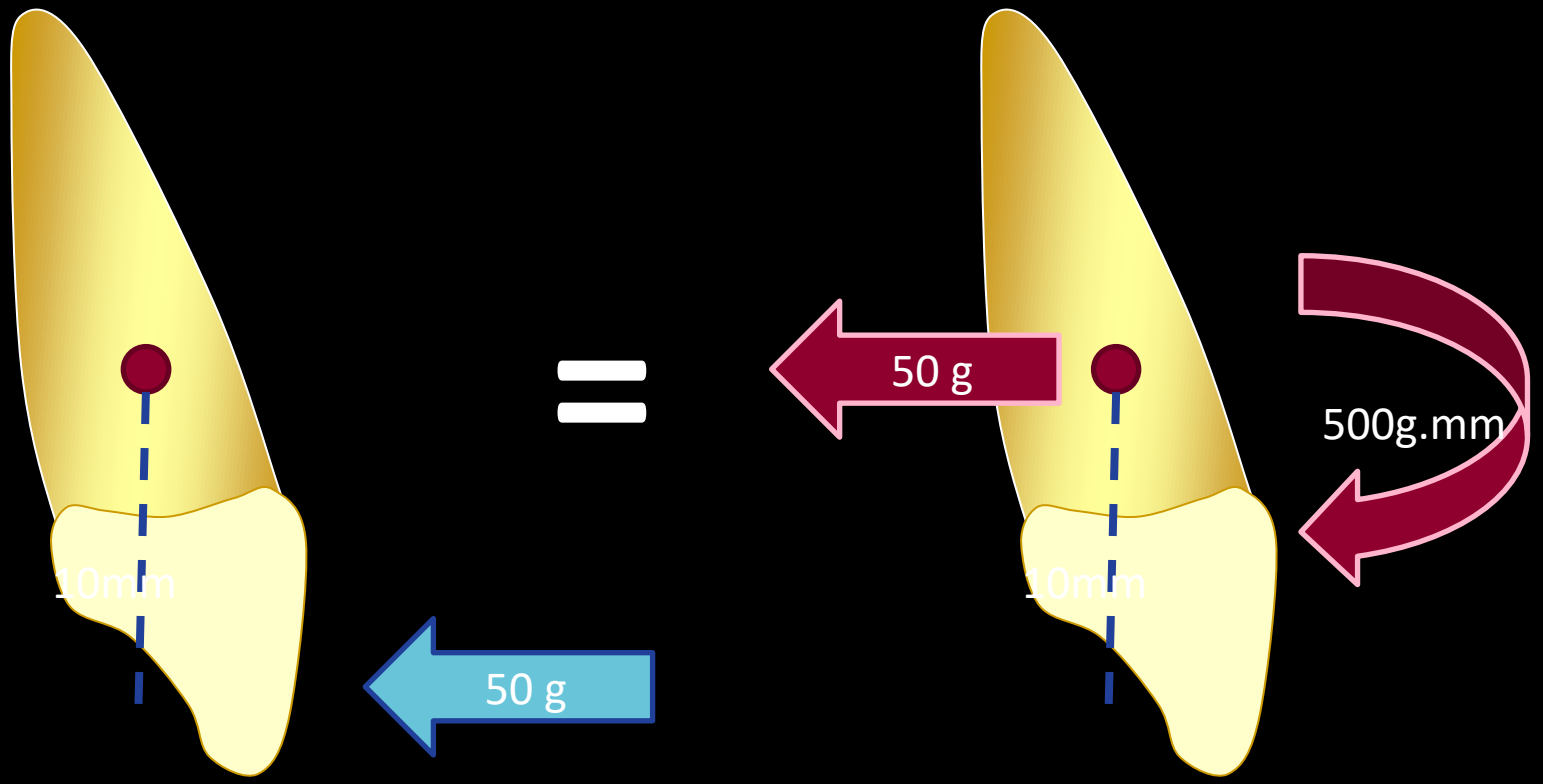
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Centre of Resistance

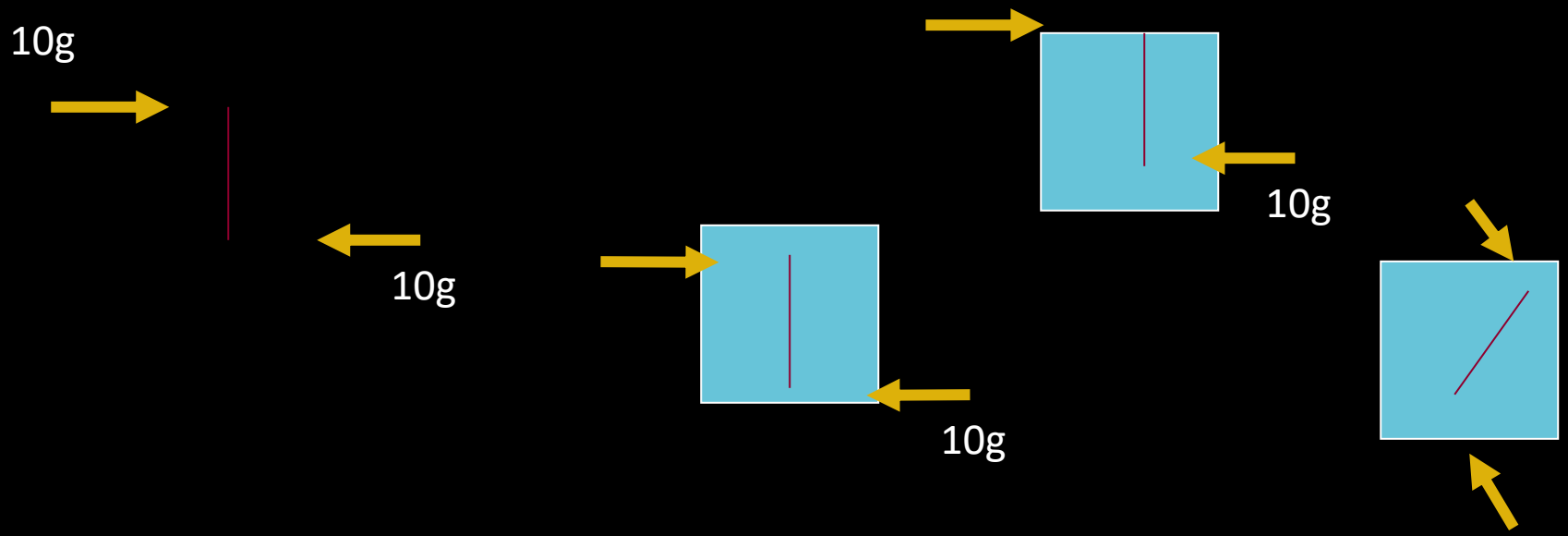
- To complete the description of a force
  - need to define it in relation to the centre or resistance of the tooth
- Burstone –from apex usually 2/3 root and just above furcation on molars

