USA dental insurance funding
Survival and Success
Endodontic Issues & Natural Tooth Survival
Restorability of Natural Teeth
Success of Implants and Supra-Structure Performance
Periodontal Risk Issues for Teeth and Implants
Factors influencing treatment decision-making for maintaining or extracting compromised teeth

Key words: treatment planning, decision-making, dental education, implant dentistry, public health, extraction, compromised teeth

Abstract
Aims: To evaluate treatment decision-making with respect to maintaining periodontally compromised teeth.

Results: The results show that factors such as experience and formal training significantly influence decision-making in dental practice.

Dentist-led decision-making affected by experience and formal training
Decision making - Dentist factors

Nine written scenarios

In Questions to the scenarios 1-9
Scenario 1a and 1b: Please choose either treatment option (a) or (b)
(a) I would choose to save the tooth 26.
Which of the following treatment options do you choose? One or more are acceptable:

- Grey Root Canal Treatment (RCT)
- Amputation of the distal end of tooth 26 after RCT
- Regenerative procedure to close the furcation
- Leave the situation unrestored
Other, please specify

(b) I would choose to extract the tooth 26.
Which of the following treatment option do you choose to replace the tooth? (Please choose only one)
- Conventional bridge 25K (assuming no problems with 23A/T)
- Replacement of tooth 26 with an single implant
- Leave the situation unrestored
- Other, please specify

Scenario 2a and 2b: Please choose either treatment option (a) or (b)
(a) I would choose to save the tooth 26.
Which of the following treatment options do you choose? One or more are acceptable:

- Only Root Canal Treatment (RCT)
- Amputation of the distal end of tooth 26 after RCT
- Regenerative procedure to close the furcation
- Leave the situation unrestored
Other, please specify

(b) I would choose to extract the tooth 26.
Which of the following treatment option do you choose to replace the tooth? (Please choose only one)
- Conventional bridge 25K (assuming no problems with 23A/T)
- Replacement of tooth 26 with an single implant
- Leave the situation unrestored
- Other, please specify

What would the three groups of dentists do?

Conclusions

• Hong Kong GDPPs and GDPTs more frequently opted not to rehabilitate compared to Hong Kong GDPs

• Findings from the regression analyses identified that GDPPs and GDPTs were three times as likely to retain compromised maxillary molars with or without pain

• GDPs (who place implants in practice without formal training) prescribe more implants (less of other options) to restore a space than GDPPs and GDPTs

• GDPs less likely to RCT and more likely to suggest Rx options where outcome not robustly supported by evidence

Conclusions

• Training status in terms of OI training will influence treatment planning & option choice.

• North American GDP surveys—different conclusions.


- Dentist-led decision-making


• **USA:** Stockhausen R, Aseltine R Jr, Matthews J G, Kaufman B. The perceived prognosis of endodontic treatment and implant therapy among dental practitioners. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2011; 111: e42–e47) found that there was no shift towards implant treatment compared with endodontic treatment, despite a perception that implant treatment produced a better outcome.
American Insurance companies

Table 1. Summary of annual failure rates, relative failure rates and 5-year survival estimates

<table>
<thead>
<tr>
<th>Type of reconstructions</th>
<th>Total number of reconstructions</th>
<th>Total exposure time</th>
<th>Mean follow-up time</th>
<th>Estimated annual failure rate</th>
<th>5-year survival summary estimate, % (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conventional FDP</td>
<td>2088</td>
<td>11998</td>
<td>5.7</td>
<td>1.28 (\pm 0.64-2.59)</td>
<td>93.8 (\pm 87.9-96.9)</td>
</tr>
<tr>
<td>Cantilever FDP</td>
<td>432</td>
<td>2112</td>
<td>5.2</td>
<td>1.80 (\pm 1.15-2.82)</td>
<td>91.4 (\pm 86.9-94.4)</td>
</tr>
<tr>
<td>Implant supported FDP</td>
<td>1384</td>
<td>6880</td>
<td>5</td>
<td>0.99 (0.64-1.52)</td>
<td>95.2 (92.7-96.8)</td>
</tr>
<tr>
<td>Tooth-implant supported FDP</td>
<td>199</td>
<td>976</td>
<td>5</td>
<td>0.92 (0.50-1.70)</td>
<td>95.5 (91.9-97.5)</td>
</tr>
<tr>
<td>Implant supported SC</td>
<td>465</td>
<td>2280</td>
<td>5</td>
<td>1.14 (0.76-1.70)</td>
<td>94.5 (91.8-96.3)</td>
</tr>
<tr>
<td>Resin bonded bridges</td>
<td>1374</td>
<td>8241</td>
<td>6</td>
<td>2.61 (1.68-4.06)</td>
<td>87.7 (81.6-91.9)</td>
</tr>
</tbody>
</table>

