THE NATURAL IMPLANT

A review of auto transplantation and uprighting of teeth

Detroit District Dental
SW/Central/Western Branches

February 9, 2016

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Acknowledgements
What is Autotransplantation of Teeth?

- Extraction of one tooth into a different location
- Surgical repositioning of a tooth—uprighting
- Intentional replantation—Extraction, repair and reimplantation, compared to conventional apical surgery
# Advantages of Autotransplantation over Implants

<table>
<thead>
<tr>
<th>TRANSPLANTATION</th>
<th>IMPLANTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Induce Bone</td>
<td>No Bone induction</td>
</tr>
<tr>
<td>Induce a gingival papilla</td>
<td>Papilla has to be created</td>
</tr>
<tr>
<td>No requirement of bone support</td>
<td>Needs 3-dimensional bone support</td>
</tr>
<tr>
<td>Eruption possible</td>
<td>Eruption not possible</td>
</tr>
<tr>
<td>Can be moved orthodontically</td>
<td>Cannot be moved orthodontically</td>
</tr>
<tr>
<td>No age requirement</td>
<td>Limited to adults</td>
</tr>
<tr>
<td>Very good cost efficiency</td>
<td>Cost efficiency debatable</td>
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</table>
Ambrose Pare - 1561 introduced the technique, of replacing extracted teeth from another individual.

John Hunter – 1750 transplanted teeth into a Rooster cock’s comb to keep them alive for later use, many poor people donated teeth for money!

Allotransplantation in the 18th century became infamous in dental history for the transmission of syphilis.

Became re-introduced in the 1950’s --- 50% success rate.
Transplants and uprightings
INDICATIONS

- Unerupted Canines
- Malposed and Impacted teeth
- Decayed and Non-restorable teeth (with a suitable donor tooth)
Clinical Exam and Diagnosis

- Clinical Space at the recipient site—most difficult at canine sites, usually need Orthodontic expansion or previously extracted sites with collapse of the B-L alveolar width
- Extensive boney lesions or abscesses
- Patient attitude towards the procedure and the somewhat uncertainty of the procedure, but generally can present as a win/win situation
Patient Characteristics for Success

- Age – stage of root development
- Patient Medical conditions – Diabetes? Smoker? (My absolute contra-indication)
- Compliance – need for regular care and ability to follow up for monitoring and addition therapy if needed
Factors Influencing Prognosis of Autotransplantation

- Donor tooth periodontal ligament
- Root shape and degree of root formation
- Extraction difficulty and location
- Functioning vs Non-functioning teeth
- Vital vs Non-vital pulp
- Recipient site adaptation – less is better!
- PDL at recipient site – More is better!
- Attached gingival and general adaptation of ST
- Fixation/stabilization – Method and duration
  - Longer periods beyond 8 weeks will cause resorption and poorer prognosis

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Root Development vs Pulp Healing

Fig 3-31 Developmental stages of roots (classification of Moorrees et al\textsuperscript{13}).

<table>
<thead>
<tr>
<th>Stage</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Beginning of root formation</td>
</tr>
<tr>
<td>2</td>
<td>⅛ root formation</td>
</tr>
<tr>
<td>3</td>
<td>⅜ root formation</td>
</tr>
<tr>
<td>4</td>
<td>⅜ root formation</td>
</tr>
<tr>
<td>5</td>
<td>Complete root formation, apical foramen is wide open</td>
</tr>
<tr>
<td>6</td>
<td>Complete root formation, apical foramen is half closed</td>
</tr>
<tr>
<td>7</td>
<td>Complete root formation, apical foramen is nearly closed</td>
</tr>
</tbody>
</table>

Fig 3-32 Healing of pulp in relation to stage of root development.

![Bar chart showing healing of dental pulp and necrosis of dental pulp at different stages of root development.]