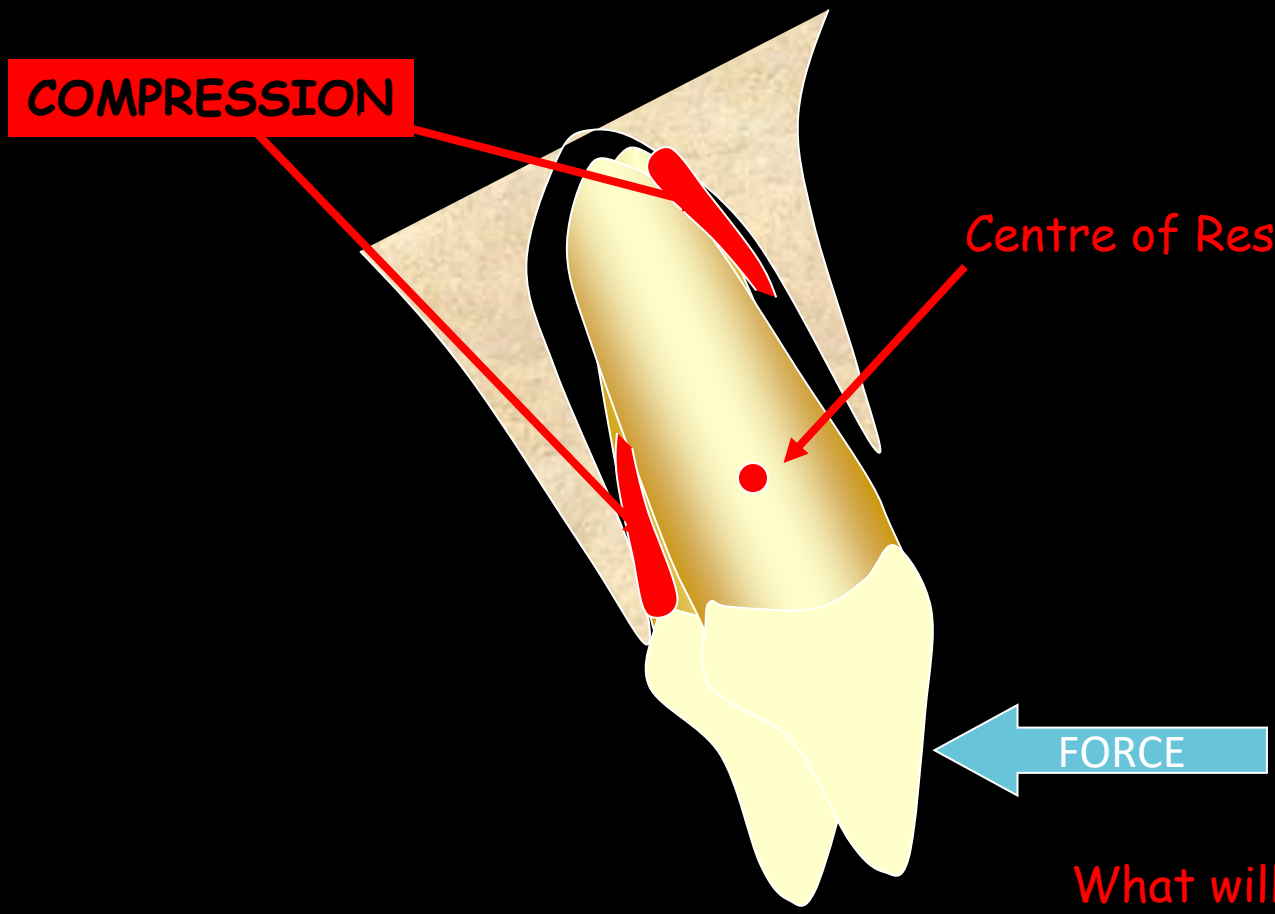


- Moment = Tendency to rotate

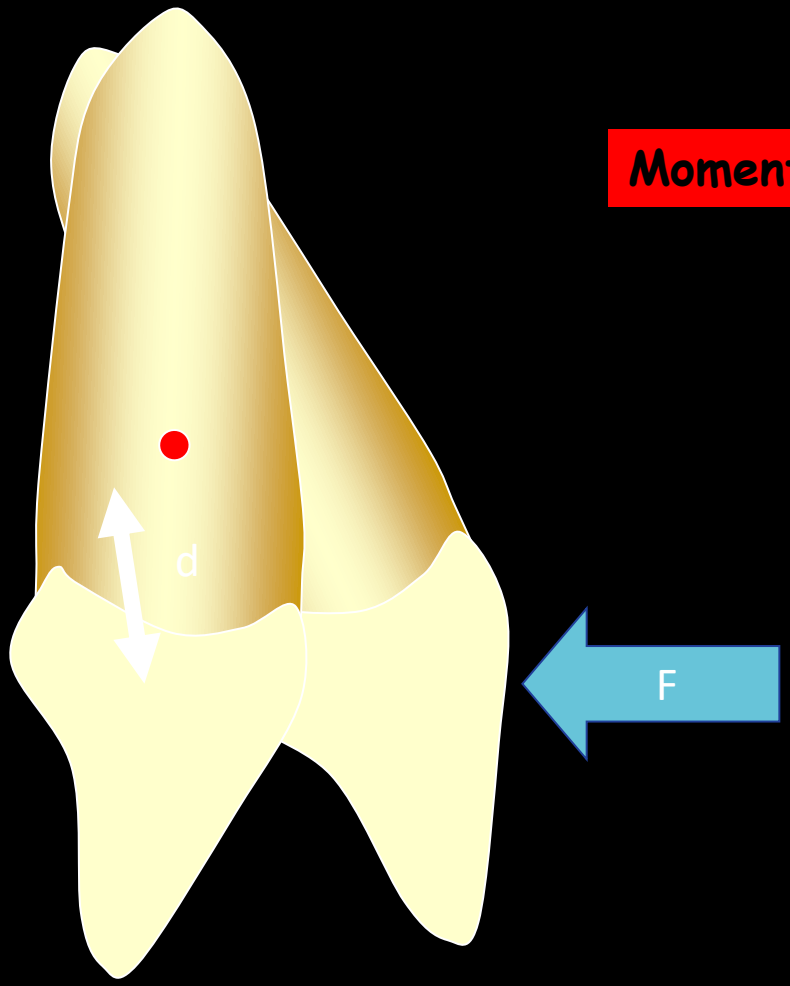


- Couple = Two equal and opposite, non colinear, parallel forces
  - Pure rotation around center of rotation (CR)





