Complete Dentures - retention and stabilization

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Factors involved in complete dentures

- Retention – resistance to vertical dislodging forces
- Complete denture retention is, in part, influenced by denture occlusion.
- A bilaterally balanced denture occlusion is intended
- Stability – resistance to horizontal and rotational forces
- The biomechanical phenomena of support, stability, and retention.
- Physical, physiologic, and mechanical factors.
Physical forces - Retention

• Adhesion, cohesion, capillary attraction, surface tension, fluid viscosity, atmospheric pressure, and external forces imparted to the prostheses by oral-facial musculature.

• Interfacial surface tension associated with the saliva layer between the denture base and supporting soft tissues is quite important. This is particularly true for maxillary prostheses. Retention is realized as this saliva layer maximizes contact with approximating prosthetic and mucosal surfaces. Therefore, xerostomic patients who experience a quantitative or qualitative reduction in saliva may have reduced complete denture retention due to decreased interfacial surface tension.
Complete Dentures

- Retention
- Stability
- Support
- Esthetic
- Reservation of remaining structures
Dislodging Forces

- Mastication
- Food adhesiveness
- Gravity
- Occlusion
- Surrounded musculature
- Parafunctional habits
Factors affecting retention

Primary
- Mechanical
- Physical

Secondary
- Muscular
- Anatomical
- Physiological
- Surgical
- Psychological
FACTORS AFFECTING DEGREE OF RETENTION

- **Primary retention**
  - physical means
  - mechanical means

- **Secondary retention**
  - surrounding musculature
  - shape of the denture borders & flanges
  - psychological factors
  - proper instructions
Adhesion

- It is the physical attraction of unlike molecules
- It acts between saliva and denture base to the mucous membrane of basal seat
Adhesion and Cohesion in water
# Factors for quality adhesion

<table>
<thead>
<tr>
<th>Adaptation</th>
<th>Type of saliva</th>
<th>Direction of displaces forces</th>
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<tbody>
<tr>
<td>• Closed to denture</td>
<td>• Size of Denture bearing area</td>
<td>• Horizontal</td>
</tr>
<tr>
<td>• Full adaptation</td>
<td>• Hyper or Hypo salivation</td>
<td>• Vertical</td>
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<td>• Rotational</td>
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Capillary penetration in porous media shares its dynamic mechanism with flow in hollow tubes, as both processes are resisted by viscous forces. Consequently, a common apparatus used to demonstrate the phenomenon is the capillary tube. When the lower end of a glass tube is placed in a liquid, such as water, a concave meniscus forms. Adhesion occurs between the fluid and the solid inner wall pulling the liquid column along until there is a sufficient mass of liquid for gravitational forces to overcome these intermolecular forces. The contact length (around the edge) between the top of the liquid column and the tube is proportional to the radius of the tube, while the weight of the liquid column is proportional to the square of the tube's radius. So, a narrow tube will draw a liquid column along further than a wider tube will, given that the inner water molecules cohere sufficiently to the outer ones.

Capillary action (sometimes capillarity, capillary motion, capillary effect, or wicking) is the ability of a liquid to flow in narrow spaces without the assistance of, or even in opposition to, external forces like gravity.
Capillary attraction

Step 2: Capillary action

- **Cohesion**: polar water molecules tend to stick together with hydrogen bonds.
- **Adhesion**: water molecules tend to stick to polar surfaces.

[Diagram showing capillary action]
Principles of Support, Retention and Stability of Complete Dentures

Retention in complete dentures refer to the ability of that denture to resist displacement in a direction opposite the path of insertion. Vertical forces are involved in retention e.g. sticky food, gravity, chewing action and oral musculature. Tongue, cheeks etc. Retention in complete dentures can be primary or secondary. Primary retention involve both physical and mechanical means.
Principles of Support, Retention and Stability of Complete Dentures

- Primary retention · Physical forces · Cohesion · Adhesion · Interfacial surface tension · Capillarity · Atmospheric pressure · Gravity

- Adhesion · Force of attraction between two unlike molecules · Denture-saliva-mucosa · Cohesion · Force of attraction between two molecules of the same type · Molecules of saliva; force between them maintain its continuity enhancing retention.
1. Interfacial surface tension: Force between two parallel surfaces separated by a thin film of liquid. Saliva act as a separating media between denture flanges and the mucosa. A concave meniscus is formed between saliva and air reducing their pressure on that side. When denture sits on that side an intimate contact is formed. This contribute to the retention of the denture.

