Treatment planning for the lost permanent incisor(s) in adolescents

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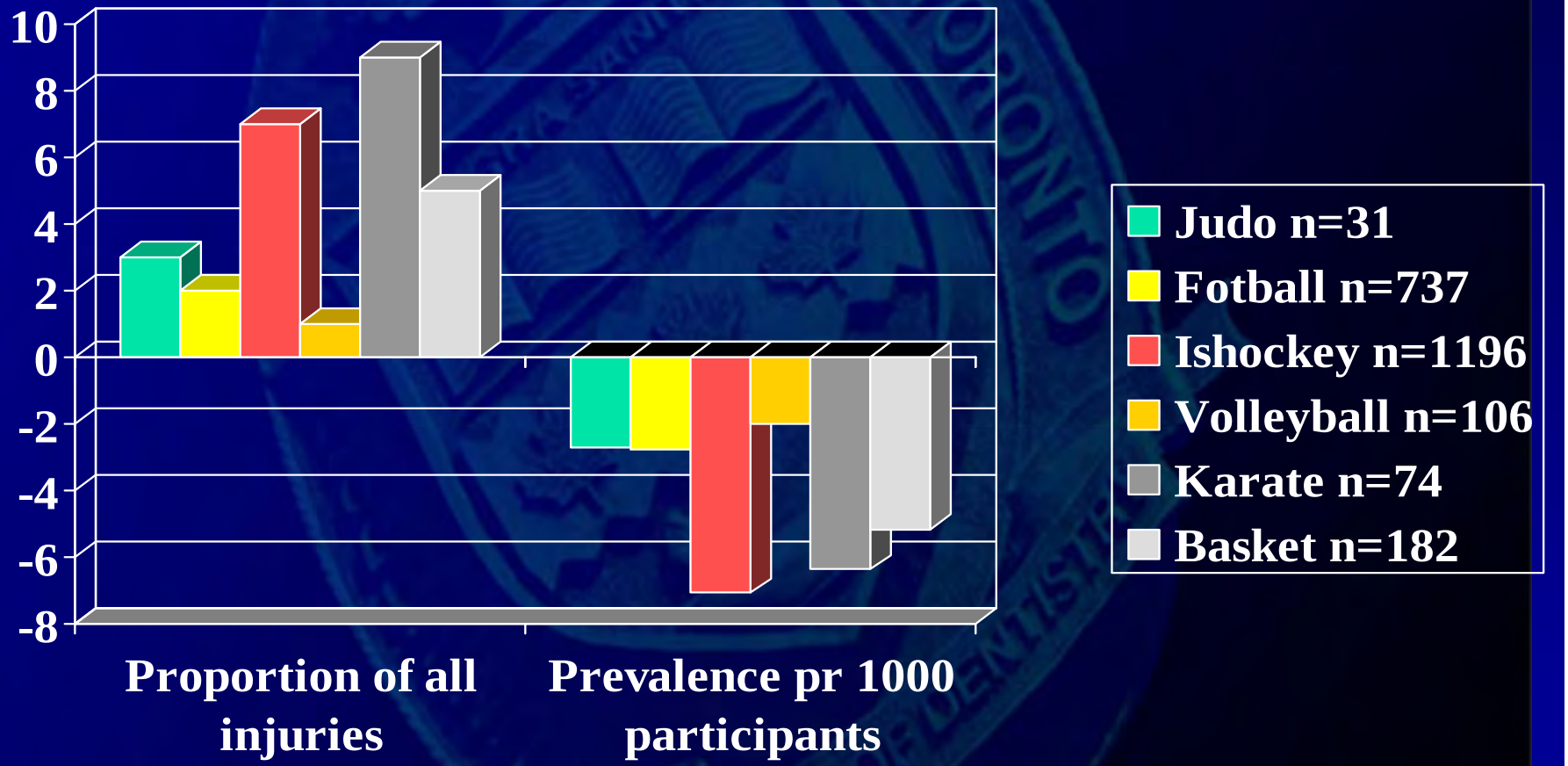
Faculty of Dentistry, University of Toronto

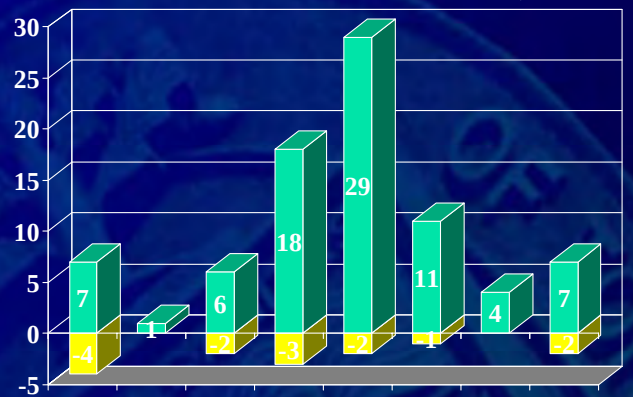
Dental injuries due to trauma in sports - Finland 1987-91 n=54186

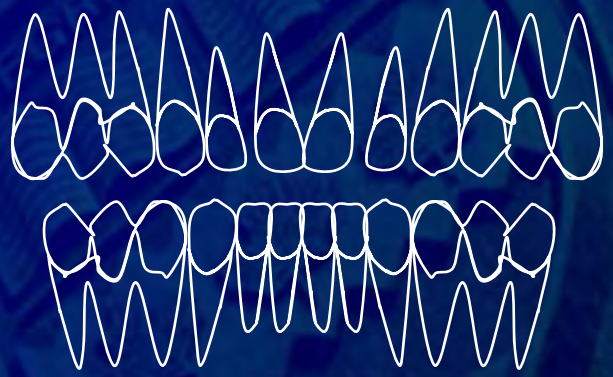


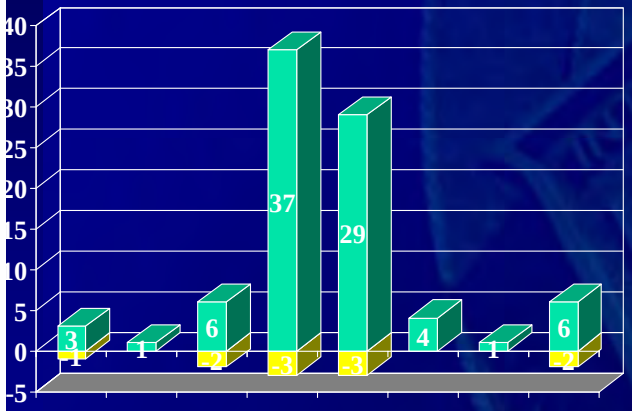
Kujala UM et al. Acute injuries in soccer, ice hockey, volleyball, basketball, judo, and karate: analysis of national registry data . BMJ *1995;311:1465-1468*

Tooth Injuries in Sports – Intra-oral location

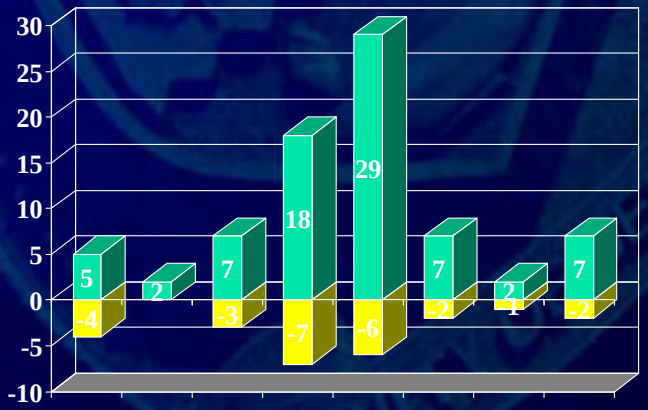
Football, 1979 (n=223)







Basket, 1989-92 (n=273)



Football, 1982 (n=258)

Source: Nysether, S. U. Oslo, 1985

Reasons for loss of incisors

Trauma

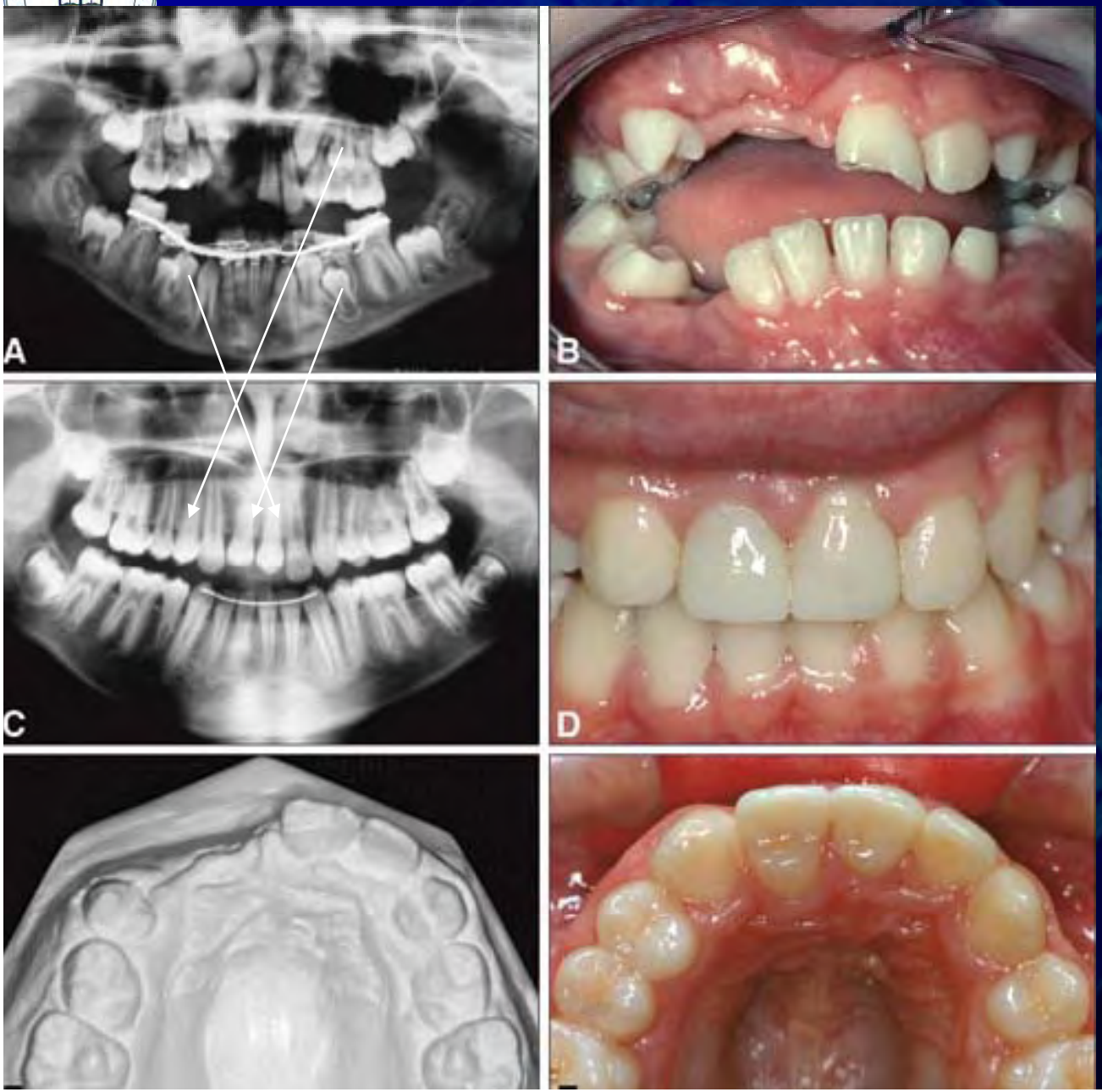
1. Fracture
   - Jaw
   - Crown-root
   - Root – cervical / middle / apical
2. Exarticulation (”avulsed tooth”)
3. Post trauma complications
   - Inflammatory root resorption
   - Ankylosis
4. Ectopic teeth

1. Fractures

Jaw fracture

Accident, age 10
Multiple corpus & condyle fractures
11 & 12 lost immediately
14 & 21 later