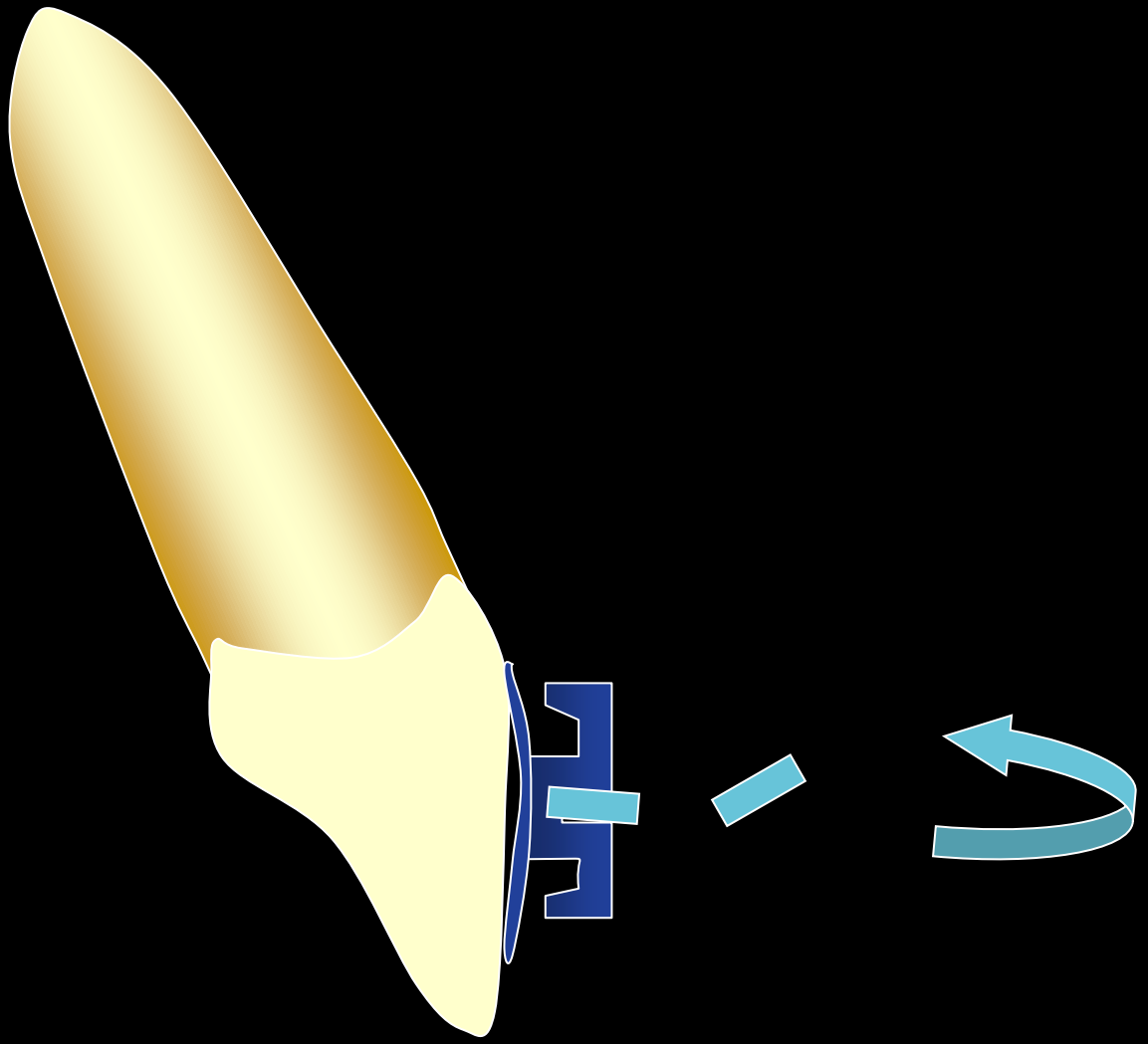
What will happen?