After 370 premolars at various developmental stages were transplanted, data on pulp healing were collected. Results show that healing of pulp cannot be expected at stage 6 or 7. Reprinted with permission from Andreasen et al.\textsuperscript{23}
Advantages

- May be a better alternative—especially in young and/or growing patients
- No preparation of adjacent teeth, except for proximal or occlusal contacts
- Cost effective compared to implants, fixed and removable prosthetics (usually charge only for the extractions, Endodontic treatment and restorative treatment if indicated are extra costs)
Disadvantages

- More surgical involvement
- Treatment outcome may be difficult to predict
- Possible complications such as:
  - Root resorption
  - Loss of attachment
  - Ankylosis
  - Loss of tooth
  - Fracture of donor tooth crown or roots
Classification of Root Resorption

- Replacement resorption – (Vital Pulp) occurs with large PDL damage, dentin is replaced by bone-partial ankylosis
- Inflammatory resorption-(dead pulp) dentin and bone replaced by granulation tissue
- Surface resorption-minor, no Ankylosis-PDL intact
Transplant optimally on the same day-can be delayed up to 2 months for socket preservation or for treatment of severe infections

- Preoperative antibiotic treatment 1 hour to 5 days before procedure
- Preoperative Motrin (400-800mg) or Aspirin treatment 1 hour before procedure, Anti-coagulation Treatment
- Decadron 4-8mg IM at recipient site immediately after Local Anesthesia or IV push slowly after induction of General or Sedation Anesthesia
Transplants and uprightings

Sequence of Treatment

- Extraction of tooth at recipient site and preparation of recipient site:
  - must be atraumatic as possible
  - Flap-less
  - Remove septal bone and contour socket as needed, sinus lift or B-L out-fracture of Alveolus with osteotomes
  - Minimize high-speed and rotary drills and use lots of sterile irrigation!
  - Curette only what is necessary, maintain as much of the PDL as possible
  - Quick root planing and scaling of adjacent teeth, must remove calculus
  - Adjustment of proximal contacts if indicated 1/2mm per surface, 2mm total as a general guideline
Sequence of Treatment

- **Extraction of Donor tooth**-
  - Flap as needed
  - Minimal incision of sulcus attachment, try to avoid PDL
  - On impacted teeth leave as much follicle as possible, minimize high-speed rotary drills and again use lots of **sterile irrigation!**
  - **Avoid the CEJ and Root surface!**
  - May require more bone removal than normal for atraumatic extraction
  - Handle tooth with serrated or diamond coated forceps by crown only
Sequence of Treatment

- Immediately try to insert tooth into recipient site within 5-10 seconds!
- Tooth may fit better rotated slightly or rotated a 180 degrees
- Adjust socket and proximal contacts if needed, while storing tooth in sterile saline soaked gauze
- Have patient with bite stick/tongue blade bite tooth into position (controversial according to Andreasen and Tsukiboshi)
- Remove hooked root apex if needed (cut off or break off) Avoid holding root surface!
- Try to achieve tight proximal contacts if possible
- Check Occlusion- premature contacts are “kiss of death”
Sequence of Treatment

- Trim follicle (if present) with new/sharp blade—leave 1-2mm cuff or flush with gingival crest
- Suture- prefer 3-0 Chromic gut (5-10days) in horizontal mattress to tightly adapt gingiva around tooth, occasionally addition interproximal and occlusal hold down sutures are needed
- If in Orthodontic treatment- bond bracket and tie into arch wire with elastic ties
- In Non Orthodontic cases if additional stabilization is needed splint with composite, Ribbond or twisted wire

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Root Canal Therapy

- Generally not needed if tooth is out of mouth less than 60 seconds or apex is open—need to observe closely for Inflammatory Root Resorption
- According to Andreasen an Tsukiboshi any tooth with a closed apex—start in 2 weeks with CaOH paste and complete with gutta percha at 2 months (same protocol if inflammatory resorption or apical pathology is suspected)
Replantation/Transplantation into existing sockets—4 to 8 weeks complete reattachment of the PDL