Jaw fracture



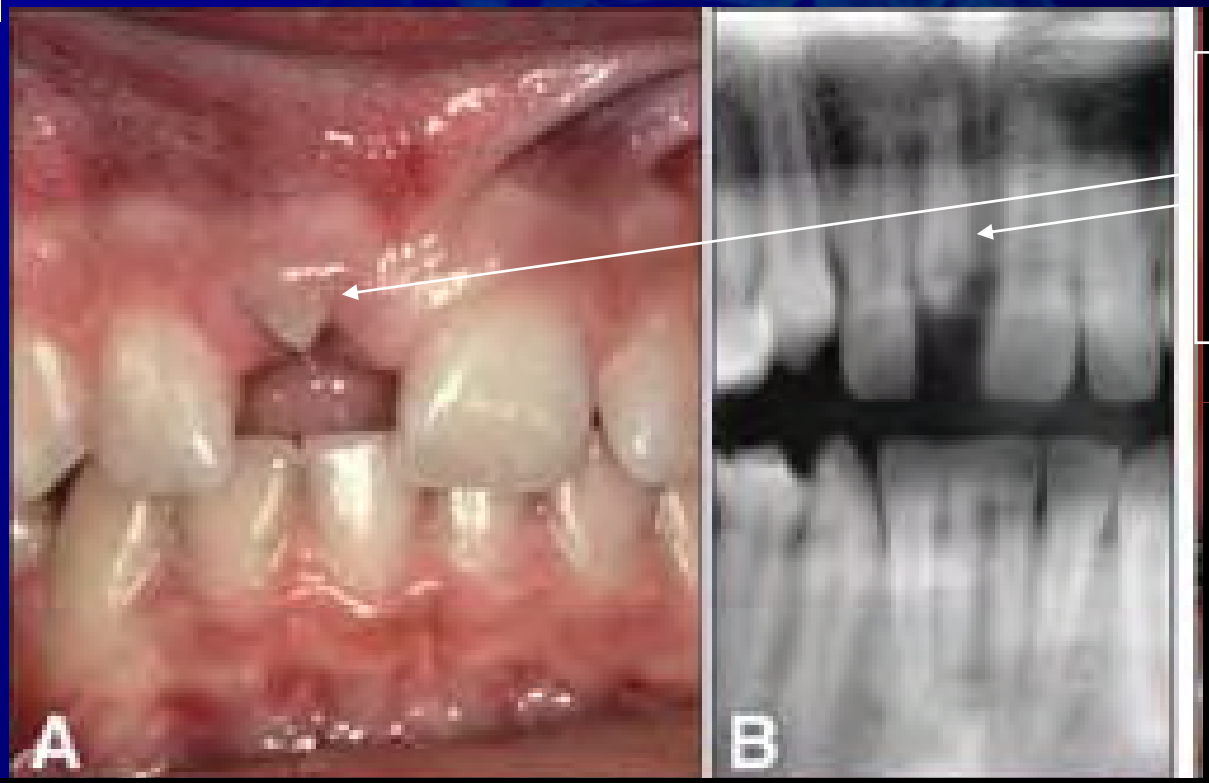
Age 10
Corpus & condyle
11 & 12
14 & 21

Autotransplant
Orthodontics
Composites

Alveolar Bone

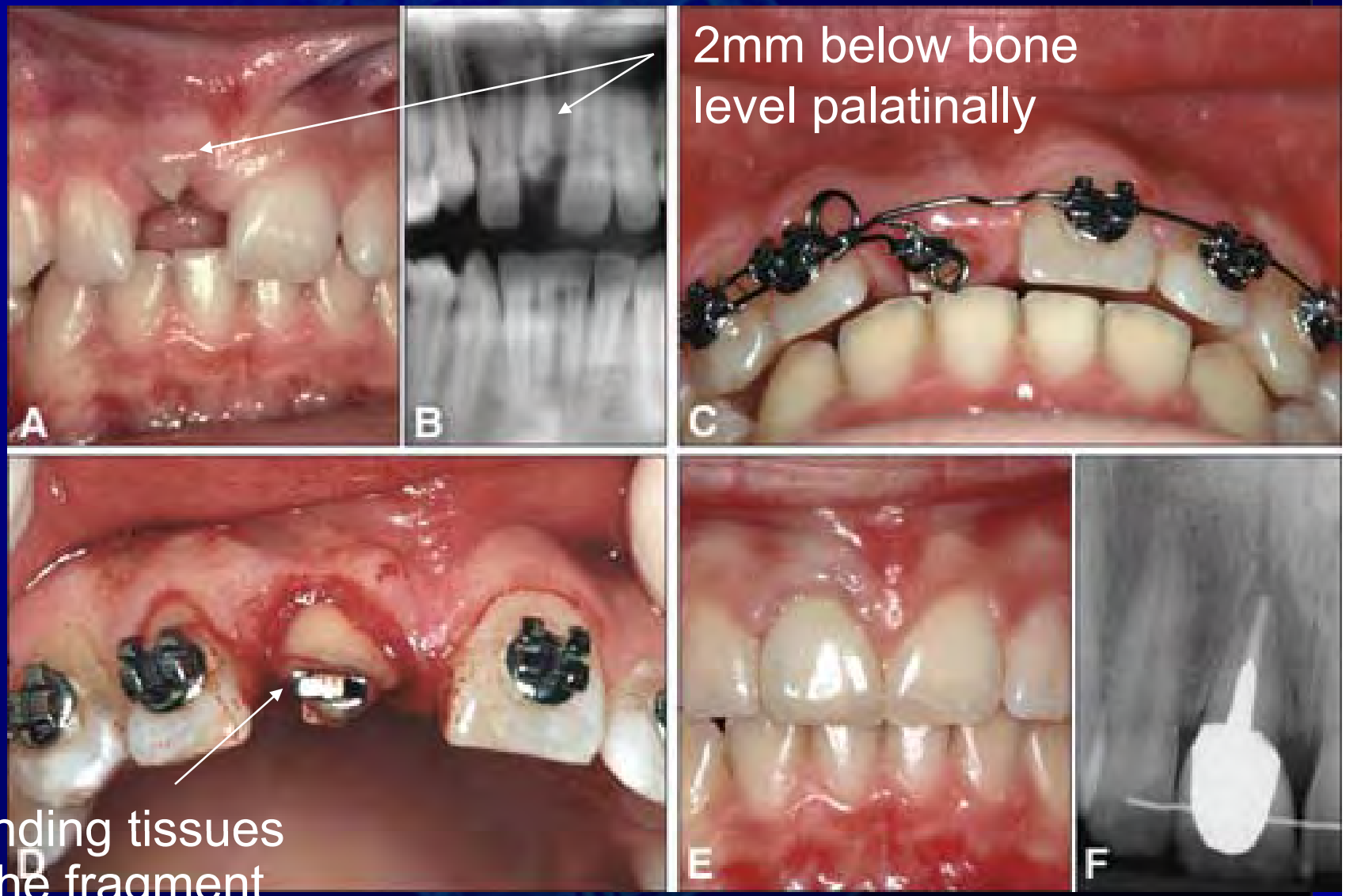
Faculty of Dentistry, University of Oslo, Depts. of Pedodontics, Orthodontics & Prosthodontics. Stenvik & Birkeland, 2007.

Crown–root fracture



2mm below bone level palatinally

Crown–root fracture



Surrounding tissues follow the fragment

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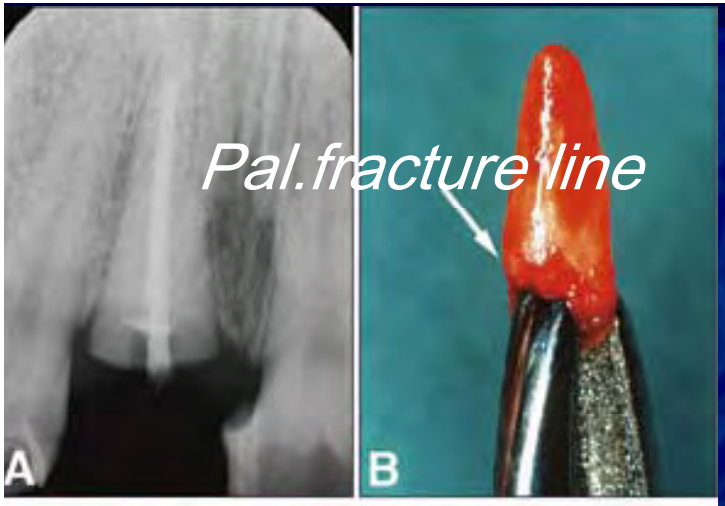

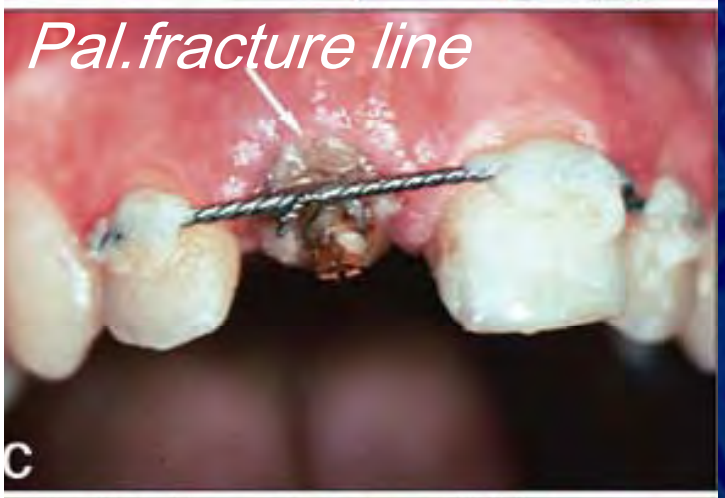

Crown–root fracture

Surgical repositioning (intraalveolar transplant) 180 degrees rotated

Fixate min. 2 weeks before crown therapy

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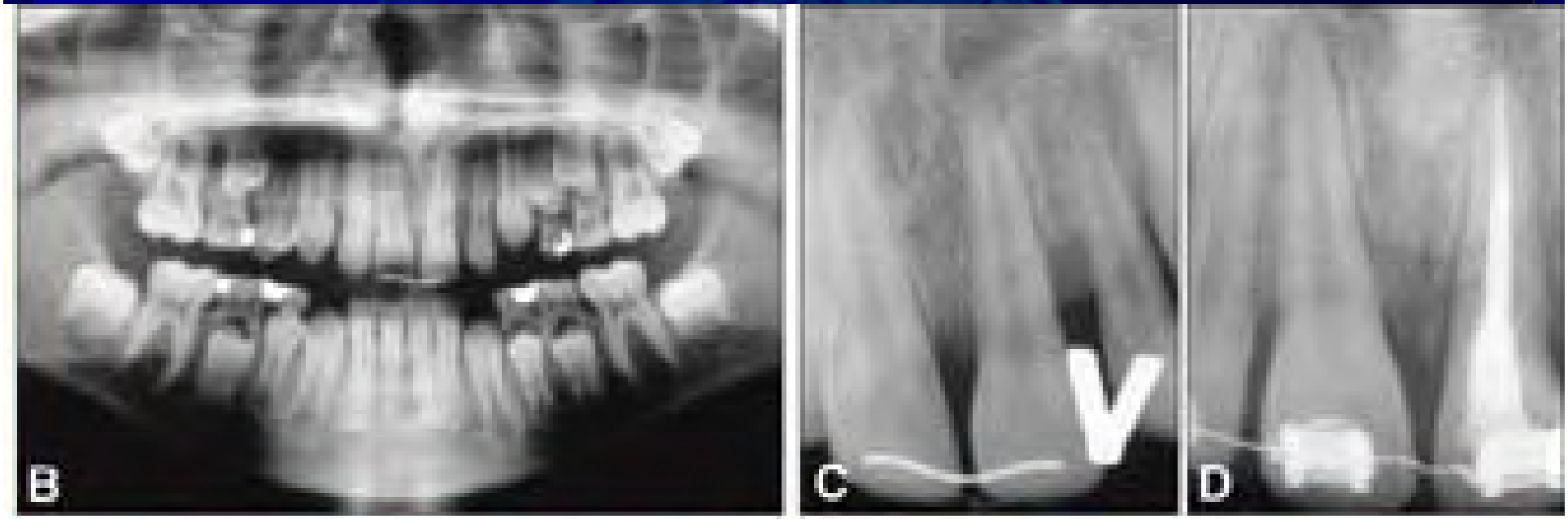
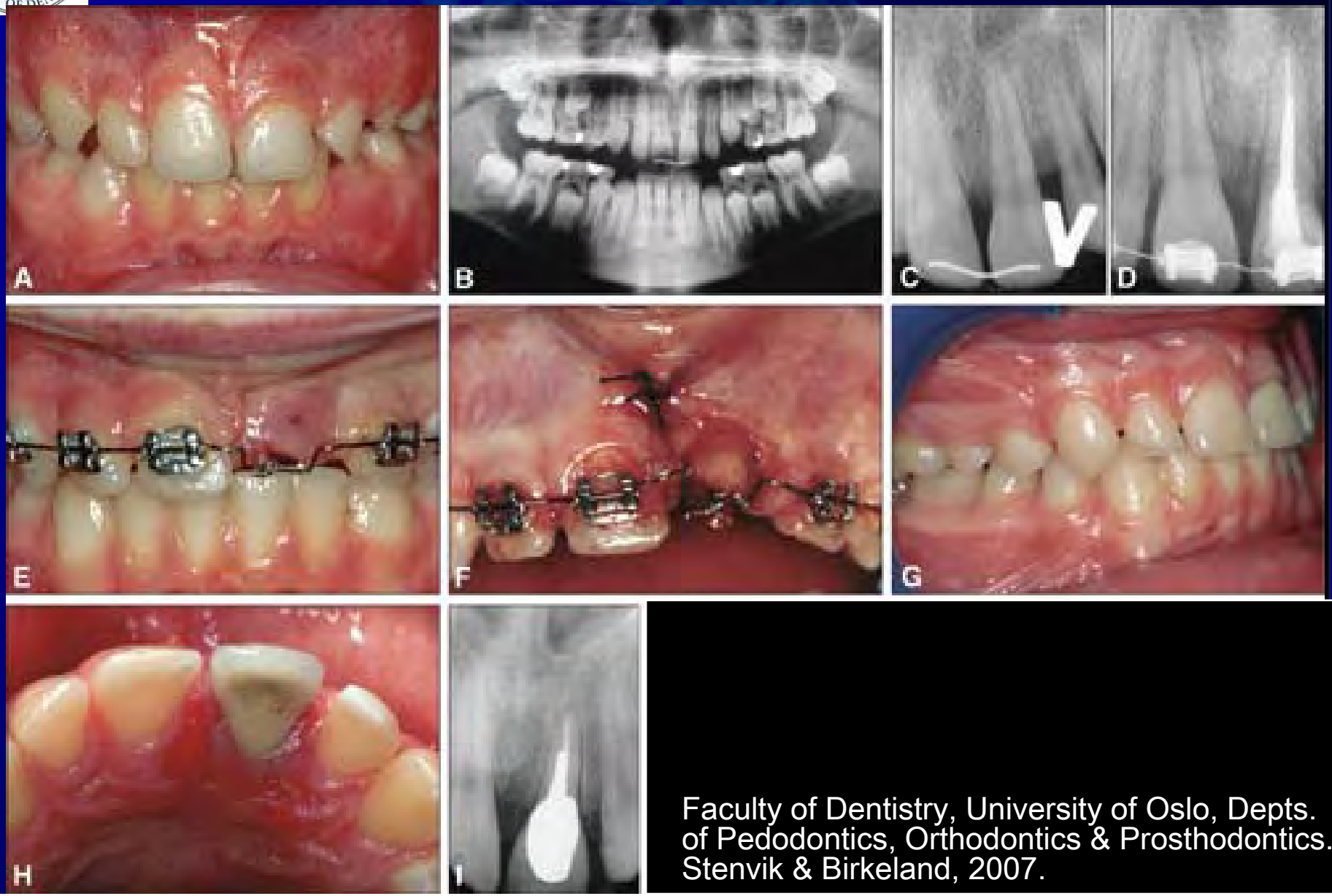
Root fracture *Cervical 1/3 third.*



Root fracture *Cervical 1/3 third.*



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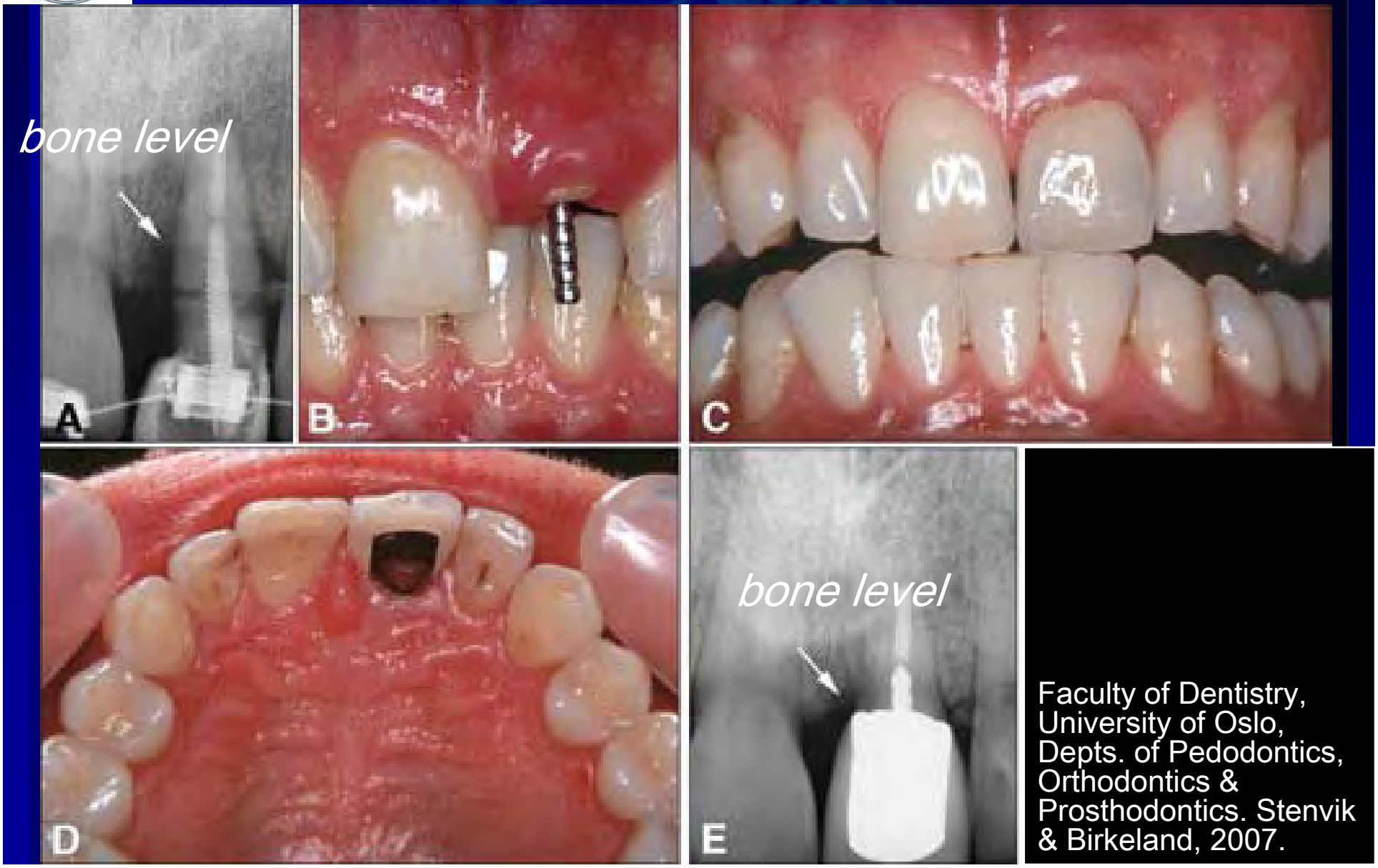
Root fracture

Middle 1/3 third.