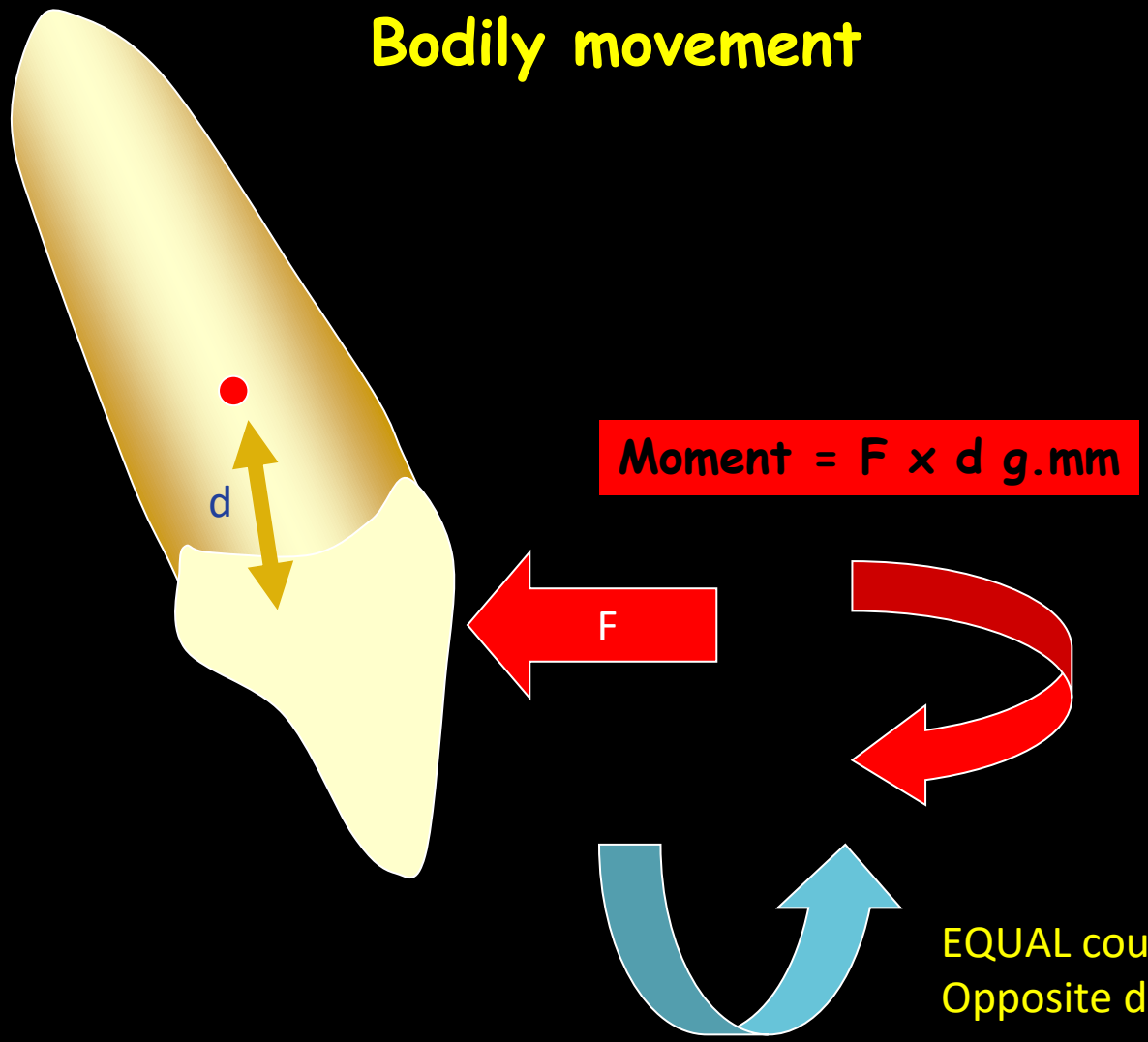
Moment = F x d g.mm

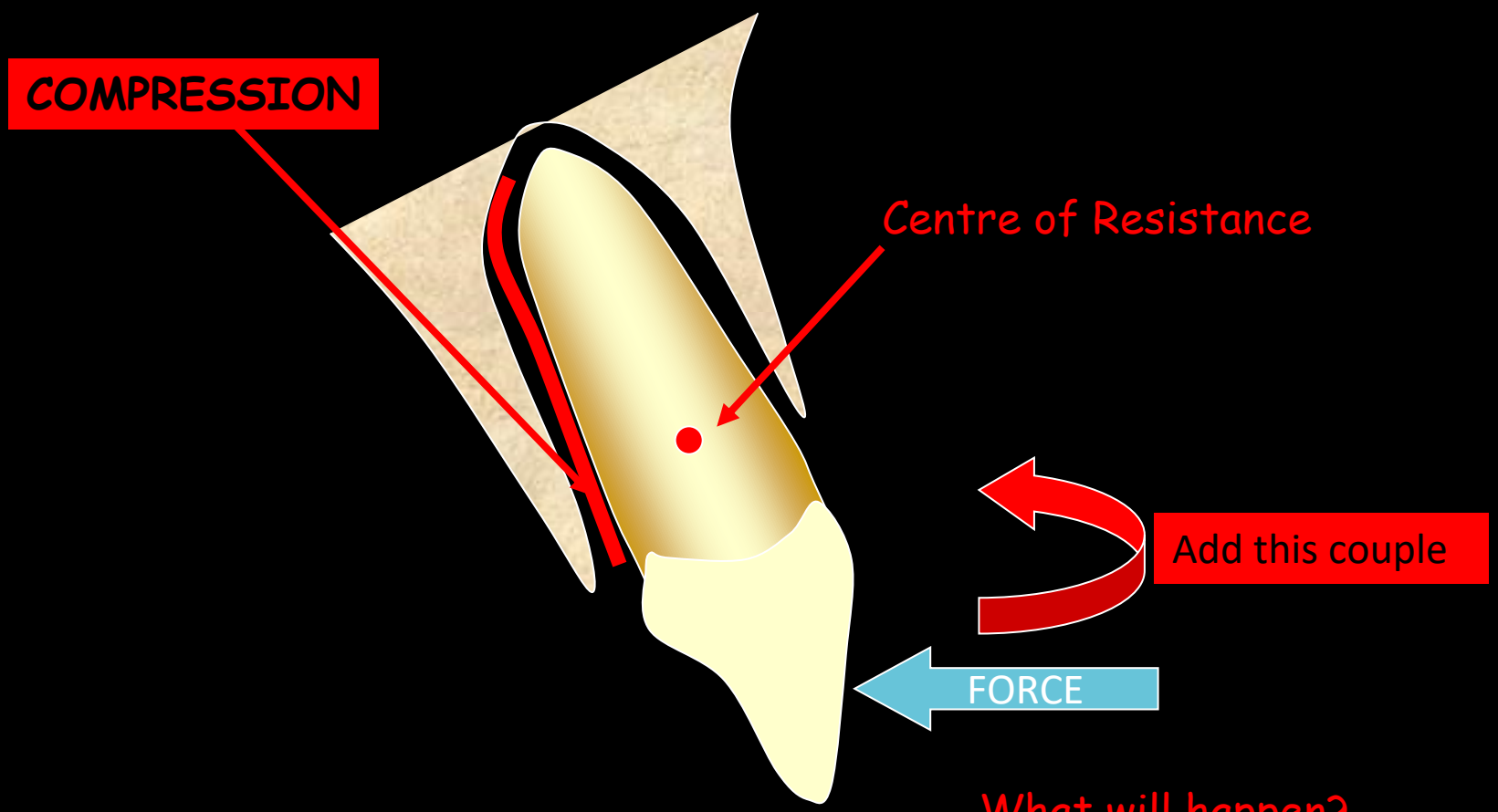
Uncontrolled Tipping

How do we apply couples?



