To splint or not to splint?
A review and application of current splinting protocols

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OUTLINE
- Biological consequences of dental trauma
- Aims of splinting
- Properties of splinting material
- Decision-making for splinting
  - Indications
  - Duration
  - Type of dental trauma
  - How to reposition and splint

GINGIVAL AND PERIODONTAL HEALING:
Gingival tissues: development of new junctional epithelium and connective tissue fibre union occurs as early as 7 days

Periodontal Ligament:
- Necrotic PDL and cementum removed by phagocytes
- PDL union begins 4-7 days post trauma
- PDL heals and regains 50-60% mechanical strength by 14 days
- Complete healing occurs 8 weeks post trauma

ALVEOLAR BONE HEALING FOLLOWING TRAUMA:
Alveolar bone
- Loss of blood supply
- Loss of innermost layer of periodontium

Stages of healing:
1. Coagulation
2. Granulation tissues formation and osteoblast differentiation by day 7
3. Connective tissues formation by day 20
4. Bone development and marrow formation by day 38
5. Bone remodelling and maturation by 2-4 months
(Evian et al 1982, Simpson 1969)

AIMS OF SPLINTING:
Maintain the repositioned tooth in correct position, provide patient comfort and improved function.
(Honório et al 2015)
To splint or not to splint

Dental splint

noun:

1. A rigid device used to prevent motion of a joint or the ends of a fractured bone.
2. A dental appliance put on the teeth to protect them from riding or from moving out of place


SPLINT MATERIAL

Desirable properties of a splint - biological consideration

- Physiological healing
- Stabilises the repositioned tooth
- Adequate fixation
- Non irritating to the soft tissues, periodontal tissues and non -cariogenic
- Cause no damage upon placement and removal
- Not exert orthodontic forces on splinted teeth

Desirable properties of a splint - chairside management

- Easy application
- Readily available
- Cause minimal damage to tooth structure upon removal
- Allows for pulp testing
- Allows for endodontic treatment
- Relatively inexpensive

Desirable properties of a splint - patient consideration

- Patient comfort
- No occlusal inference
- Aesthetic appearance
- Easy to access and maintain oral hygiene

TYPES AND EFFECT OF SPLINT MATERIAL AND THICKNESS:

Rigid
- Cervical root fractures, alveolar bone fractures
- Eg. stainless steel >0.5mm

Flexible device
- Allows for optimal pulp and periodontal ligament healing
- Eg. nylon, stainless steel, Nickel Titanium up to 0.016 (0.4mm)> direct composite splint

Compound
- Eg. Orthodontic bracket and wire

(Kwan et al 2012, Berthold et al 2009)
**SPLINT MATERIAL AND THICKNESS:**

**Rigid**
- Stainless steel wire > 0.016 (0.5mm), direct composite resin alone (e.g., ProTemp), Titanium Ring Splint

- Direct composite resin reinforced with fibreglass ribbon


**SPLINT MATERIAL AND THICKNESS:**

**Flexible**
- Nylon, stainless steel, Nickel Titanium up to 0.016 (0.4mm)

- Stainless steel wire < 0.016 with composite resin or GIC based cement

- Titanium Trauma Splint (TTS)

- Orthodontic bracket and wire


**TYPES OF DENTAL INJURIES:**

(a) Periodontal injury
- Concussion
- Subluxation
- Luxation (extrusion, intrusion, lateral)
- Avulsion

- An injury to the tooth-supporting structures without increased mobility or displacement of the tooth, but with pain to percussion.
- Splinting is not indicated

(dentaltraumaguide.org)

**(b) Tooth injury**
- Uncomplicated crown fracture
- Complicated crown fracture
- Root fracture

(Concussion)

(dentaltraumaguide.org)
**TYPES OF DENTAL INJURIES:**

(a) Periodontal injury
- Concussion
- Subluxation
- Luxation (extrusion, intrusion, lateral)
- Avulsion

Extrusive luxation
- Partial displacement of the tooth out of its socket; alveolar socket bone is intact.
- Stabilise with a flexible splint for 2-weeks

Intrusive luxation
- Displacement of the tooth into the alveolar bone.
- Accompanied by comminution or fracture of the alveolar socket
- Stabilise with a flexible splint for 4-6 weeks