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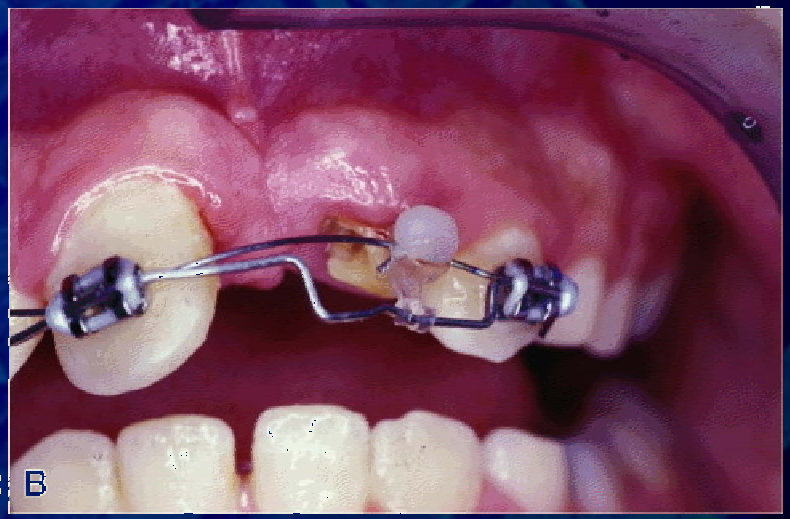
Root fracture

Middle 1/3 third.



Schwartz-Arad et al., 2004

1. Fractures

2. Exarticulation

Exarticulation

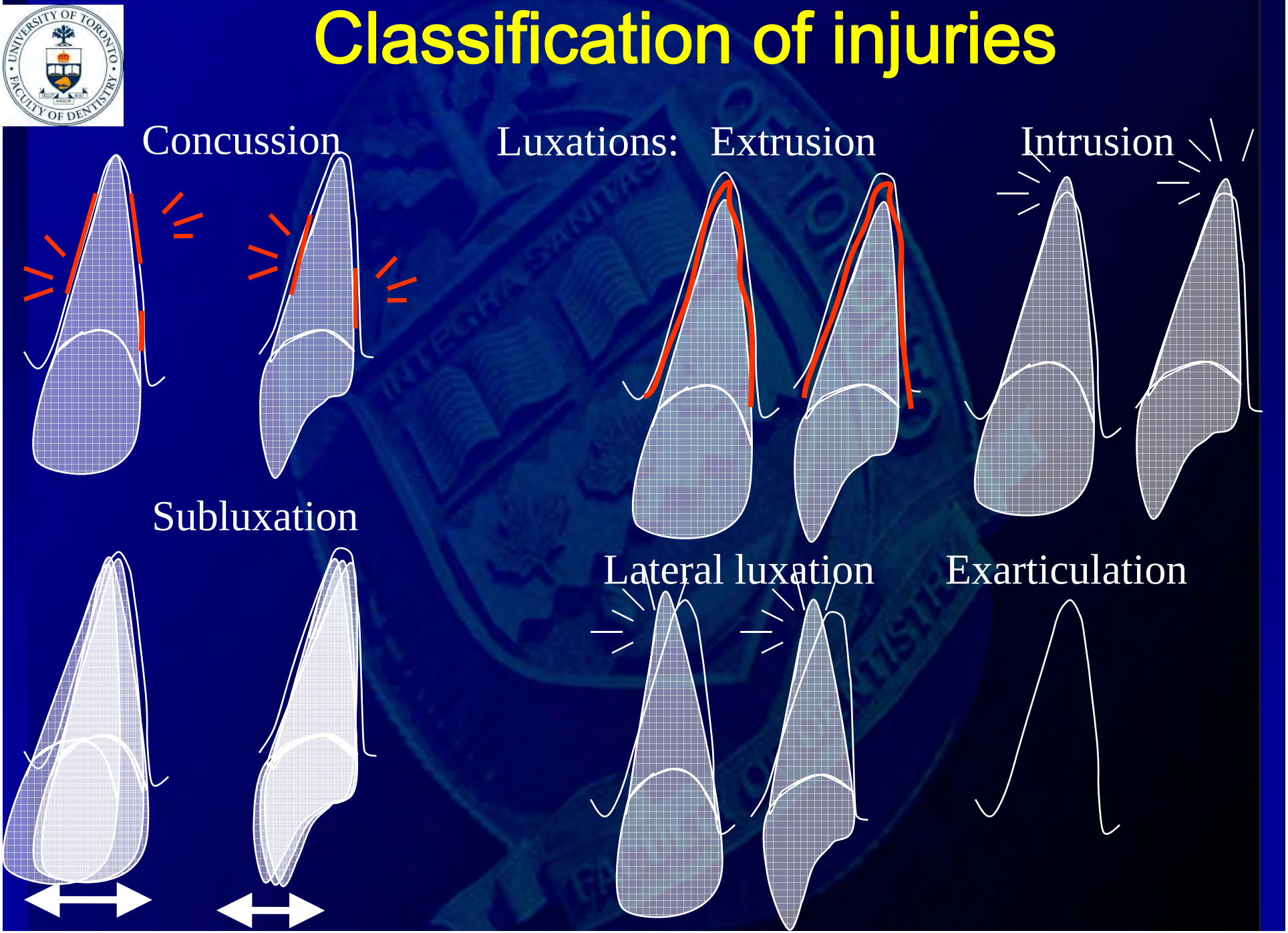
- 0.8-1.7% of all tooth damages are avulsions
- Slightly higher % loss due to later root resorption and ankylosis

  (Scandinavia, 1995)
- Replanted teeth: 22% lost after 2.5 years (7% cervical resorption, 3% epithelial downgrowth, erupting canine, pre-orthodontic consideration, root resorption, 2% endodontic failure, new trauma

  (Ebeleseder et al., 1998)

1. Fractures
2. Exarticulation
3. Post-trauma complications

Classification of injuries



Progressive resorption

Prevalence following tooth trauma

Concussion 0%
Subluxation 0%
Lateral luxation 4%
Extrusion 6%
Exarticulation and replantation 40%
Intrusion 64%

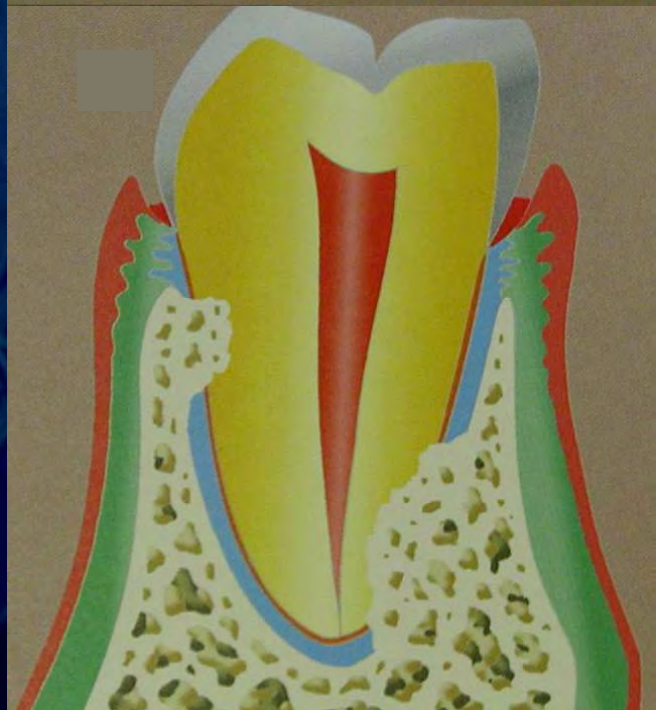
(Andreasen et al. .94)

FREQUENT OBSERVATIONS! EARLY INTERVENTION!

Surface Resorption

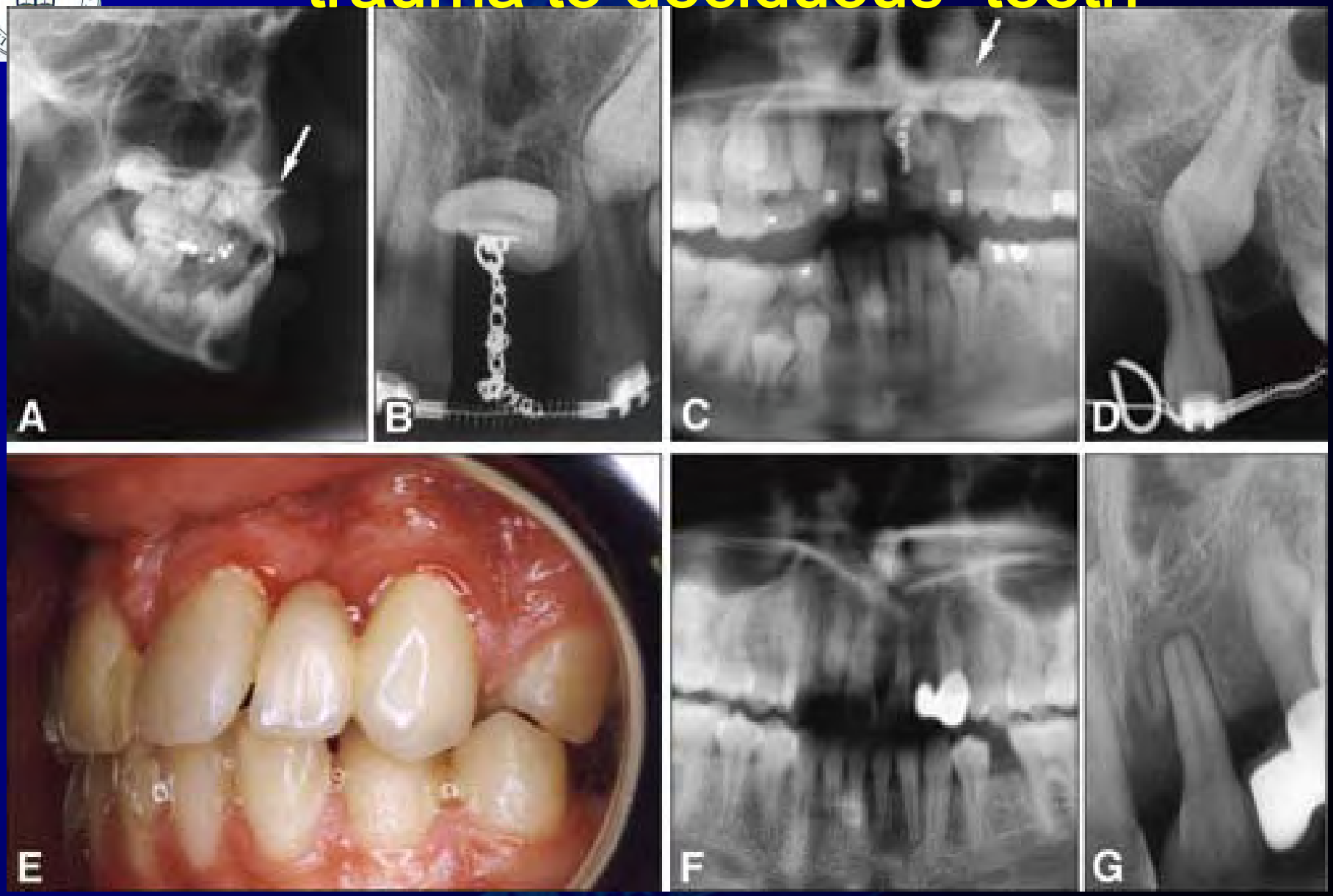
Inflammatory Resorption -granulation tissue

Replacement Resorption → ankylosis



1. Fractures
2. Exarticulation
3. Post-trauma complications
4. Ectopic teeth

Ectopic resorption – secondary to trauma to deciduous teeth



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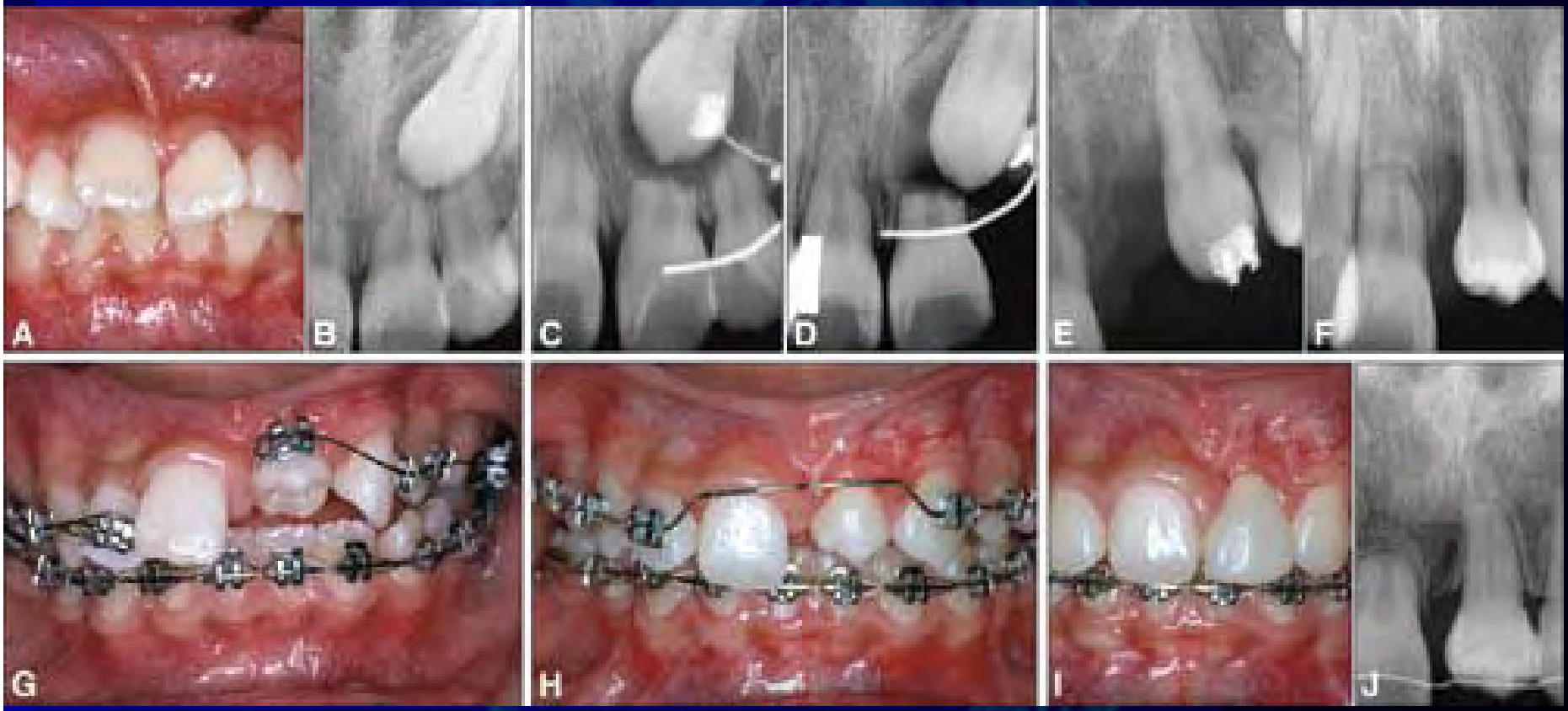
Stenvik & Birkeland, 2007

Ectopic resorption



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Management

What was a common element in most of the preceding case presentations?

What was a common element in most of the preceding case presentations?

Maintain the alveolar bone!