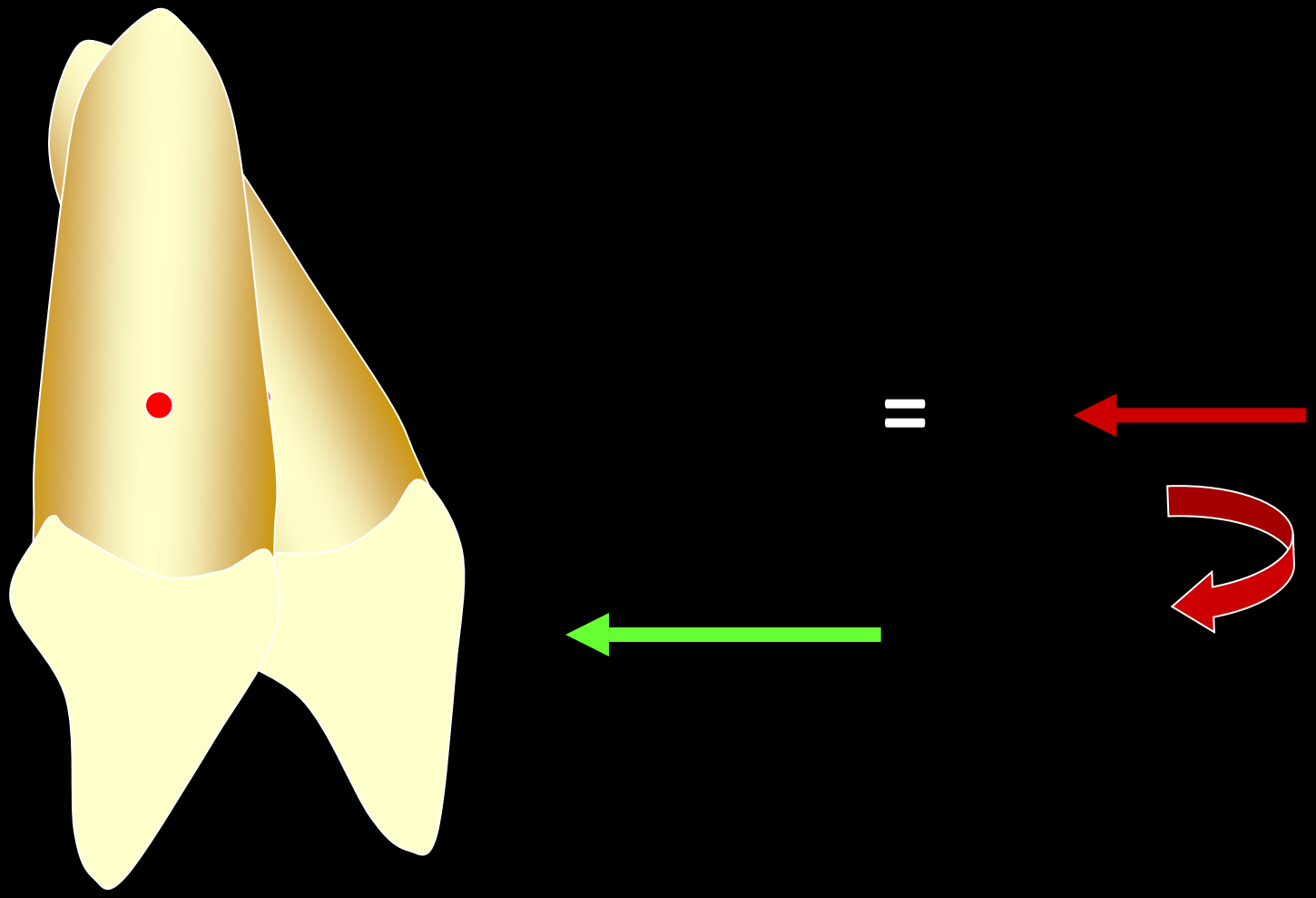
Bodily movement



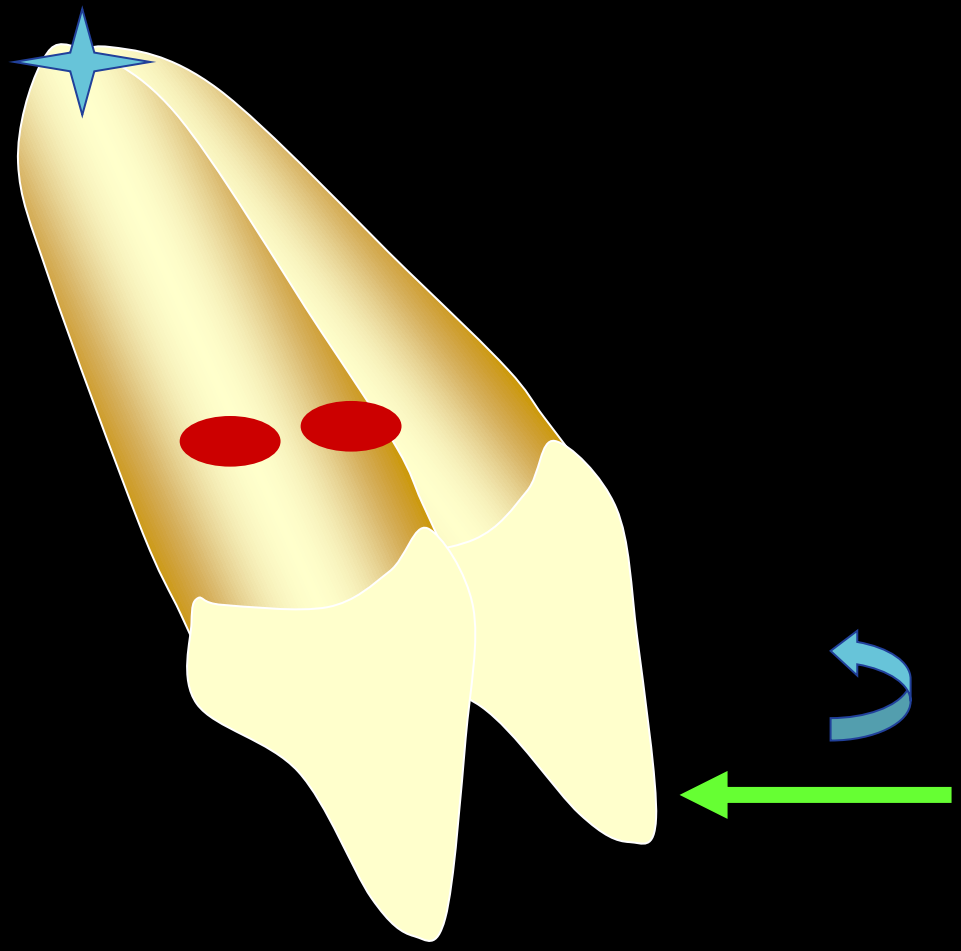

COMPRESSION
Centre of Resistance
Add this couple
FORCE
What will happen?

- Centre of Rotation
  - Another method to describe tooth movement

Uncontrolled Tipping

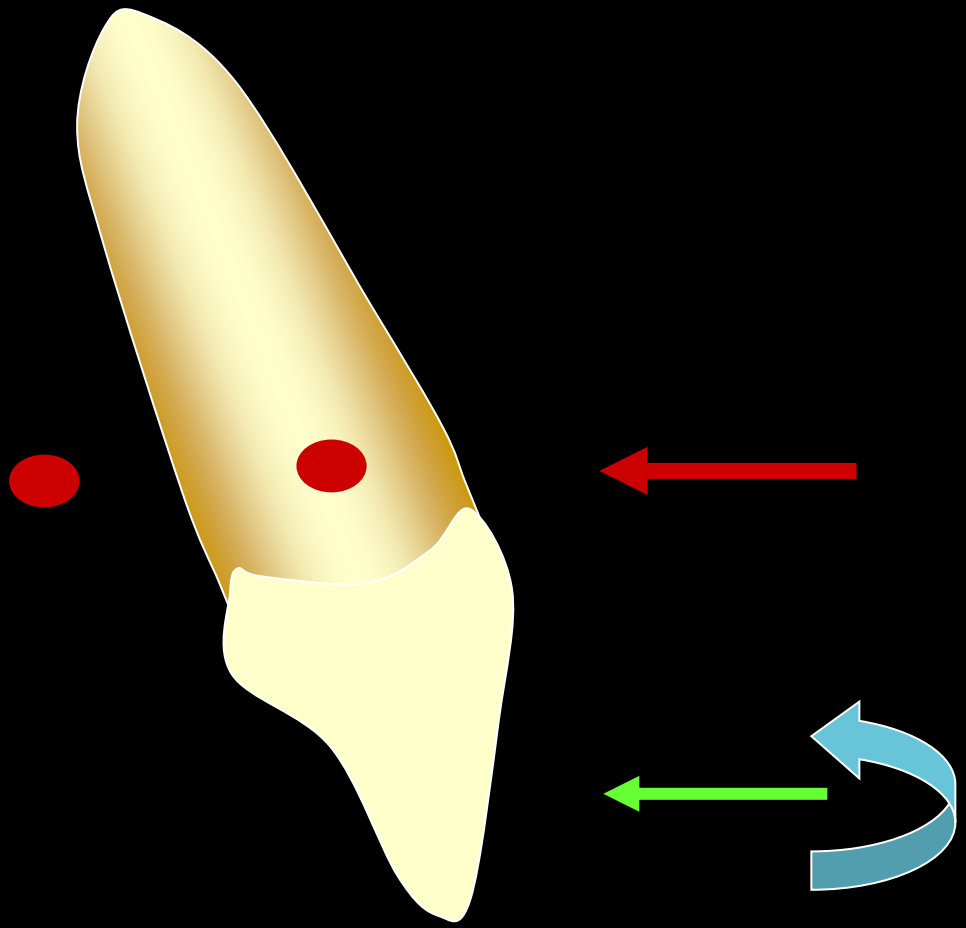


Controlled Tipping



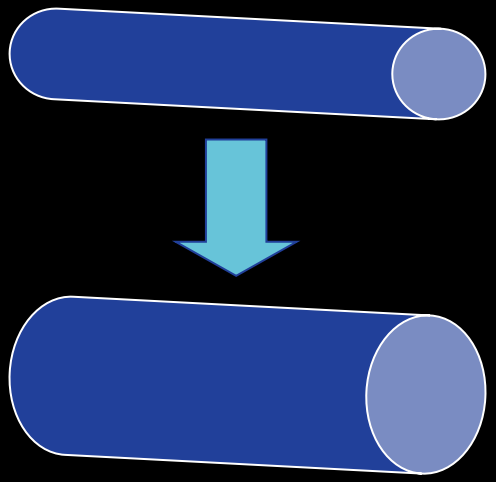
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Translation



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

- 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.

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- 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 3. Mechanical Principles in Controlling Orthodontic Force

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Be sure that you are able to:

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6. Demonstrate the relationship between wire size, strength, stiffness and the force produced for a given deflection.
7. Explain the difference between tipping and bodily tooth movement, and how an applied force can produc either.

