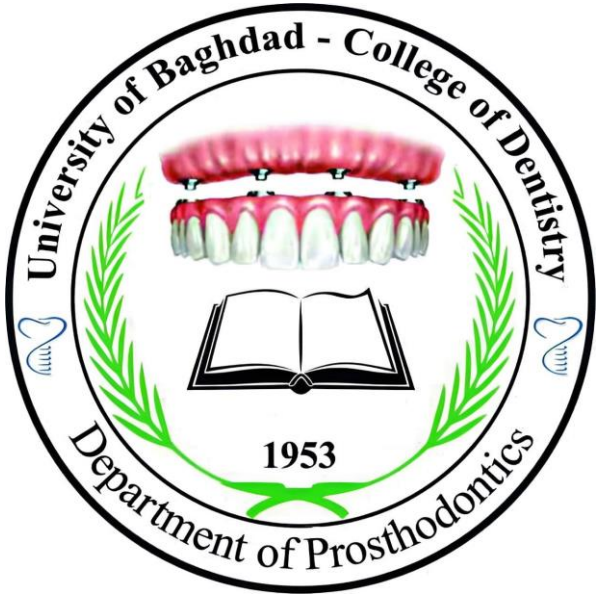
Magnetic Attachment Used in Tooth-Supported Overdentures



LEC. MOAMIN I. ISSA

The Need for Magnetic Attachments

Enhancing Denture Stability

- Traditional challenges with complete dentures (stability, retention).
- The role of magnetic attachments in addressing these challenges.
- Particularly beneficial for patients with advanced alveolar bone resorption.
- Initial attempts in the 1930s.

Components of Magnetic Attachment Systems

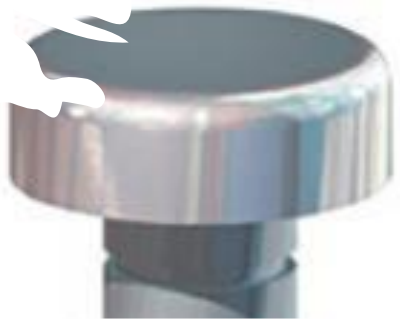
- **Magnet:** Typically Cobalt-Samarium (Co5Sm) embedded in the denture base.
- **Keeper:** Platinum-Cobalt-Nickel alloy positioned on the root/implant (can be magnetized).
- **Soft-Magnetic Shield:** Helps contain the magnetic field.
- **Non-Magnetic Seal:** Provides protection.


Magnet


Keeper

Components of Magnetic Attachment Systems

- Magnet
- Keeper
- Soft-Magnetic Shield
- Non-Magnetic Seal



Historical Overview of Magnetic Materials

- Early use of "AlNiCo" (Aluminum, Nickel, Cobalt) magnets (Winkler and Pearson, 1967).
- Transition to Cobalt-Samarium (Co5Sm) magnets (late 1960s).
- Introduction of Neodymium-Ferrum-Boron (NdFeB) alloys (early 1980s).

Historical Overview of Magnetic Materials

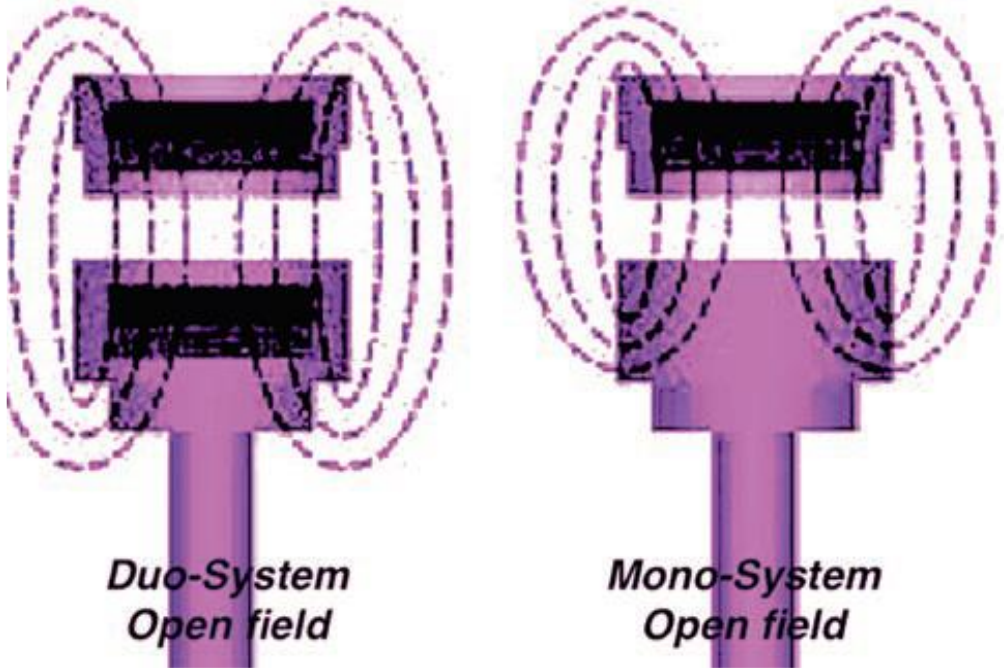
- With the invention of the rare earth elements such as Samarium (Sm-Co) and Neodymium (NdFeB), new magnetic systems were developed in prosthodontic applications.