Transplantation into a newly prepared alveolar socket—cervical and gingival areas heal within 1-3 weeks and mature bone in 2-6 months

No chewing or function for 8 weeks and begin final orthodontic movement at 8 weeks

Prognosis of the transplant depends on the presence of the PDL on the root surface, it protects the root from resorption
PDL Survival

- **Survival outside the mouth in dry conditions**-
  - 18 mins/~70% survival
  - 30 mins/~28% survival
  - 60 mins/~21% survival

- **Survival outside the mouth in water**
  - 18 mins/~80% survival
  - 30 mins/~71% survival
  - 60 mins/~71% survival
  - 120 mins/~61% survival
Horizontal Bone Regeneration
Prognosis

Fig 7-7 Overall survival and success rates of autotransplantation.*

- Attachment loss
- Inflammatory resorption
- Replacement resorption
- Surface resorption
- No attachment gain

16 (10%)

110 Teeth

Survival: 90%
Success: 80%

*Cases of surface resorption are considered successful.

Fig 7-8 Overall survival and success rates of surgical extrusion.*

- Normal healing
- Inflammatory resorption
- Replacement resorption
- Surface resorption

7

40 Teeth

Survival: 95%
Success: 95%

*Average patient age at the transplantation time is 32; average years of follow-up is 4.5; and transplanted teeth include anterior, premolars, and molars.

Fig 7-9 Survival and success rates of transplantation to extraction sockets with existing periodontal ligament.

- Normal healing
- Inflammatory resorption
- No attachment gain

107 Teeth

Survival: 100%
Success: 95%

Fig 7-10 Survival and success rates of transplantation to nonextraction sockets (no existing periodontal ligament).

- Normal healing
- Attachment loss
- Inflammatory resorption
- Replacement resorption
- Surface resorption

19 (60.5%)

83 Teeth

Survival: 77%
Success: 60%

Fig 7-11 Survival and success rates of transplantation to nonextraction sites in patients older than 40 years.

- Normal healing
- Attachment loss
- Inflammatory resorption
- Replacement resorption

15 (29.4%)

51 Teeth

Survival: 71%
Success: 49%

Fig 7-12 Survival and success rates of transplantation to nonextraction sites in patients aged 40 years and younger.

- Normal healing
- Attachment loss
- Inflammatory resorption
- Surface resorption

2 (60.4%)

33 Teeth

Survival: 88%
Success: 75%
Recommended Radiographic Monitoring

- Immediate post op
- 1 month – possible first signs of root resorption
- 2 month – Inflammatory root resorption if present
- 3 month – healing phase near completion
- 6 month – healing phase complete
- 12 months and yearly on routine appointments

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Clinical examples of Autotransplantation

3-03-04
#27

1-31-05
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Transplants and uprightings
Transplants and uprightings

12/11/07

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LC
Transplants and uprightings
Transplants and uprightings
Transplant #11

Pre-op

Immediate Post-Op

8 weeks post-op

Post-op 1 year
Transplants and uprightings
Auto-transplant #27

Immediate Post-Op

5 year Post-Op

Transplants and uprightings
6 weeks post-op, possible inflammatory Resorption?
Transplants and uprightings
#16 into #15  1 year post-Op
Transplants and uprightings
Immediate Post-Op

Transplants and uprightings
Transplants and uprightings

Preop

Failed Endodontics

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Immediate Post op
3 months post op

12-15-2009

12-15-2009

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Transplants and uprightings
Transplants and uprightings

3 months post op
Transplants and uprightings
Transplants and uprightings
10 year Post Op

12-14-2009

Transplants and uprightings
Transplants and uprightings
Clinical examples of Uprightings
Transplants and uprightings
Transplants and uprightings
Transplants and uprightings

Preop

3½ year Post-Op

Immediate Post-Op
Transplants and uprightings
Transplants and uprightings
Transplants and uprightings
Pre op #32 into #18
Transplants and uprightings
Questions?
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