DONE

Part 4. Orthodontic Anchorage and Controlled Tooth Movement

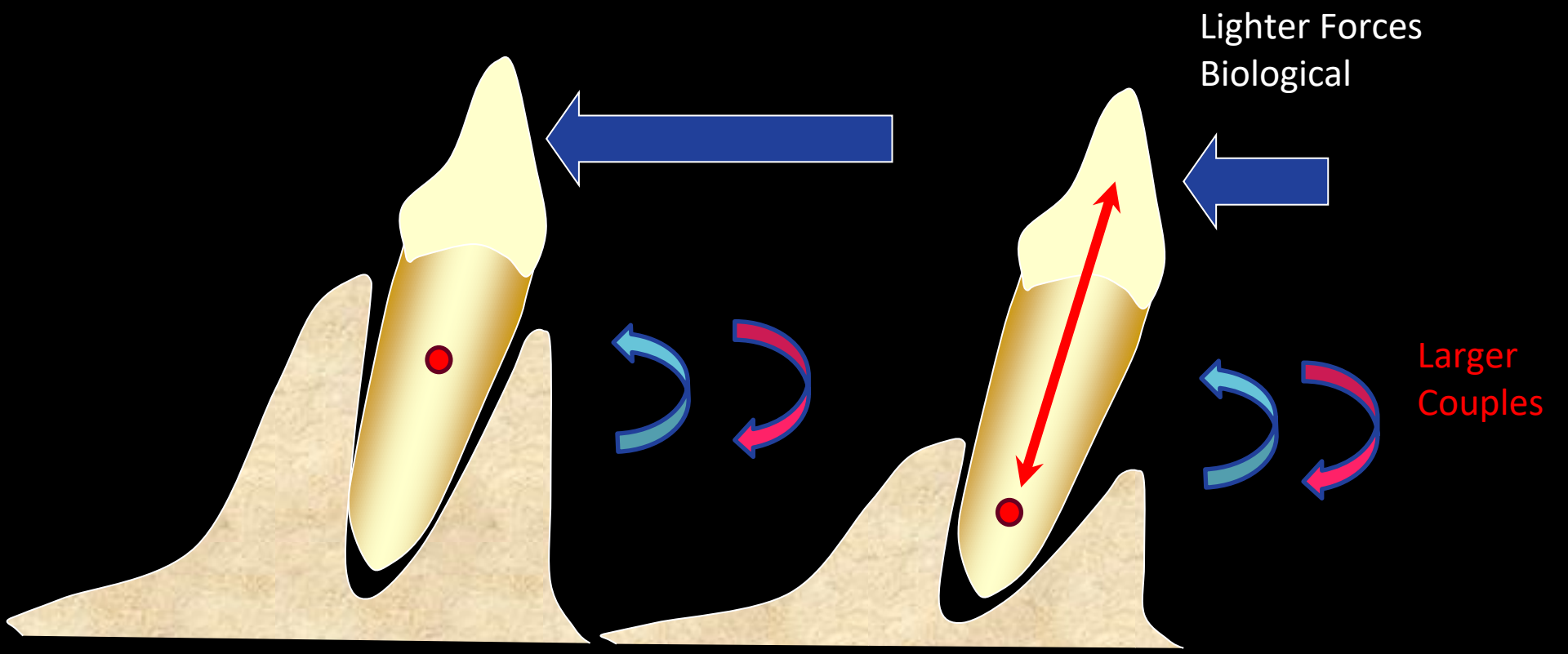
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Be sure that you are able to:

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 as 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).