- Rare earth alloys are more retentive compared to the old ones due to high magnetism and resistance to diamagnetism features.

Two Main Types of Magnetic Attachment

Open field

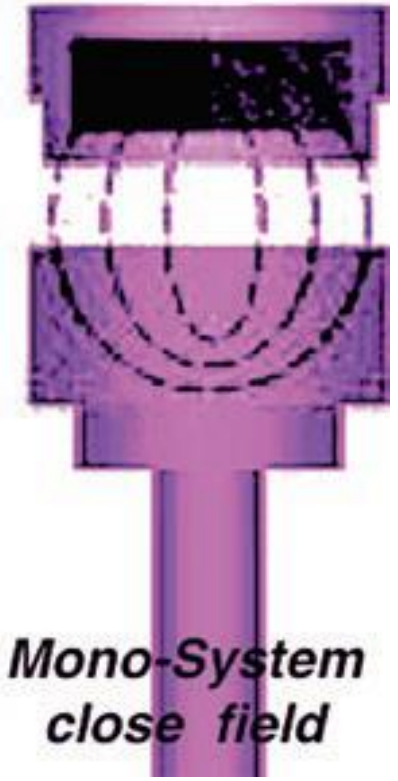
- Magnetic lines of flux pass through various materials.
- Earlier type of magnet used for overdenture retention.
- Lateral field reduction with ferromagnetic end plates/keepers.



Two Main Types of Magnetic Attachment

Closed-field

- Magnetic field contained within the magnet-keeper unit.
- Higher attractive force per unit size.
- Less resistance to magnetic force within the system.
- Newer, more common type.
- Reduced external magnetic flow fields.
- Generally more biocompatible (less cytotoxic).
- Stronger magnetic circuit.



Factors Affecting Retention

Keeper's Thickness:

- Optimal retention around 1.2 mm for stainless steel.
- Increased thickness reduces retention and placement ease on root surface.