2. Capillarity action: When the space between the denture and mucosa is narrow enough it act as a tube that sucks saliva and distributes it throughout the denture bearing area increasing retention. Gravity: Beneficial for mandibular denture but may be detrimental for the upper denture.
Principles of Support, Retention and Stability of Complete Dentures

- Atmospheric pressure - Suction effect. When a force is exerted perpendicular and away from fully seated denture the pressure between the denture and the mucosa falls below the ambient pressure resisting displacement. Proportional to the size of the denture bearing area.
- Good fit, bolder molding and good impression must be ensured.

- Muscular forces harmony must be created between the denture and the oral musculature. Tongue frenal relieve mylohyoid, buccinators masticatory muscles play a role. Denture must be well polished. Depend on the ability of the patient to adapt to the new prosthesis.
- Secondary retention
- Indirect retention obtained when stability and support of the denture is optimum i.e. when other forces which tend to unseat the denture are eliminated.
Factors affecting physical forces: Saliva. Quantity and quality: xerostomia? excessive salivation? type of saliva? Surface area. The greater the surface area the better the retention.

Peripheral seal: Good peripheral seal improves retention; good bolder molding posterior seal and peripheral seal prevent air entry into the denture and denture bearing area.

Intimacy of contact: the closer the denture and the denture bearing area are the better the retention.
Stability is affected by: Residual ridge size and contour, Residual ridge quality, Palatal vault, Neutral zone and surrounding musculature, Abnormal ridge relationships, Occlusal factors, Intimate contact, Direct bone anchorage, Flange shape and contour.

STABILITY: The ability of a prosthesis to resist displacement by functional horizontal or rotational forces.
Sources of support All denture bearing areas, Maxilla - hard palate, maxillary tuberosity, residual alveolar ridge, Mandible - buccal shelf, residual alveolar ridge. Thus impressions must cover as much area as possible, with relief of the limiting structures.

SUPPORT - Resistance to vertical movement or displacement of the dentures towards the basal seat area.
Retention and Stabilization by Biomechanical approaches and means

Factors
Anatomical retention

- Denture Baseplate
- Bearing Area
- Parallel ridge walls
Physiological and muscular retention

Physiological
- Saliva

Muscular
- Oral musculature
- Facial musculature
Retention

Physical
- Adhesion
- Cohesion
- Interfacial surface
- Tension
- Capillarity
- Atmospheric pressure
- Gravity

Mechanical
- Undercuts
- Retentive springs
- Magnetic forces
- Denture Adhesives
- Suction Chamber or Disk
- Implants
modifications in areas of support (natural dentition vs. complete denture); (2) functional and parafunctional considerations; (3) changes in morphologic face height, and temporomandibular joint (TMJ); and (4) cosmetic changes and adaptive responses.

The clinical implications of an edentulous stomatognathic system are considered under the following factors:
Modifications in areas of support (natural dentition vs. complete denture)

- Support mechanism for the natural dentition
- Soft Connected Tissues
- Occlusal forces
- Reflex mechanisms
- Muscles, tendons, joints
<table>
<thead>
<tr>
<th>Category</th>
<th>Retention Options</th>
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| Mechanical approach       | • Laminar coil springs  
                            | • Heavy metals application - amalgam                   |
| Anatomical retention      | • Hard Palate Arch  
                            | • Alveolar ridges                                     |
| Biomechanical retention   | • Pelota                                                  |
                            | • sub periosteal and intercostal implants              |
Biophysical approaches and means for retention and Complete Dentures Stabilization
Atmospheric pressure, vacuum, adhesion, cohesion, surface tension, viscosity, base adaption, border seal, seating force and muscular control have all been cited at one time or another as major or contributory factors, but usually as an opinion without proper reference to fundamental principles.
Suction retention
Liquid and capillary pressure

\[ p_{at} + \Delta p \]

\[ p_{at} - \Delta p \]
Surface Tension

- Buccal tissue compliance
- Narrow space for viscous flow
- Surface tension
- Lowered pressure
Viscosity
Base Adaptation
Seating force
Border seal
Radiated lines on baseplate
Thank you very much for your attention.