Diagnostic classification system of traumatic dental injuries (Ebeleseder , 1994)

Score	Hard dental tissues H X	Endodont E +	Periodontium P +	Alveolar bone A+	Gingiva G
5	Intact crown	Intact endodont	Intact periodontium	Intact alveolar bone	Intact gingiva
4	Enamel infraction, fracture of the root apex	Exposure of dentine, small pulp exposure, questionable vitality	Concussion (inclusive minimal increase of mobility)	Contusion of the marginal bone	Contusion
3	Enamel-dentine fracture, intra-alveolar root fracture	Large pulp exposure, internal contusion (root fracture), apical contusion or rupture, successful endodontic treatment	Subluxation, extrusion, lateral luxation, luxation, and fracture of the alveolar process	Fracture of the alveolar socket	Rupture of the papilla
2	Crown-root fracture, directly restorable	Infection of the pulp	Intrusion, replantation with vital periodontium	Fracture of the alveolar process	Vertical laceration
1	Crown-root fracture, only indirectly restorable	Endodontic complications (e.g., internal root resorption, inflammatory resorption)	Luxation and periodontal infection	Fracture and infection	Infected laceration
0	Vertical fracture, lost tooth	Endoperiolesion	Replantation with necrotic periodontium	Loss of the alveolar socket	Loss of gingiva

Patient mediated needs

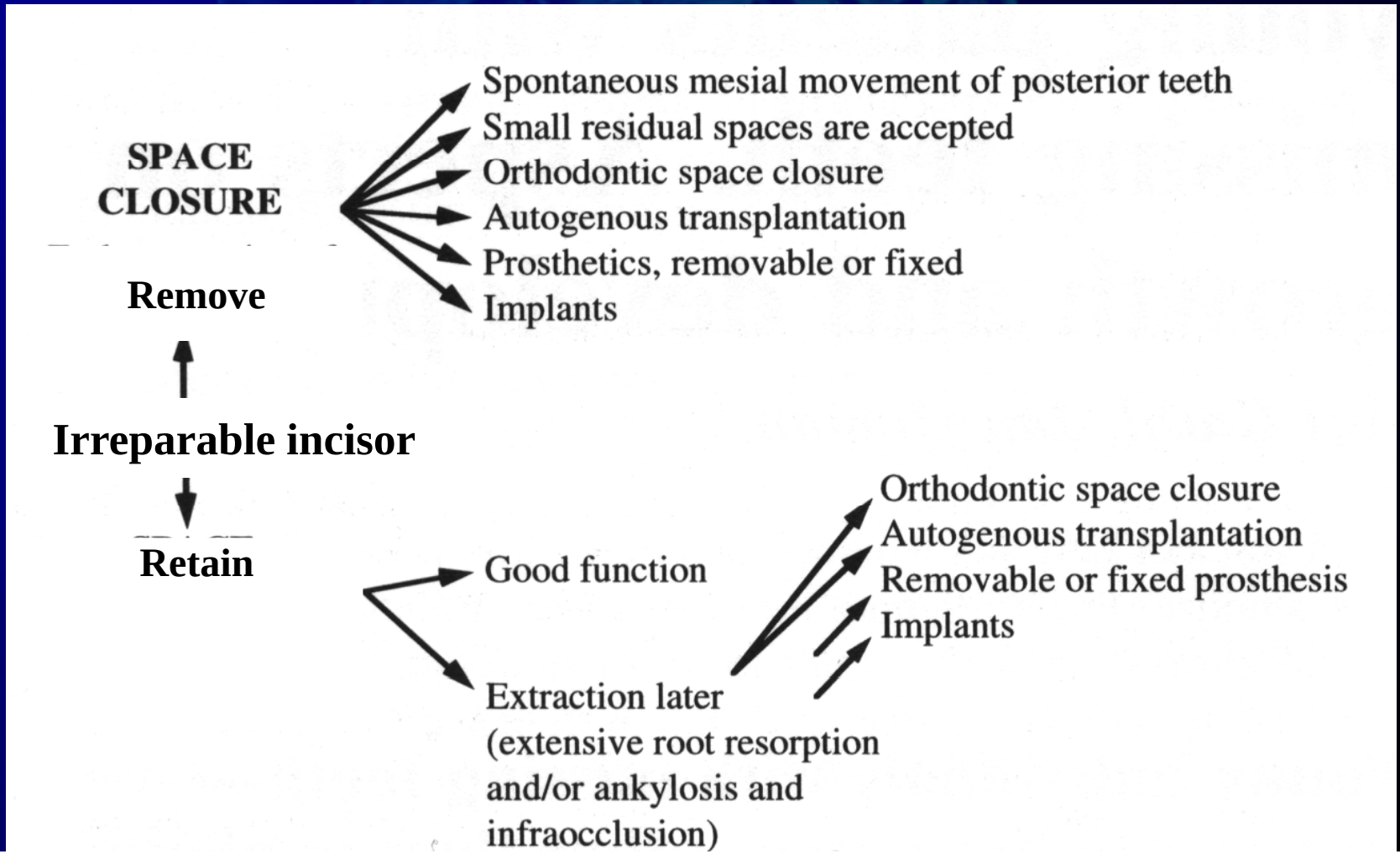
1. Esthetic requirements
2. Psychological well-being
3. Speech
4. Other
   - Space maintenance
   - Prevent muscular parafunction (tongue, swallow)
   - Chewing ability

Choice of appropriate intervention complicated by:

* Few long term studies
* New technical solutions have been introduced
* Method reported: indications, procedures, execution?
* Higher demands of aesthetics than before

Therapy alternatives for young patients with irreparable incisor(s)

Decision-tree



Rule #1

It is necessary to make an individual treatment plan for each patient

Rule #2

General Rules do not apply

Rule #3

The management at the early phase will determine the long term outcome

Crown–root fracture

1. Removal of coronal fragment + endodontics + orthodontic extrusion → temporary crown
2. Extraction and surgical repositioning 180º endodontics → temporary crown
3. Avoid extraction if possible

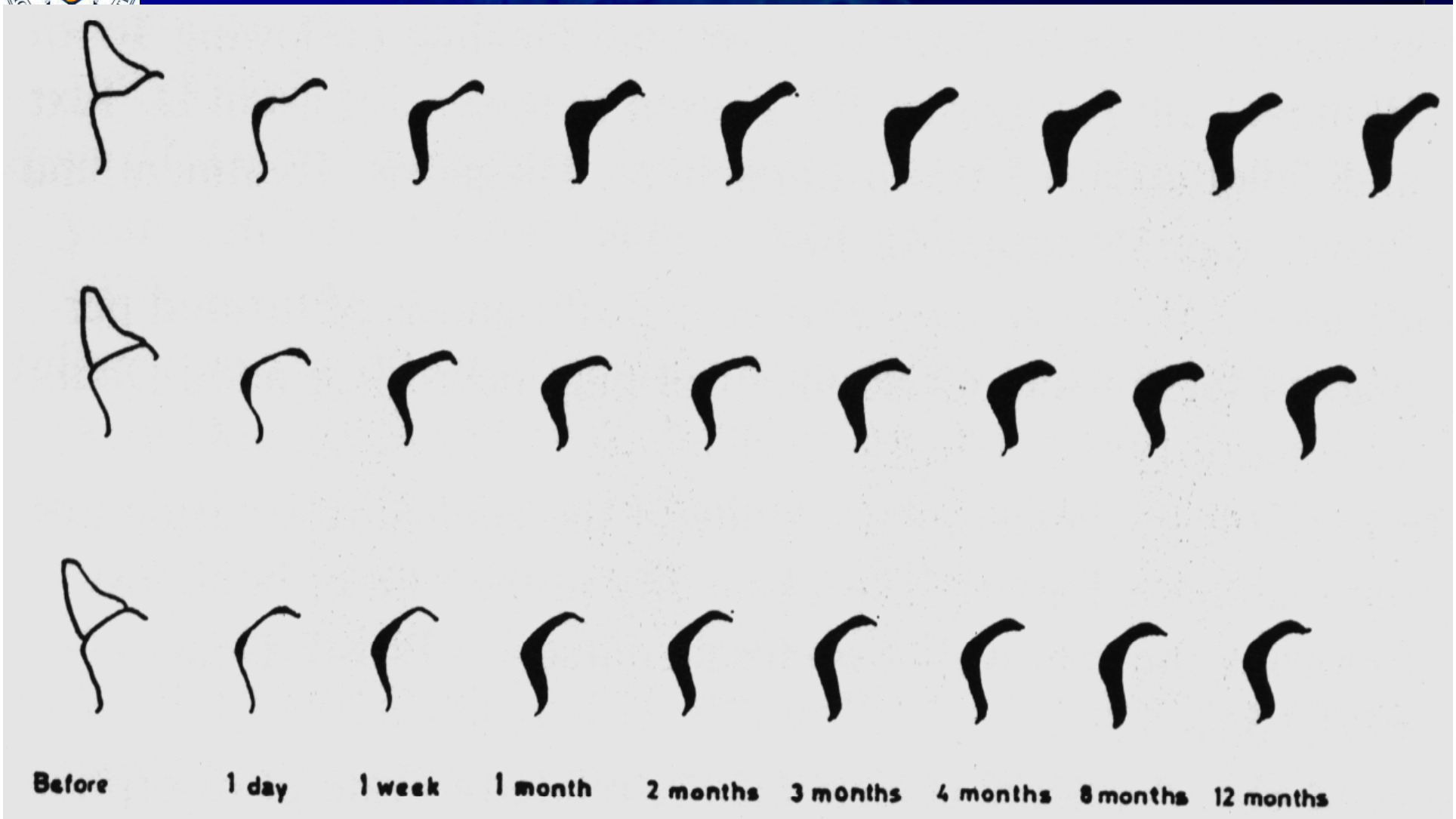
Root fracture

1. Observe (apical:middle:cervical third?)
2. If communication, or signs of inflammation, remove coronal fragment + endodontics + orthodontic extrusion→ temporary crown
3. Avoid extraction if possible

Replace the exarticulated tooth

Advantage	Disadvantage
➢ Buy time! ➢ Retain bone	➢ Frequent controls and follow-up examinations

Bone loss following tooth extraction



+ unknown damage of the buccal bone plate?

Lam, 1960

Replace the exarticulated tooth

Advantage	Disadvantage
➢ Buy time! ➢ Retain bone	➢ Frequent controls and follow-up examinations

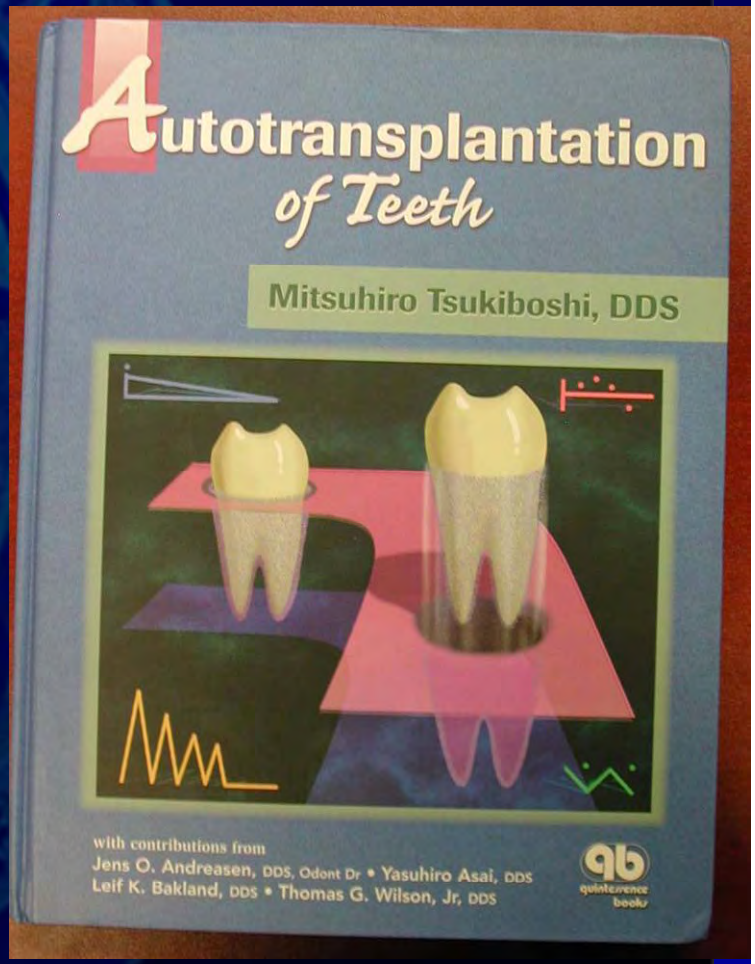
EXCEPTION:

IF PATIENT < 12 YEARS OLD:

CONSIDER AUTOTRANSPLANTATION

Auto-transplantation

”The transplantation of embedded, impacted or erupted teeth from one site to another in the same individual into extraction sites or surgically prepared sockets”



Autotransplantation and prognostic variables

Intrinsic factors

- Root development of donor tooth
- Size of apical foramen
- Timing of ortodonthic intervention
- Surgical technique

Clinical experience

- Trauma to the periodontal ligament and root-resorption

  (Andreassen et al 90)
- Eruption and growth of the alveolar process

  (Paulsen et al. 98)

Autotransplantation of (1st.) premolars with incomplete root formation to anterior maxilla

* > 90 % success
* New periodontal membrane
* Continuous root formation
* Pulp obliteration
* Keep alveolar process
* Keep functional occlusion

Replace the exarticulated tooth

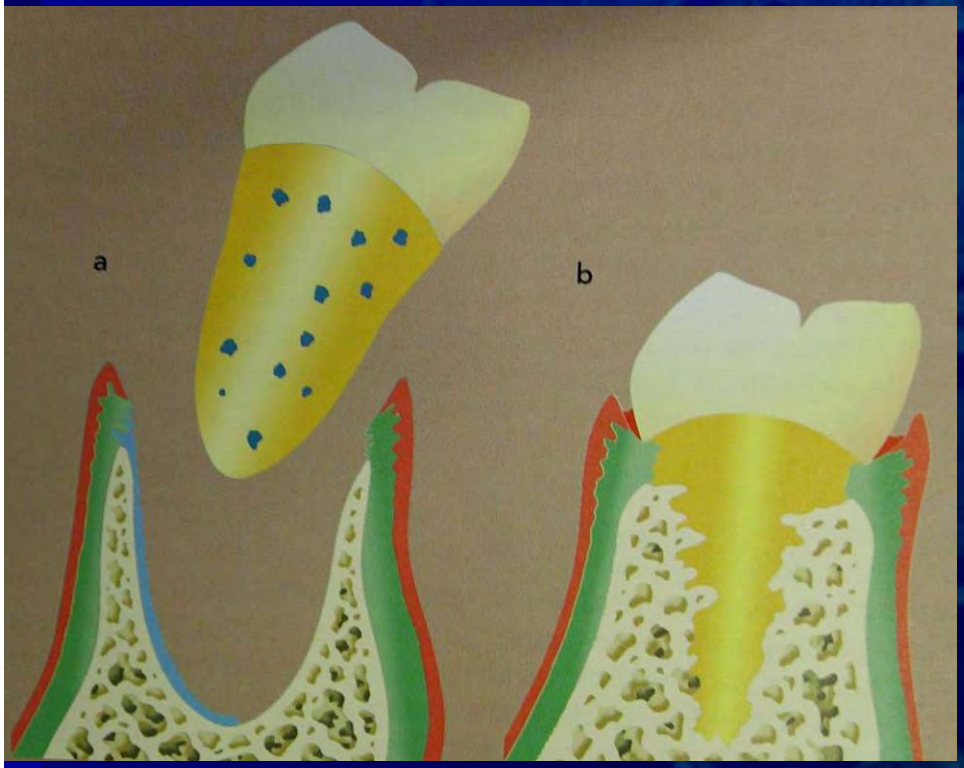
Advantage

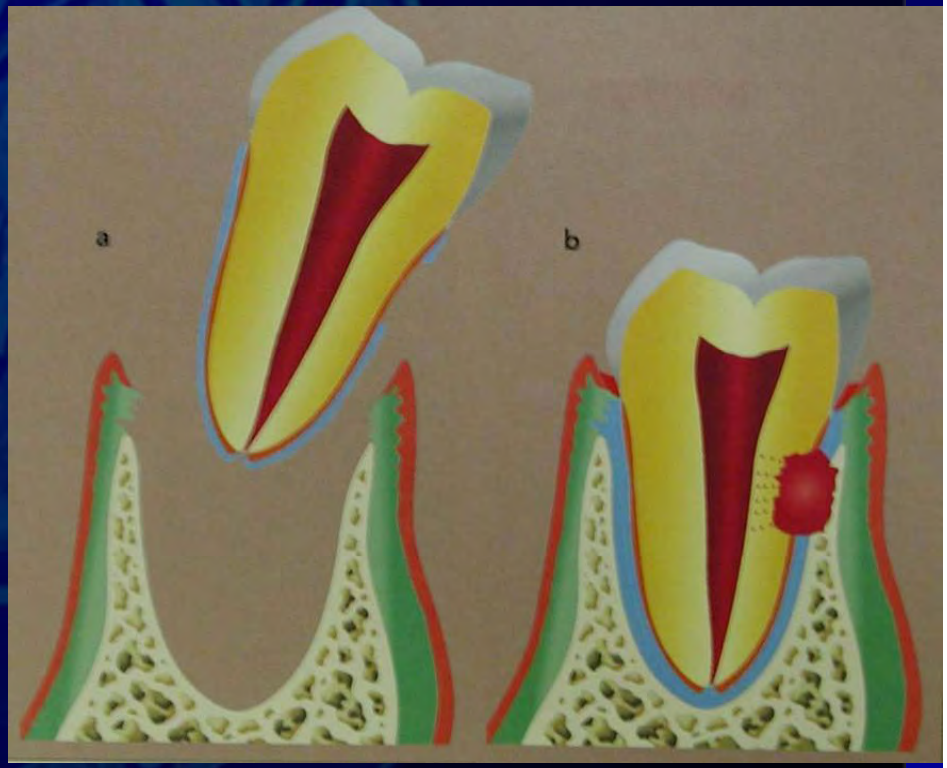
- Buy time!
- Retain bone
- Symmetry maintained