**Clinical tips:**
- Splinting:
  - Avoid the risk of aspiration - protect airway
  - Avoid the risk of losing tooth - change suction tips
- Support the alveolar bone
- Aim to reposition to the same position as the contralateral tooth
- Confirm repositioning with a radiograph, incisor edge of adjacent teeth
- Stabilise with a flexible splint for 4-6 weeks

**Reposition with digital pressure**
**Apply acid etch on the labial surface**
**Light cure flowable composite resin**
Reposition with digital pressure

Apply acid etch on the labial surface

Light cure flowable composite resin

TYPES OF DENTAL INJURIES:

(a) Periodontal injury

- Concussion
- Subluxation
- Luxation (extrusion, intrusion, lateral)
- Avulsion

Lateral luxation

- Displacement of the tooth other than axially
- Accompanied by comminution or fracture of either the labial or the palatal/lingual alveolar bone
- Stabilise with a flexible splint for 4-weeks

Clinical tips:
- Support the alveolar bone
- May require extrusion prior to repositioning
- Confirm repositioning with a radiograph,
- Stabilise with a flexible splint for 4-weeks
Avulsion
• Tooth is completely displaced out of its socket.
• Stabilise with a flexible splint for 2-weeks

Avulsion
- Splinting:
  - Avoid the risk of aspiration - protect airway
  - Avoid the risk of losing tooth - change suction tips

Clinical tips:
- Support the alveolar bone
- Avoid applying excessive apical force
- Confirm repositioning with a radiograph, incisor edge of adjacent teeth
- Stabilise with a flexible splint for 2-weeks

(b) Tooth injury
- Uncomplicated crown fracture
- Complicated crown fracture
- Root fracture

Root fracture
- Fracture confined to the root
- Splinting not always indicated
- If splinting, then duration is dependent on level of fracture and degree of mobility

(c) Dentoalveolar fracture

Dental hard tissue injuries

(a) Periodontal injury
- Concussion
- Subluxation
- Luxation (extrusion, intrusion, lateral)
- Avulsion

Dentoalveolar fracture

(b) Tooth injury
- Uncomplicated crown fracture
- Complicated crown fracture
- Root fracture

Reposition with extraction forceps or digital pressure

Apply acid etch on the labial surface

Light cure flowable composite resin

Repositioned tooth

Apply acid etch on the labial surface

Light cure flowable composite resin
TYPES OF DENTAL INJURIES:

Root fracture

- Splinting:
  - Avoid the risk of aspiration - protect airway
  - Avoid the risk of losing tooth - change suction tips

Clinical tips:
- Support the alveolar bone
- Apply apical pressure
- Confirm repositioning with a radiograph, incisor edge of adjacent teeth
- Stabilise with a flexible splint for 1-4 months depending on the location of the root fracture

Dentoalveolar fracture

- A fracture of the alveolar process; may or may not involve the alveolar socket
- Splinting for 4 weeks

Clinical tips:
- Support the alveolar bone
- Apply digital pressure
- Confirm repositioning with a radiograph, incisor edge of adjacent teeth
- Stabilise with a splint for 4 weeks
- Extend splint only to adjacent teeth unless otherwise indicated clinically

Gingival tissues:
- reversible damage if periodontium was healthy prior to trauma
- Irritation or damage from splint can lead to soft tissue injury

Periodontal Ligament:
- Slight mobility during initial healing phase allows for physiological resorption of ankylosis sites in replanted teeth

Current evidence supports short-term, non-rigid splints:
- Luxated,
- Avulsed and
- Root fractured teeth

Healing prognosis related to type of injury rather than type or duration of splint

Trend towards improved periodontal healing following splinting for shorter periods


CONSIDERATIONS OF SPLINTING ON HEALING

SUMMARY:

Dental hard tissue injuries

(a) Periodontal injury
- Concussion
- Subluxation
- Luxation (extrusion, intrusion, lateral)
- Avulsion

(b) Tooth injury
- Uncomplicated crown fracture
- Complicated crown fracture
- Root fracture

(c) Dentoalveolar fracture

SUMMARY:

- Determine the type of dental trauma
- Periodontal injury: flexible splint for up to 2 weeks
- Tooth injury: splint where applicable
- Dentoalveolar injury: splint for 4 weeks

Type and duration of splint does not affect healing outcome following dental trauma

SUMMARY:

Clinical tips:
- Protect the airway
- Change suction tips
- If splinting, prebend wire and splint the injured tooth last
- Analgesics, oral hygiene and dietary advice
- Reappoint for appropriate review