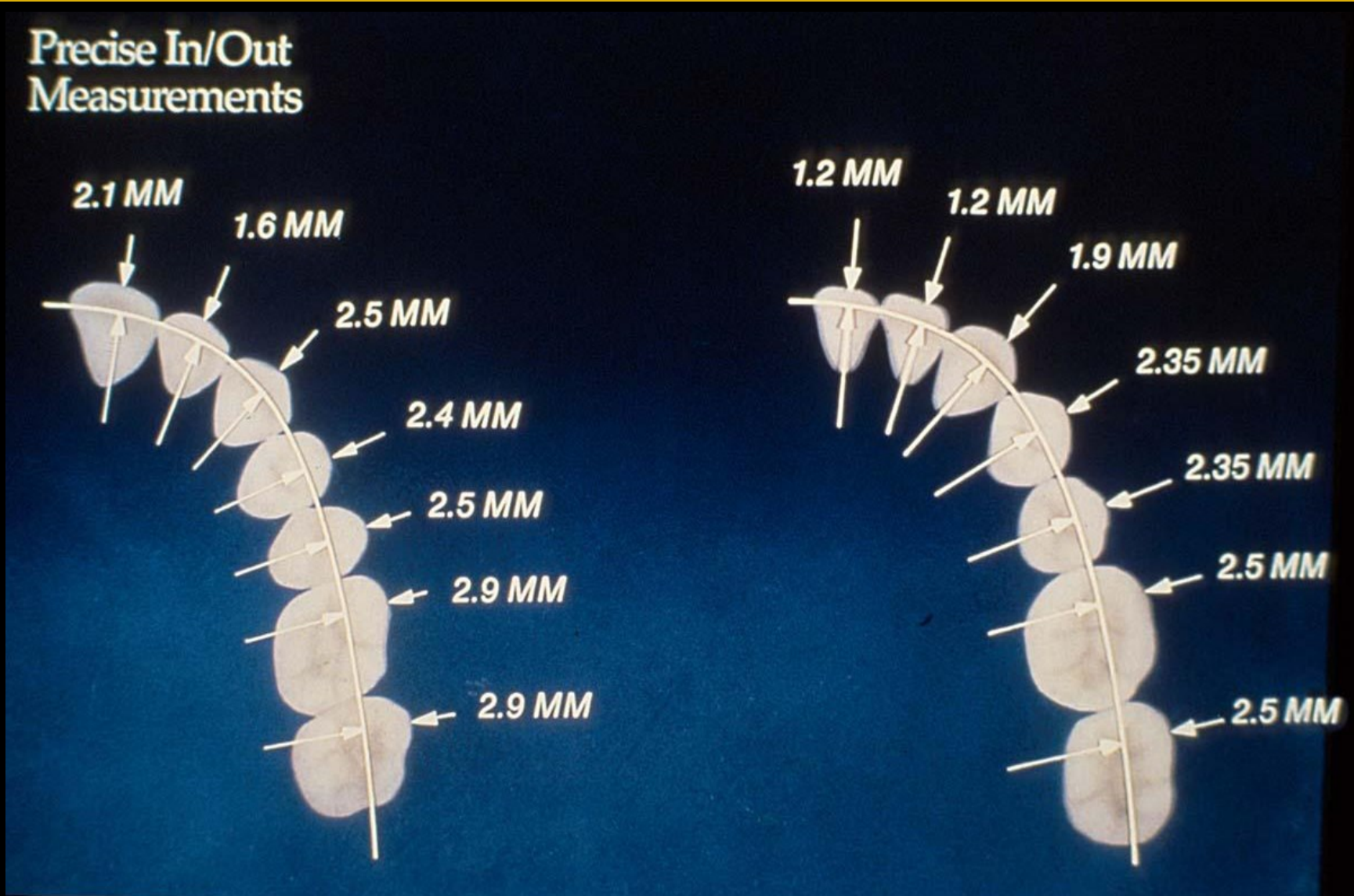


Design of the Staightwire Appliance

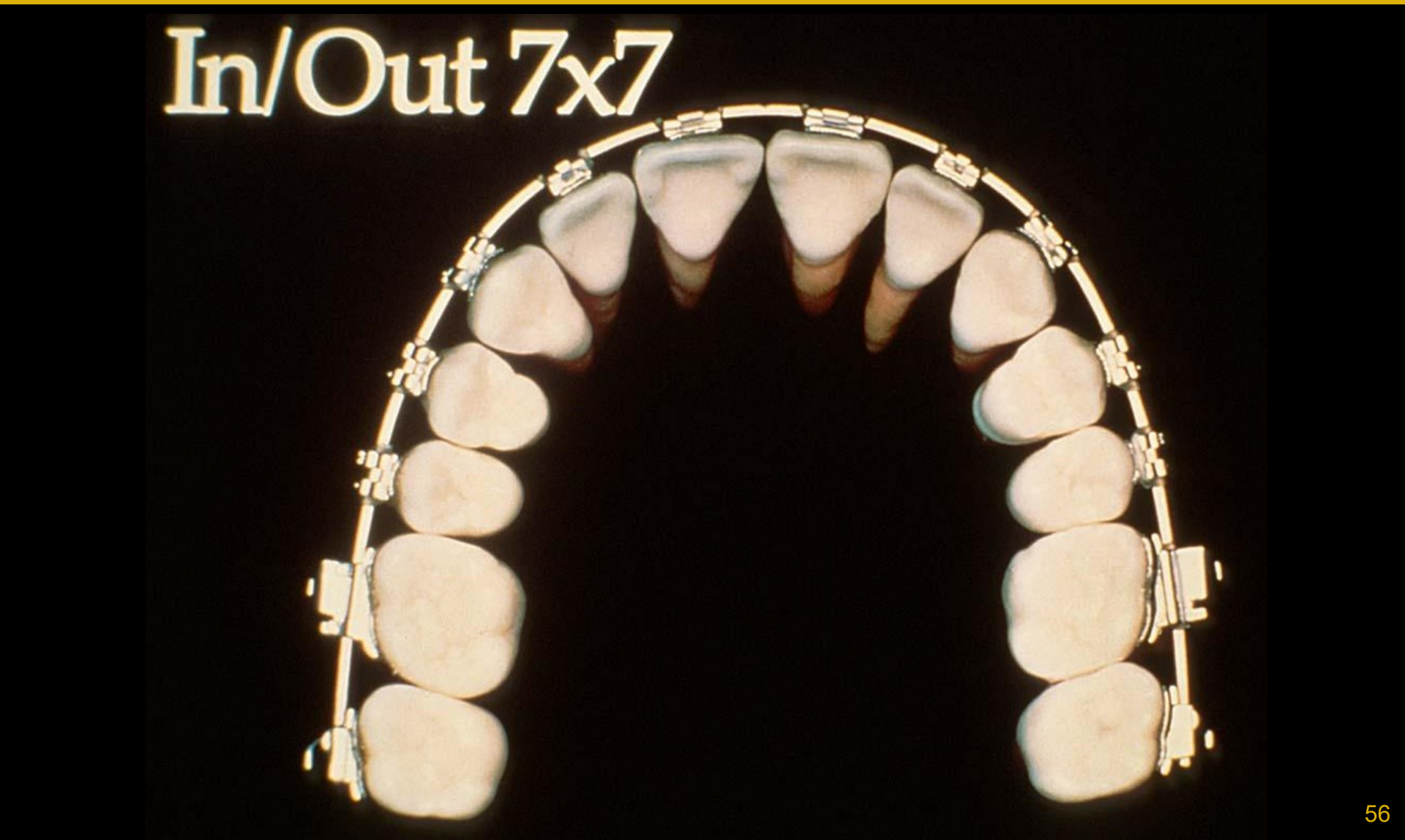
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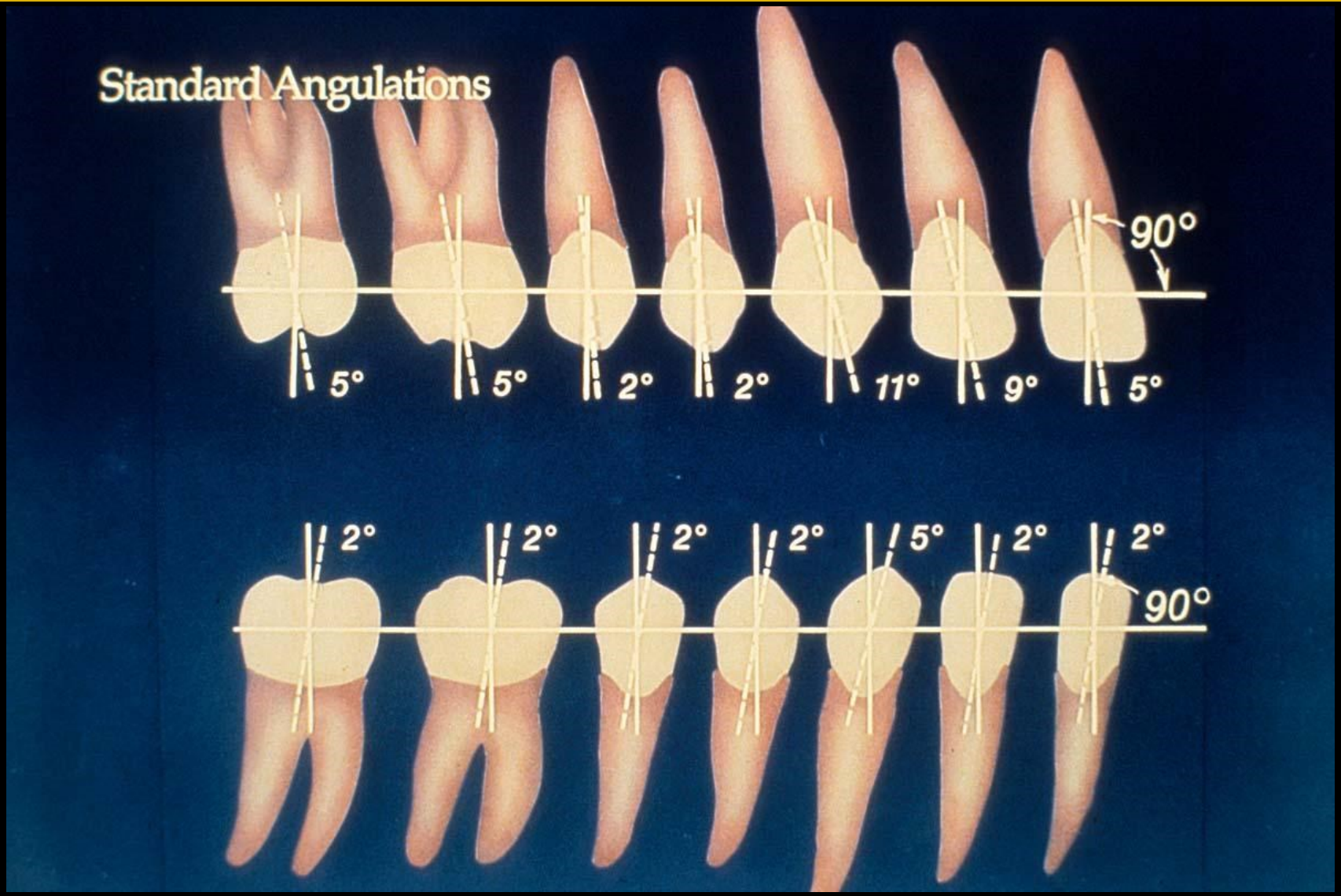
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4. Describe the adaptations in the contemporary edgewise appliance to reduce in-out (first order) bends in arch wires.