Disadvantage

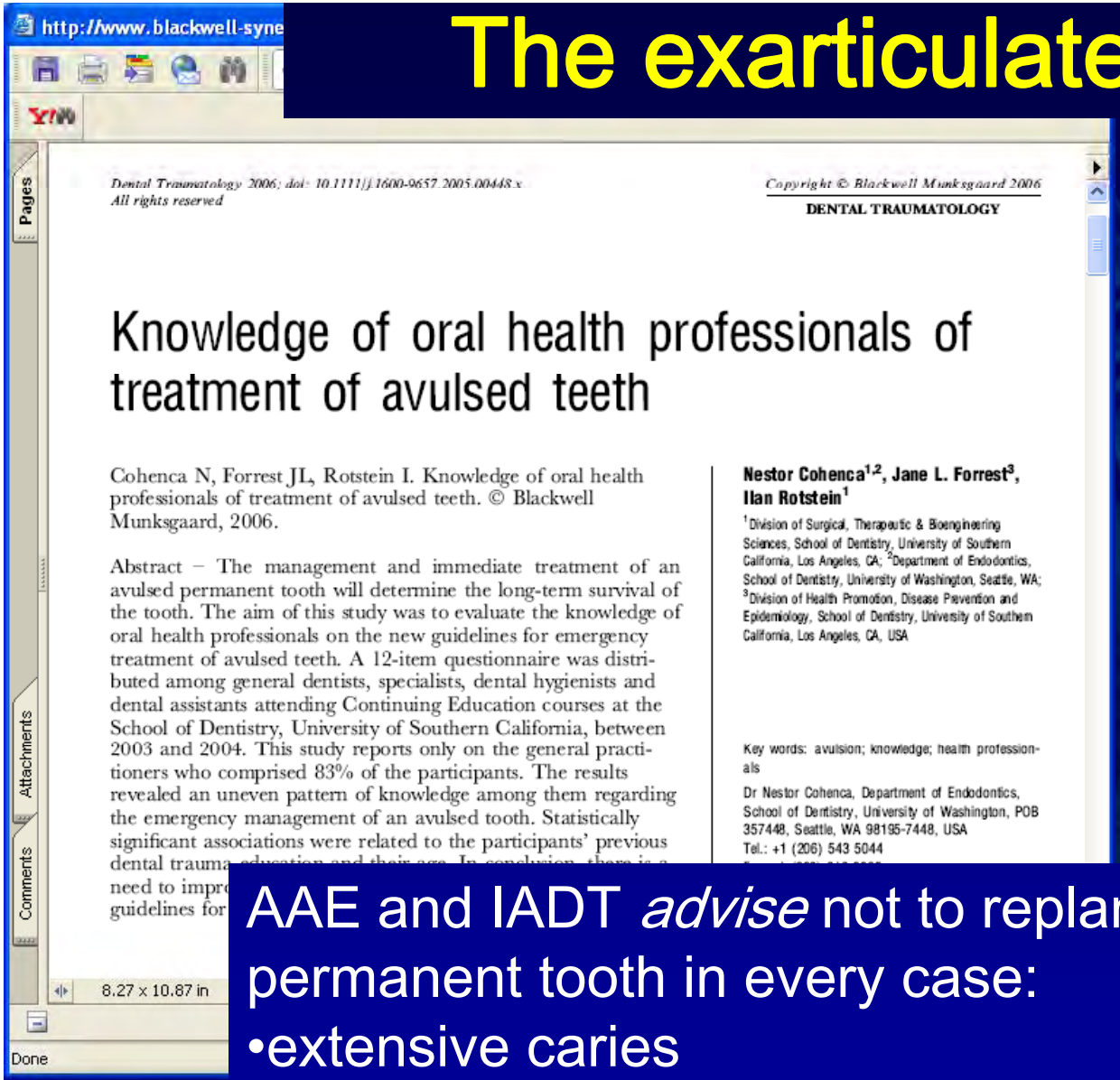
- Risk of:
  - Infection?
  - Pulp necrosis
  - Ankylosis
    - Infraposition
    - Ridge disharmony
    - Soft tissue disharmony
  - Inflammatory resorption
    - Discoloration

The exarticulated tooth – replanting the tooth and potential risks?





The exarticulated tooth



http://www.blackwell-syne

Pages

Attachments

Comments

8.27 x 10.87 in

Done

Dental Traumatology 2006; doi: 10.1111/j.1600-9657.2005.00448.x

DENTAL TRAUMATOLOGY

Knowledge of oral health professionals of treatment of avulsed teeth

Cohenca N, Forrest JL, Rotstein I. Knowledge of oral health professionals of treatment of avulsed teeth. © Blackwell Munksgaard, 2006.

Abstract – The management and immediate treatment of an avulsed permanent tooth will determine the long-term survival of the tooth. The aim of this study was to evaluate the knowledge of oral health professionals on the new guidelines for emergency treatment of avulsed teeth. A 12-item questionnaire was distributed among general dentists, specialists, dental hygienists and dental assistants attending Continuing Education courses at the School of Dentistry, University of Southern California, between 2003 and 2004. This study reports only on the general practitioners who comprised 83% of the participants. The results revealed an uneven pattern of knowledge among them regarding the emergency management of an avulsed tooth. Statistically significant associations were related to the participants' previous dental trauma [illegible] need to impr[illegible] guidelines for

Nestor Cohenca[1,2], Jane L. Forrest[3], Ilan Rotstein[1]

[1]Division of Surgical, Therapeutic & Bioengineering Sciences, School of Dentistry, University of Southern California, Los Angeles, CA; [2]Department of Endodontics, School of Dentistry, University of Washington, Seattle, WA; [3]Division of Health Promotion, Disease Prevention and Epidemiology, School of Dentistry, University of Southern California, Los Angeles, CA, USA

Key words: avulsion; knowledge; health professionals

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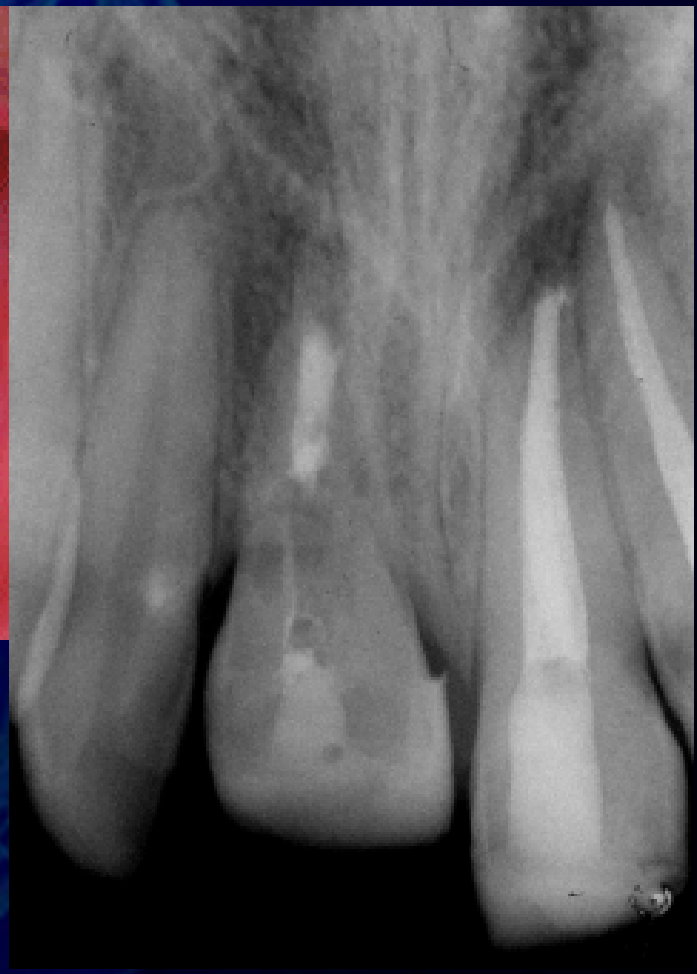
AAE and IADT *advise* not to replant an exarticulated permanent tooth in every case:

- extensive caries
- severe root damage
- open apices that remained in dry conditions >1 h.

<u>Many dentists replant a permanent tooth in every case</u>

Is Ankylosis the biggest concern?