Factors Affecting Retention

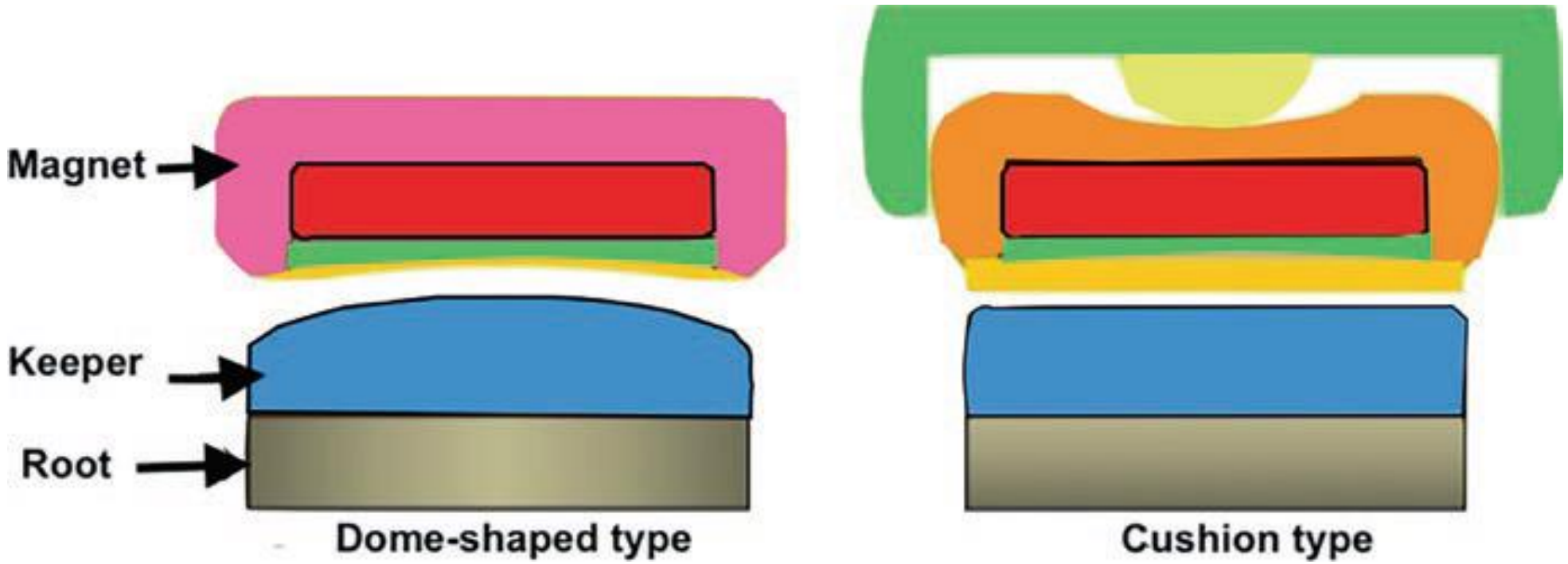
Air Space:

- Attractive forces remain even with a gap (open-field).
- Gap needed for magnetic change transmission through keepers (optimal around 0.8 mm).
- Large gaps in closed-field systems significantly decrease attraction.
- Closed-field attraction decreases dramatically with even a small gap.

Factors Affecting Retention

Magnet size and shape:

- Larger sm-co magnets increase attractive force
- Neodymium magnets offer even greater attractive force
- Flat type: high retention force.
- Cushion type: shock-absorbing effect, less retentive in oblique directions, permits vertical movement.
- Dome type: less attractive force than flat, but less decrease in non-axial forces, allows lateral movement.


Magnet
Keeper
Root
Dome-shaped type
Cushion type

Factors Affecting Retention

- **Corrosion:**
  - Early magnets susceptible to corrosion from oral fluids and wear.
  - Corrosion-resistant materials (ferrite/austenite stainless steel) now used.
  - Protective coatings and thicknesses to maintain magnetic force.
  - Modern attachments are now corrosion-resistant.

Factors Affecting Retention

- **Laser-Welded Yoke Encasement:**
  - Technique developed in the 1990s for corrosion protection
  - Magnet sealed in a stainless steel "yoke" via laser welding

Advantages of Magnetic Attachments

- They take a small area in overdentures.

- The magnetic force works parallelly with the denture's adhesion force and negative Forces.

- It offers more stabilization and retention compared to traditional partial dentures.

- Easily applied without any unique technique.

Advantages of Magnetic Attachments

- Offers more accessible inlet and outlet to the denture.
- Reduces lateral forces in supporting teeth.
- Simply offers better oral hygiene due to a smaller retention area for dental Biofilm.
- Since it is a simple technique, it is quite useful for geriatric and disabled patients.

Disadvantages of Magnetic Attachments

- Retention loss caused by corrosion and heat exchange.
- Hard to repair.
- Expensive.
- Limited use of forces since the magnets only affect where they are located.
- Weak corrosive resistance of magnets within the oral fluid requires encapsulation within a relatively inert alloy such as stainless steel or titanium.
- They do not provide a positive locking device. Thus, the retention provided is generally less compared to intra-radicular retention systems.

- ***Magnetic resonance imaging (MRI) and magnets***

Magnets and ferromagnetic keepers can cause distortion and artifacts in head/neck MRI.

Recommendation: Remove magnetic dentures and unscrew keepers before MRI.

Minimal risk of patient injury due to keeper displacement during MRI Unscerw from implants.


Thank you