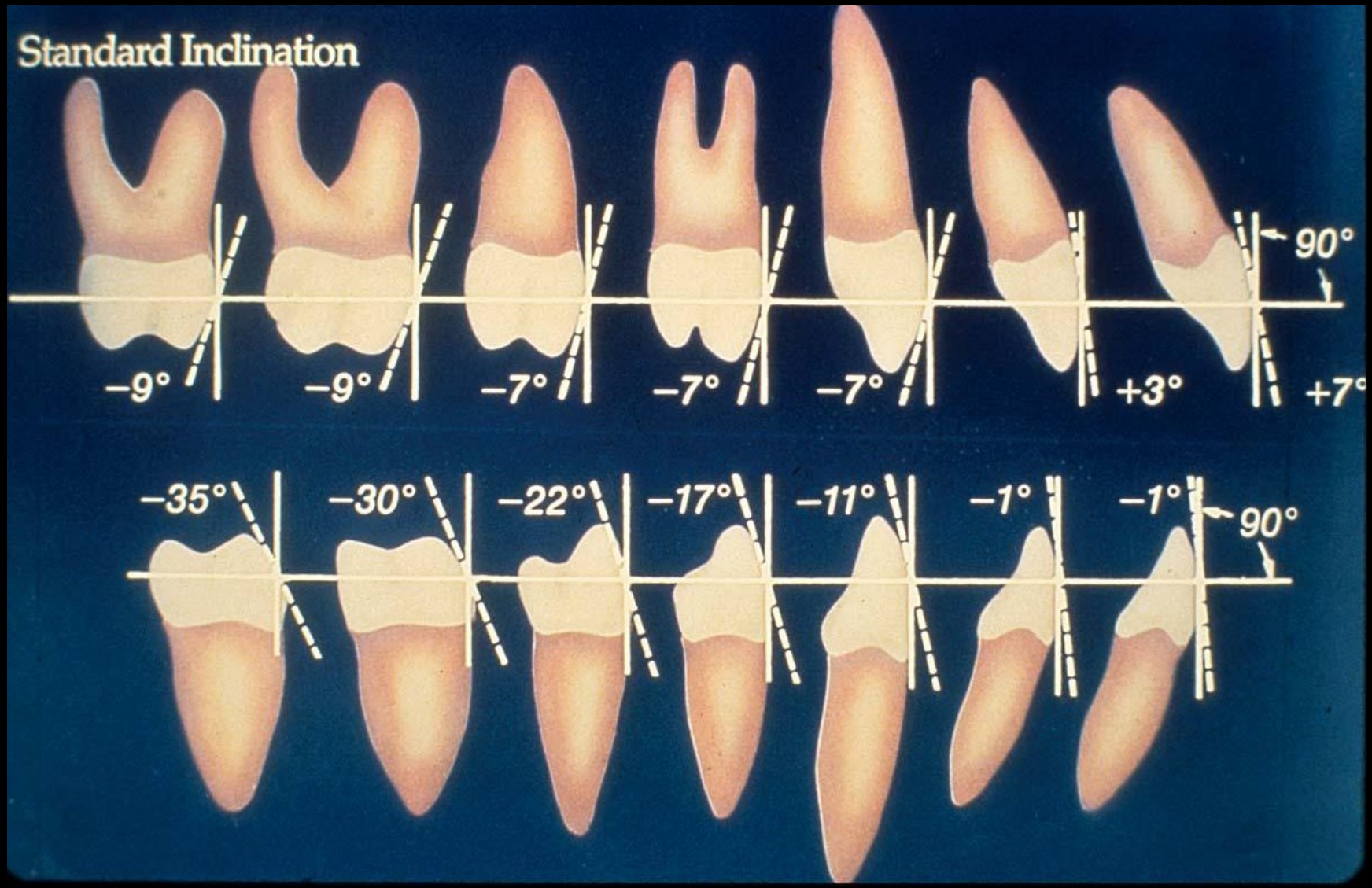


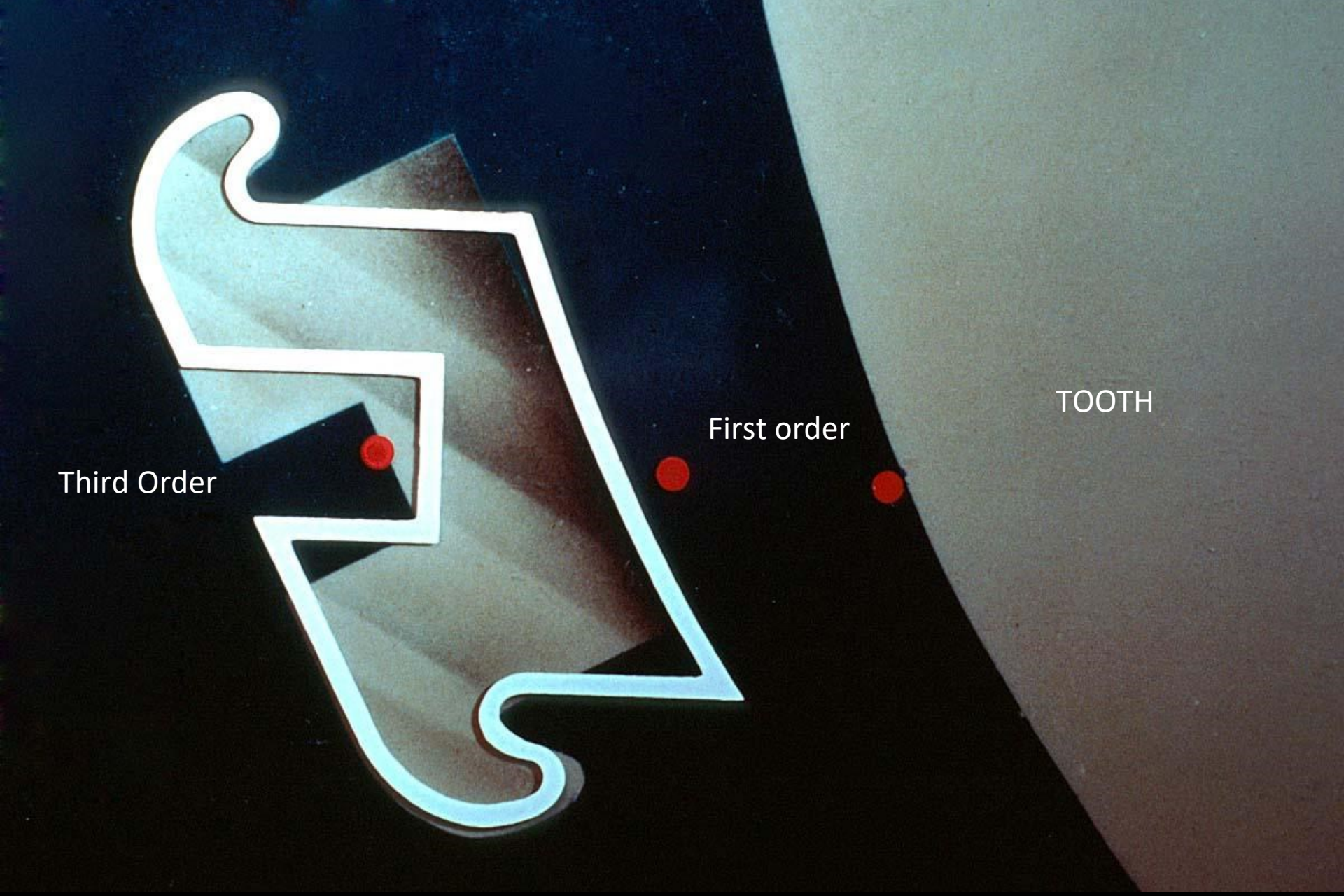
5. Describe the adaptations in the contemporary edgewise appliance to reduce angulation (second order) bends in arch wires.



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

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Third Order
First order
TOOTH