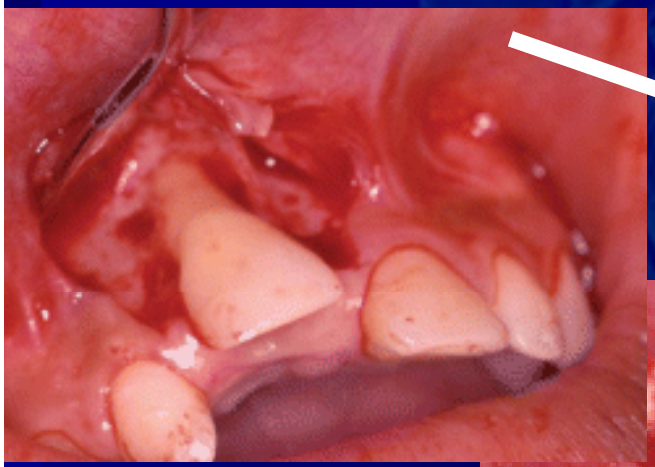
Ankylosis

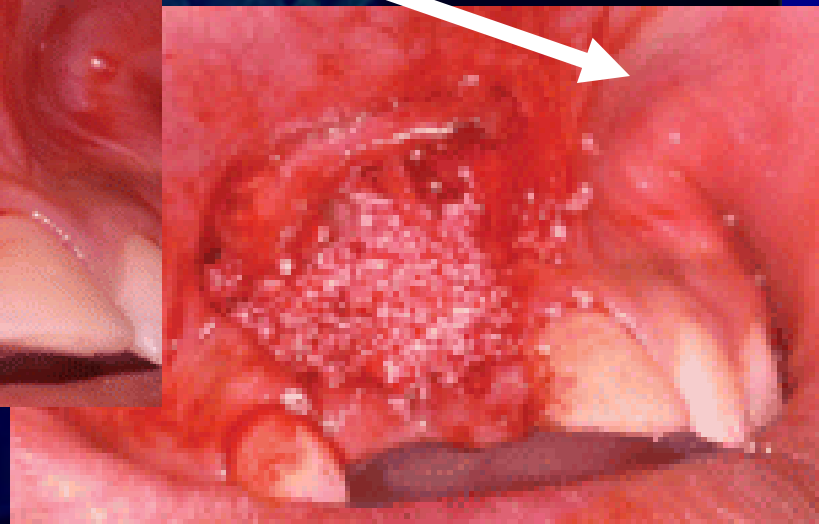


Treatment ASAP

Alternative A, Decoronation

Ankylosis - Alternative A, Decoronation

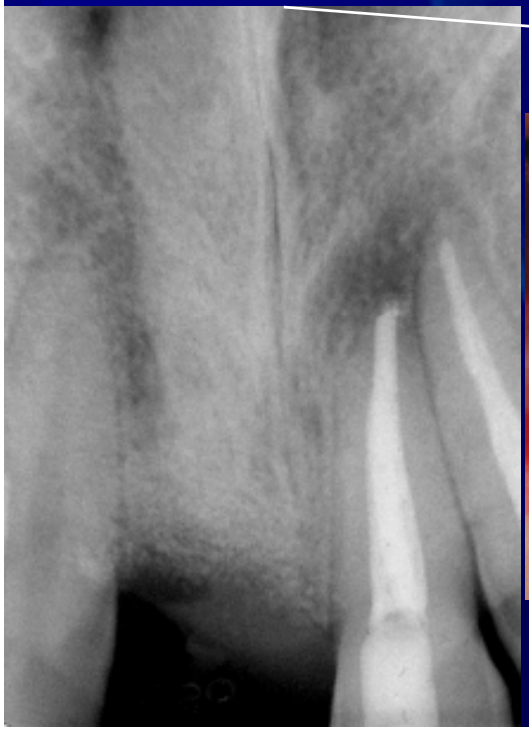


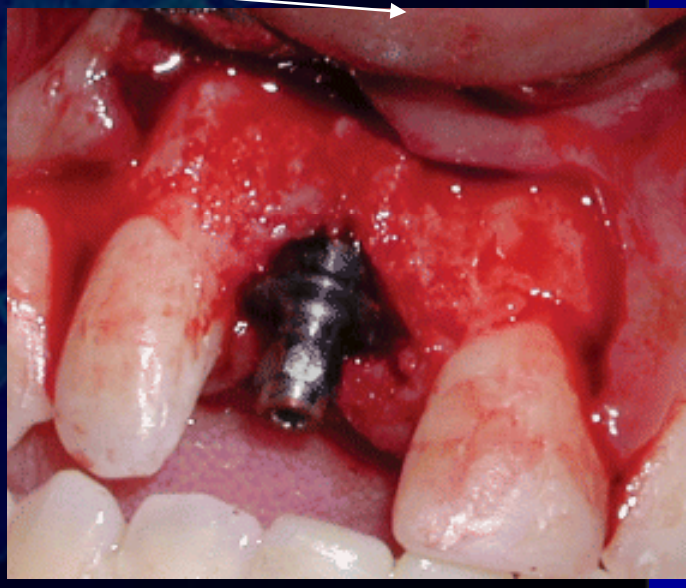


Ankylosis - Alternative A, Decoronation







Ankylosis - Alternative A, Decoronation

Cohenca & Stabholz , 2007

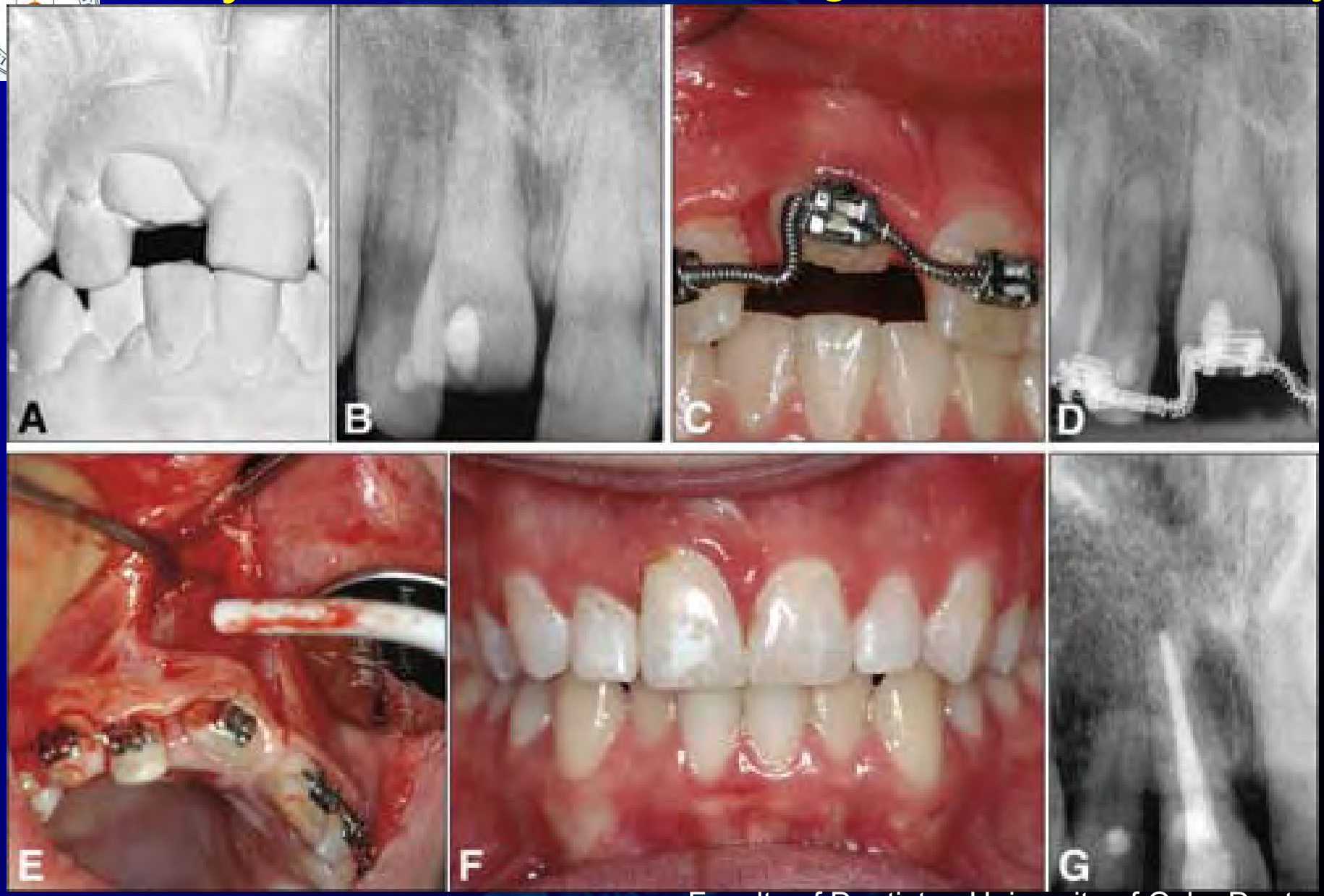
Ankylosis

Treatment ASAP

Alternative A, Decoronation

Alternative B, Surgical block osteotomy

Ankylosis- Alternative B. Surgical block osteotomy



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Ankylosis

<u>Treatment ASAP</u>

Alternative A, Decoronation

Alternative B, Surgical block osteotomy

(Alternative C, Intentional extraction & repositioning)

Ankylosis

Treatment ASAP

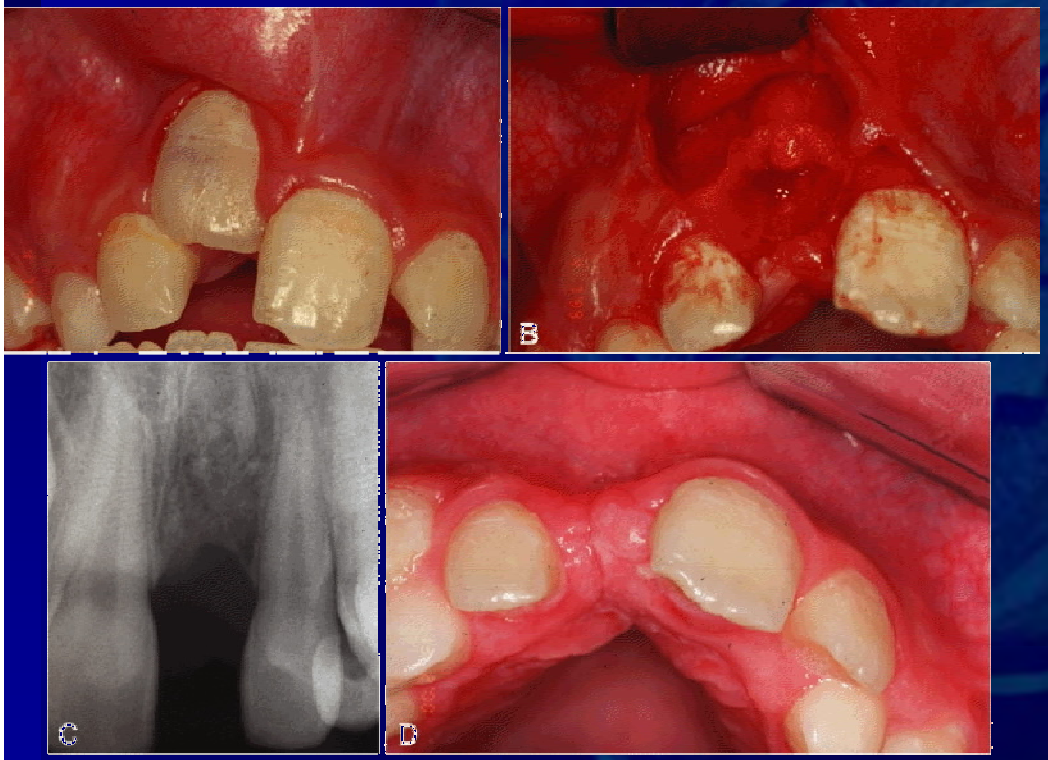
Alternative A, Decoronation

Alternative B, Surgical block osteotomy

(Alternative C, Intentional extraction & repositioning)

(Alternative D, Distraction Osteogenesis (adults)))

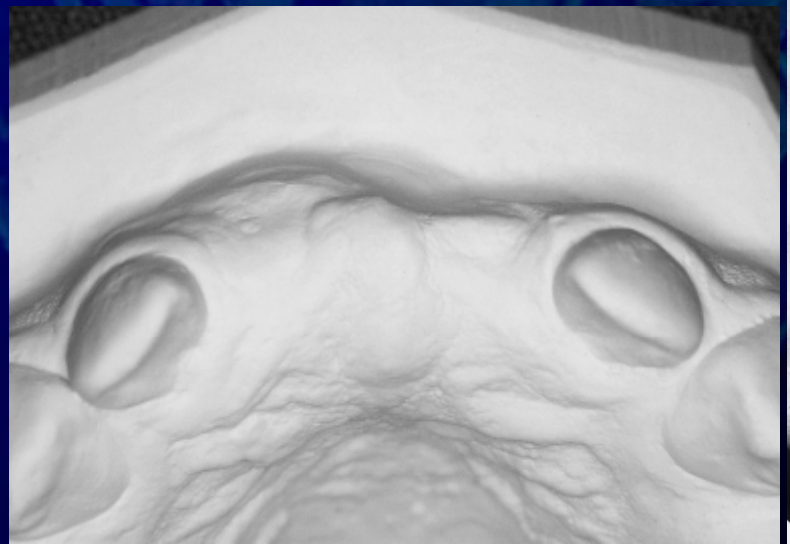
Ankylosis – decoronation on a young patient



- 11-year + 3 y.
- Decoronation + 3 y. shows vertical bone coronal
- Vertical dimension of the alveolar process preserved
- Root proportionally moves apically.
- Horizontal bone defect and partial space closure remains
- Bone augmentation need

Schwarz-Arad, 2004

Ankylosis – decoronation on a older patient



Filippi et al., 2001

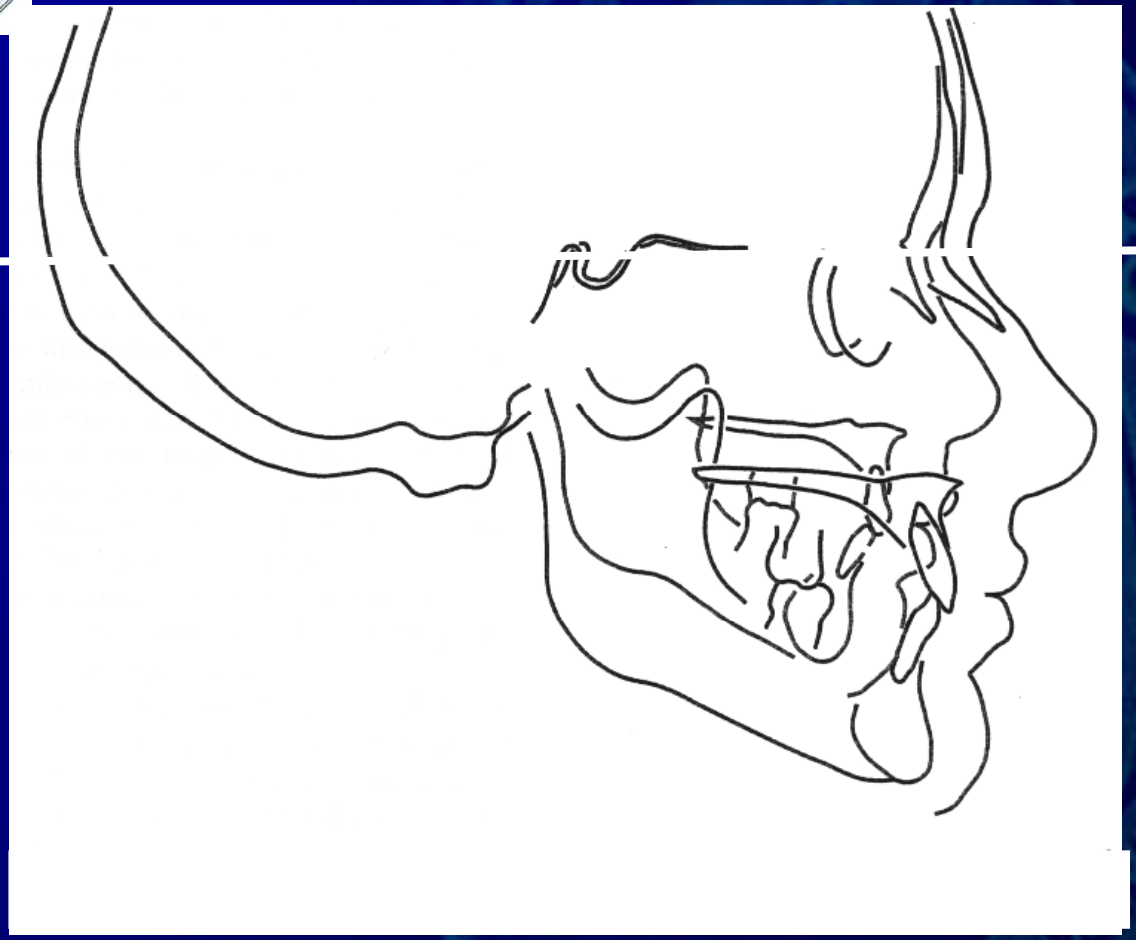
Biggest concern is lost tissues
How to restore in the anterior maxilla

Alternatives

FIRST:

Consider consequences of interventions in the mixed dentition with regard to jaw development and establishment of the permanent dentition

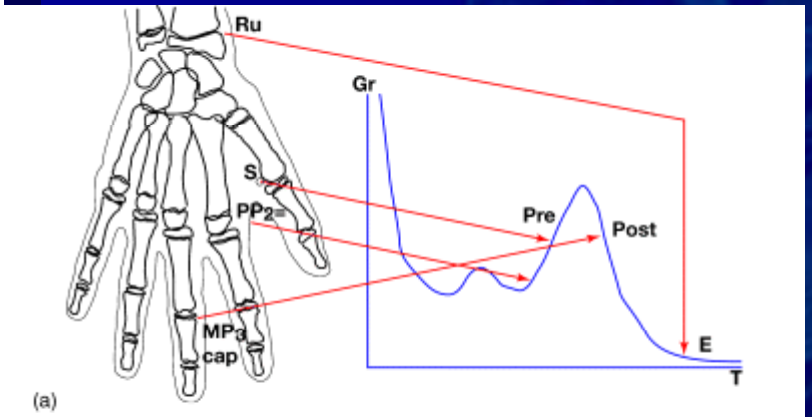
Growth



<u>Growth:</u>
Horisontal
Vertical

<u>Planes:</u>
Sagital
Frontal
Transversal

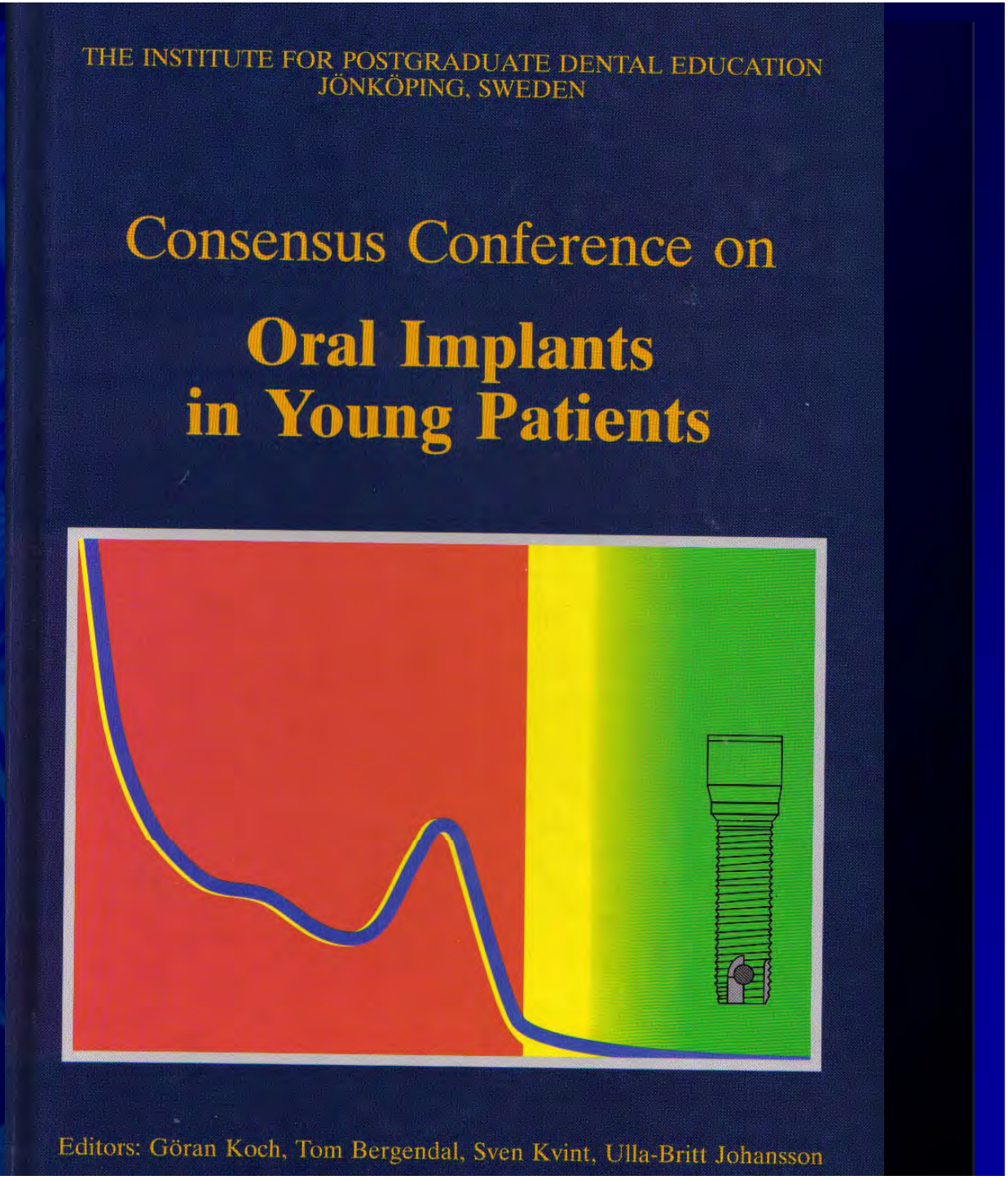
Growth in time



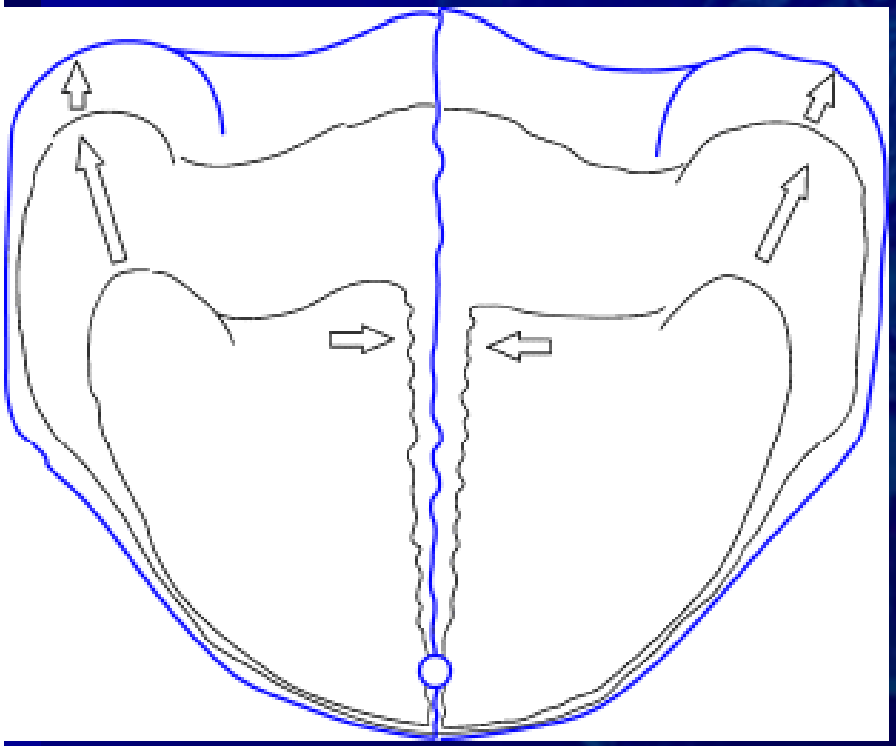
Hand–wrist radiograph indicators can be used to place a patient in the general area of the growth curve.

Koch G,
Bergendal T,
Kvint S,
Johansson UB,
1996

Publisher: Gothia
Isbn: 9-1720-5044-6



Maxillary growth- horisontal plane



Transversal: mainly via the midpalatal suture.

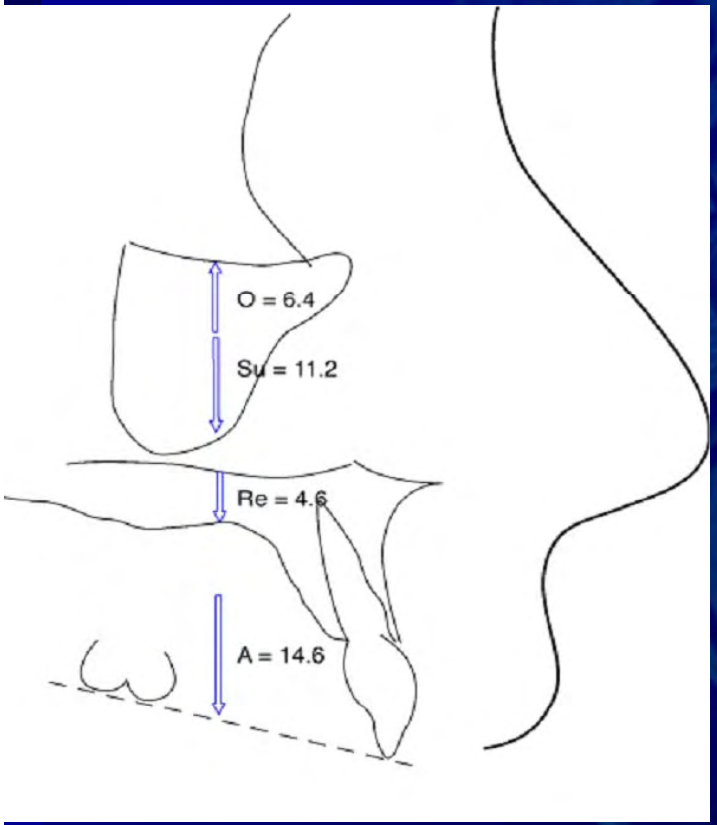
- 3x posterior vs anterior
- 16:26 width less due to adaptive changes within the dental arch.

Length: sutural growth and bone apposition at the tuberosities

- frontal part rel. stable

Op Heij, et al. 2003

Maxillary growth- sagital plane

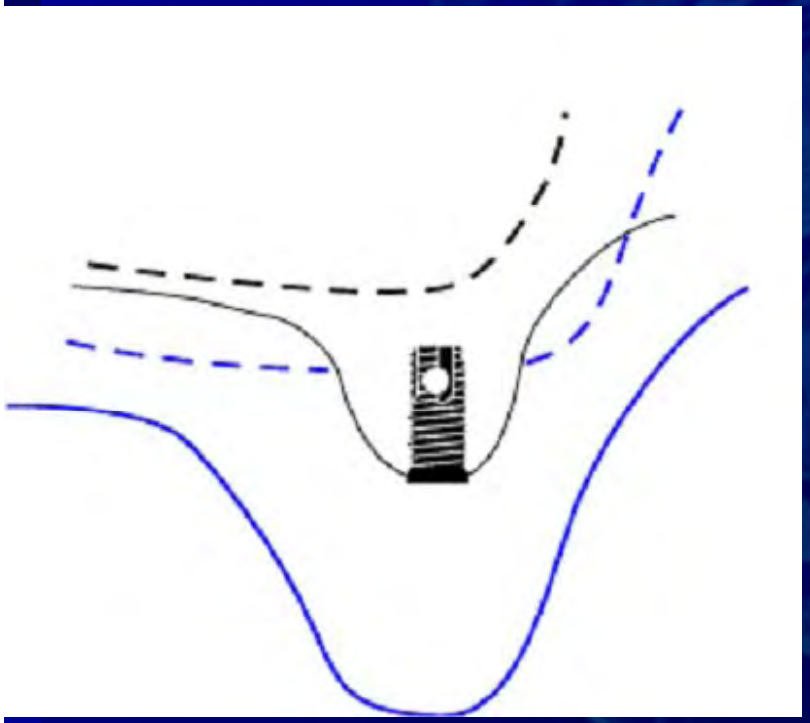


Vertical development from age 4 to adulthood: Sutural and appositional growth of the dentoalveolar complex combined with tooth eruption.

Sutural growth (Su), average 11.2 mm (varying from 9.5 to 13 mm)
Resorptive lowering (Re) of the nasal floor, average 4.6 mm associated with appositional growth at the palatal side
Appositional increase in alveolar height (A), average 14.6 mm (varying from 9.5 to 21.0 mm)
Bone apposition at the orbit floor (O)

Björk& Scheller, 1977

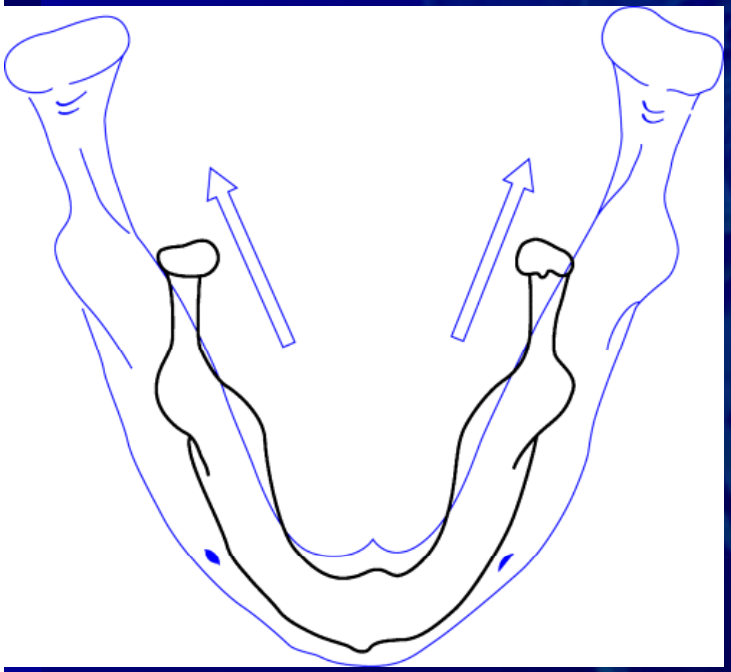
Maxillary growth- sagital plane



An early placed implant (e.g. at the age of 5), can be found in the floor of the nose after puberty, while the permanent teeth have further grown down 15 mm.

Op Heij, et al. 2003

Mandible growth- horisontal plane



Lateral direction:

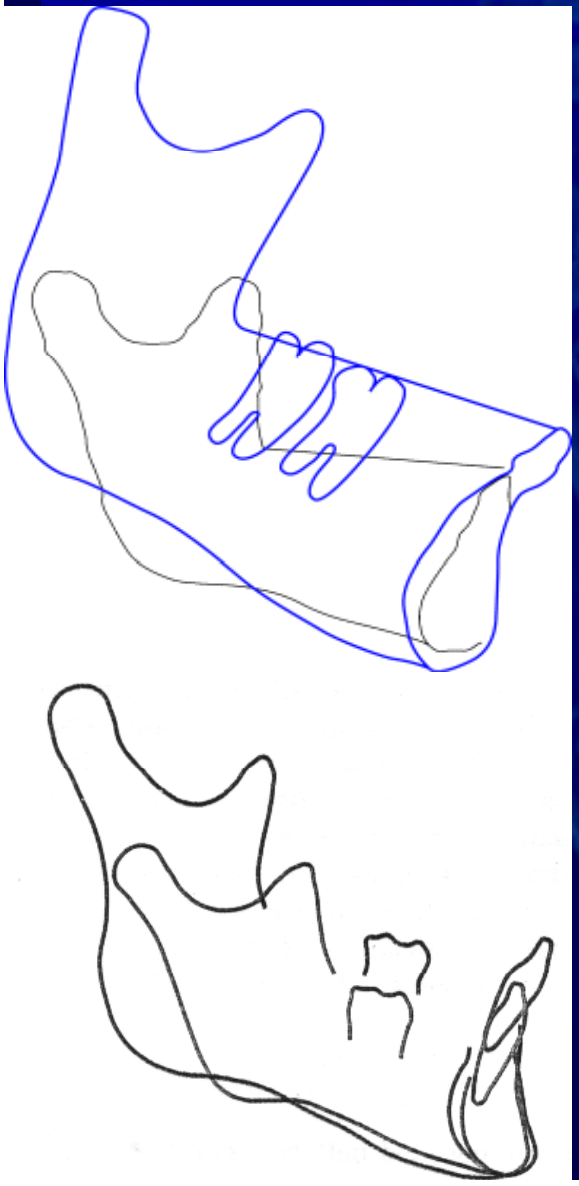
- Anterior: little change
- Premolar–molar region: moves laterally through bone remodeling (vestibular bone apposition, lingual resorption).

Anteroposterior direction:

- mainly growth through condylar growth
- increase in length of the corpus through resorption at the ventral side of the ramus and bone apposition at the dorsal side.

Op Heij, et al. 2003

Mandible growth- sagital plane



Condyle growth

- causes lengthening
- has no direct impact on possible implants.
- makes the corpus mandibulae undergo a limited rotation.

Height

- increases mainly through bone apposition at the dentoalveolar complex, especially during the tooth eruption phase and the growth at the condyle.

Op Heij, et al. 2003

Alternatives

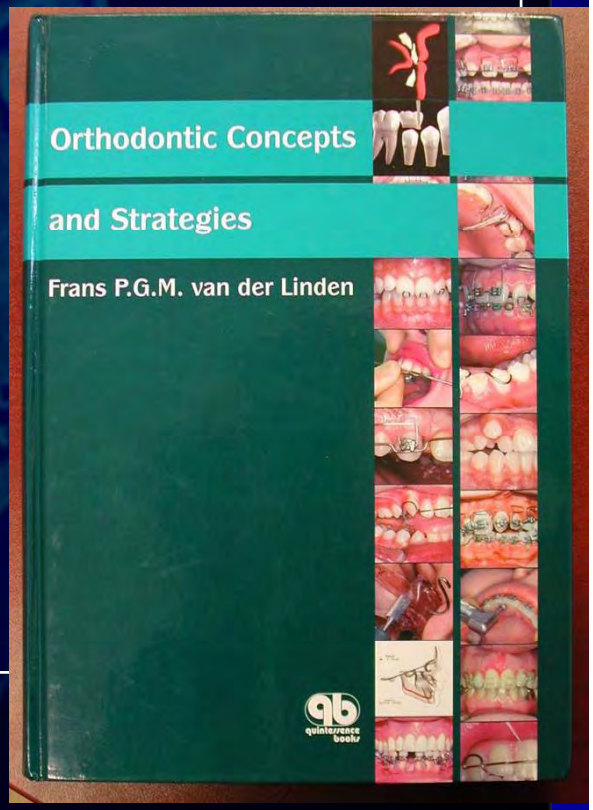
Consider consequences of interventions in the mixed dentition with regard to jaw development and establishment of the permanent dentition

1. Orthodontic space closure

1. Orthodontic space closure

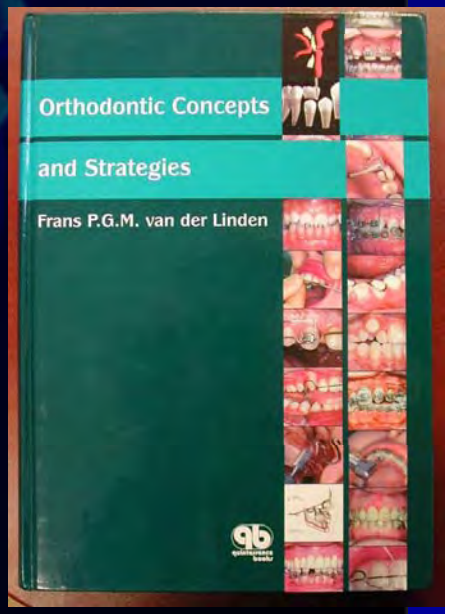
General considerations

- Morphology and dimension requirements
- Esthetics requirements
- Patient age
- Space situation
- Mid-line
- Root-cement
- Symmetry



Indicators for orthodontic solution

* Young patient
* Lack of space
* Proclined incisives
* Large lateral
* Other need for orthopedic treatment

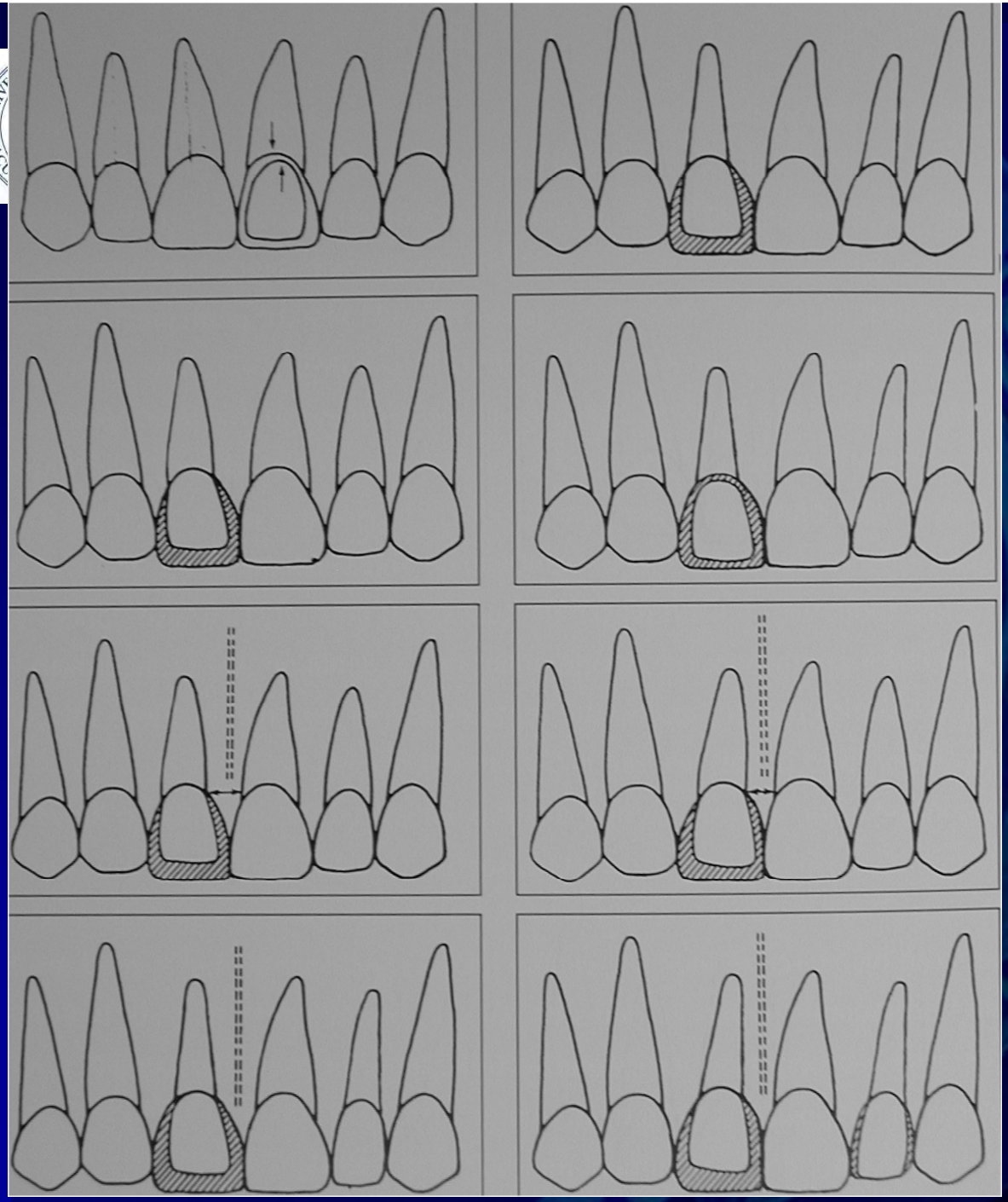


Orthodontic process if early loss of central

* Move lateral to midline immediately
* Extract 1st deciduous molar to obtain mesial movement of 1st molar
* Deciduous canine extracted depending on angulation of canine
* Complete the orthodontic treatment early in the permanent dentition

Treatment aims with orthodontic space closure

* Symmetry with regard to midline
* Correct axial angulation
* Avoid retrusive dentition
* If class II: keep distal occlusion
* Neutral relation ⇨ distal occlusion
* Simple interventions if early start
* Change tooth forms after completed orthodontics



Morphology details

2 vs 5°

Gingival contour

Cervical margin height

Angulation & papilla fill

Canine width narrowed & lateral adjusted

Alternatives

Consider consequences of interventions in the mixed dentition with regard to jaw development and establishment of the permanent dentition

1. Orthodontic space closure
2. Conventional prosthodontics

Fixed ”esthetic” solutions – preimplant –pre-etch-bridge era

Fixed prothodontics and young patients

Complications

- Large risk for accidental pulp exposure
- Large risk of pulp damage due to thermic, osmotic chemical and bacterial effects
- Tooth in eruption, retention and esthetic problems
- Contour and gingival problems

Delay! Delay! Delay!

Etch bridges on young patients

- Occlusion
- Caries activity
- Preparation of teeth
- Cement
- Complications
  - Loosening (30-50% within 3-5 years)
    - Children vs adults?
  - plaque-retaining – secondary caries
  - esthetics

Etch bridges on young patients

- Seems to loosen more than for adults
  - More often problems with a dry work field?
  - Longer clinical crowns?
  - Resin attachment to enamel depend on age?
- Etch bridges that become loose is often after short time – good cement technique crucial.
- Recemented etch-bridges show higher loosening rate compared to recemented repaired etch-bridges – consider functional stresses
- Preparation of guideplanes, occlusal stops and proximale furrows increase retention but decrease reversibility of therapy

Alternatives

Consider consequences of interventions in the mixed dentition with regard to jaw development and establishment of the permanent dentition

1. Orthodontic space closure
2. Conventional prosthodontics
3. Removable flipper

Temporary Removable "Esthetic" solutions

Alternatives

Autotransplanted teeth	Implants
Induce bone	No bone induction
Induce a gingival papilla	A gingival papilla has to be created (if possible)
No requirement of bone support	Requires three-dimensional bone support
Eruption possible	Eruption not possible
Can be moved orthodontically	Cannot be moved orthodontically
No age-related requirements	Limited to adults
Very good cost efficiency	Cost efficiency debatable

4. Implant supported therapy
5. (Auto-transplantation)

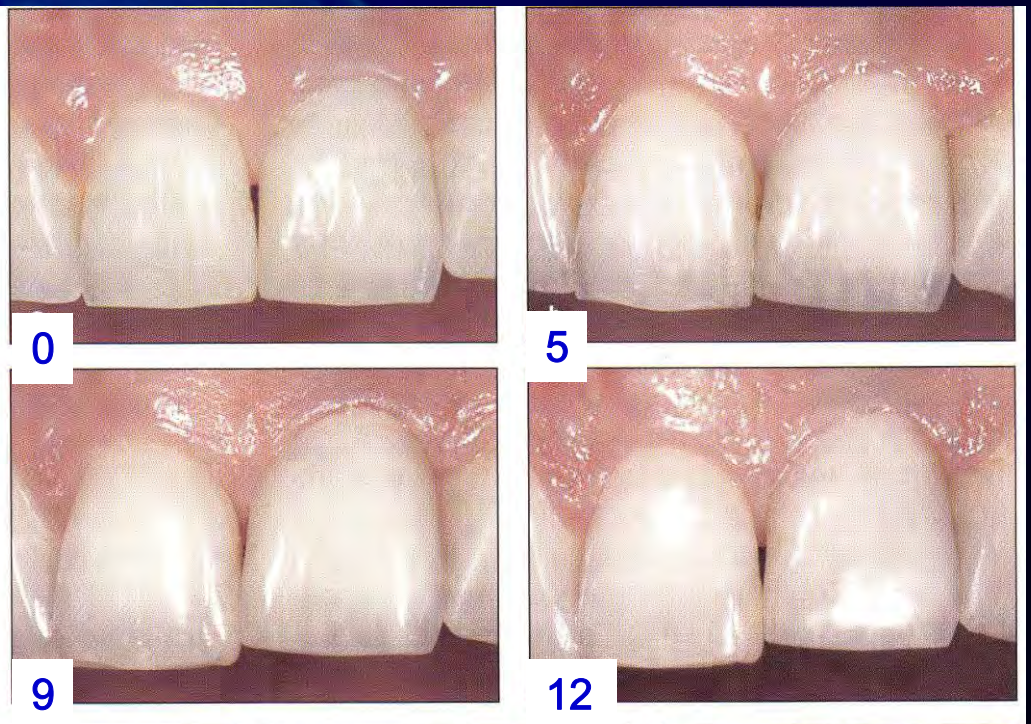
Alternatives

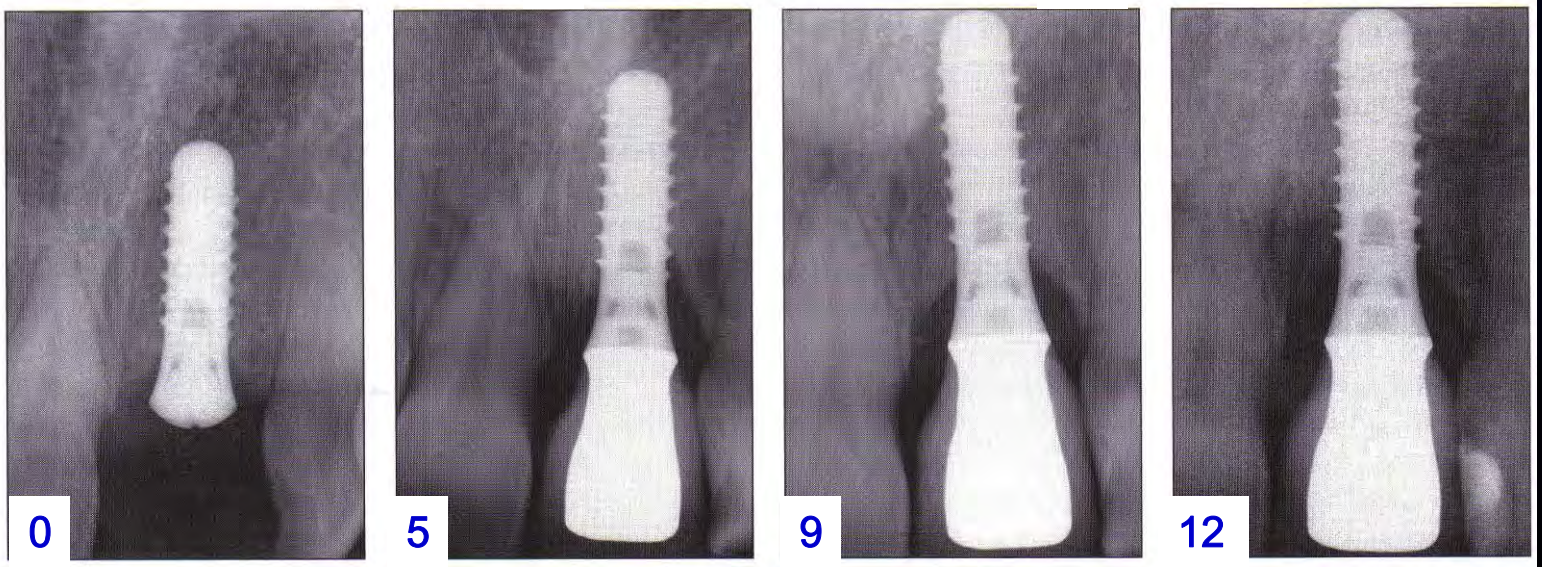
Consider consequences of interventions in the mixed dentition with regard to jaw development and establishment of the permanent dentition

1. Orthodontic space closure
2. Conventional prosthodontics
3. Removable flipper
4. Implant supported therapy
5. (Auto-transplantation)

Teeth continue to erupt

Teeth continue to erupt – 5 / 9 / 12 years postsurgery





Op Heij, et al. 2006

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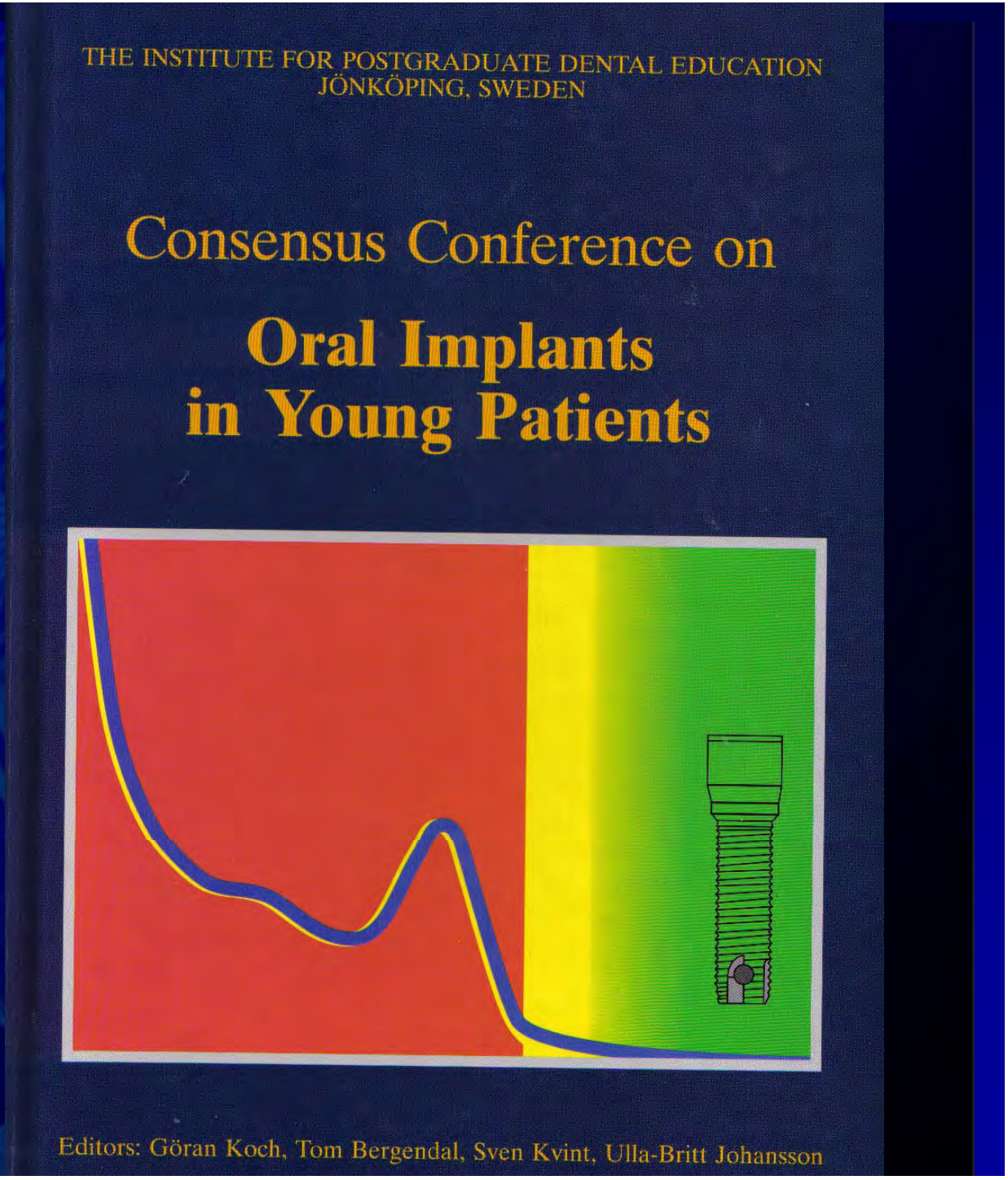

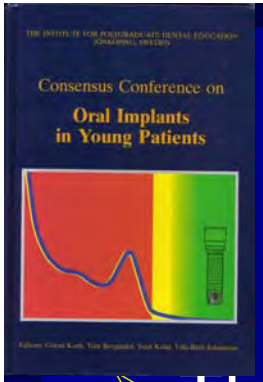

What is the optimal age for placing oral implants in young patients?

- There is no fixed chronological age for implant placement. Instead, biological age should be determined regarding growth and skeletal development which should he completed or nearly completed as assessed by different methods:
    1. longitudinal body height measurement
    2. hand-wrist radiograph

In cases of anodontia and severe oligodontia, however, oral implants may be placed before the pubertal growth spurt.

Implant therapy – delay!

5 years

Palatal position

Op Heij, et al. 2003

Implant therapy – delay!

Implant therapy – delay!

Implant therapy – delay!

Three major reasons for not placing implants in patients before growth ends:

1. The implant does not follow the growth of the alveolar ridge and will remain in an infraposition or perhaps even submerged
2. An implant can potentially influence the normal growth of the jaw
3. Immature bone reacts differently from mature bone. The implant may deviate from the original positional axis

Thank you for your kind attention