*Based on standard Poisson regression.
†Based on random-effects Poisson regression.

Note that RBBs drop down to 65% at 10 years compared to 89.2% for FDP and 86.7% for OI FPD and 89.4% for OI SC
Comparison of RCT’d teeth with OI SCs

Doyle SL, Hodges JS, Pesun IJ et al.
Retrospective cross sectional comparison of initial nonsurgical endodontic treatment and single tooth implants.

J Endod 2006; 32: 822–827
A comparative study matched 196 single-tooth implants to 196 root-canal-treated teeth.

Compared 4 different outcomes:
- Success
- Survival
- Survival with intervention
- Failure

Interestingly, 73.5% of implants were considered successful in comparison with 82.1% of endodontically treated teeth.

Failure was recorded in 6.1% of subjects in both groups.

Implants required a significantly greater amount of interventions (18%), which varied from connective tissue graft and remedial surgery for peri-implantitis to screw loosening.

Although markedly fewer (3.6%) interventions for the endodontic group were noteworthy and included root canal treatment and apical surgery.

Endodontic Rx tooth survival

Survival at eight to ten years was 87%.

They were able to place the influential factors in order of significance:

1. A full coverage coronal restoration after root canal treatment
2. Tooth has both mesial and distal proximal contacts
3. Tooth not acting as abutment for either a removable or fixed prosthesis
4. Tooth type, specifically non-molar teeth.

Endodontic Tooth Survival

After four years the cumulative tooth survival rate was 95.4% for primary treatment and 95.3% for secondary treatment.

Post-operative factors relevant to survival of root filled teeth were:

- The presence of a cast restoration coronally (positive)
- Two proximal contacts (positive)
- Cast post and core (negative)
- Terminal tooth (negative)

Survival Comparison
Survival rates of NHS RCT’s mandibular 6s

- RCT of 174 lower 6s - 12 NHS practices
- Salford (NW England)
- 90% retained at 5 years - **Most failures in first year**
- **10% failure**: 15 extracted, 1 retreated
- Most important positive statistical significant on tooth survival was **presence of crown**
- **No correlation** of tooth survival and **quality of post-op radiograph**

*Tickle et al, British Dental Journal (2008)*
Implant fixture and supra-structure survival

Prosthodontic problems become apparent between years 5 & 10

Pjetursson et al.
A systematic review of the survival and complication rates of implant-supported fixed dental prostheses (FDPs) after a mean observation period of at least 5 years.

- Implant survival rate in this larger cohort was 95.6% after 5 years and 93.1% after 10 years.
- Suprastructure survival: 95.4% and 80.1% after five and ten years respectively.
Endodontic revision can we predict what will work?

• The poorer the quality of the primary root filling in situ the easier and more predictable will be your re-treatment. You can then expect a 80% positive outcome (NG et al 2011) if you can achieve your objectives

• Ideally you want to revise a short poorly obturated root fillings!

• High risk: perforations, resorption, ledges, blockages, iatrogenic error – anything that stops you reaching your objective. The ‘Toronto’ study
Retreatment or radiographic monitoring in endodontics

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Department of Dental Medicine and Stomatology, and *Department of Hospital Administration, Catholic University of Louvain, Belgium

Endodontic Issues

Retreatment usually means removing a GP - do not be scared of the stuff it will not bite! – You need to get to the end of the canal very early and achieve patency.
Ng et al (2008):
Existing Apical Area
Good Coronal Seal
Obturation within 2mm from radiographic apex
Voidless and well condensed obturation

Pre-operative factors that made a difference to outcome:
- Presence of periapical lesion (49% lower)
- Size of periapical lesion (14% lower for every 1mm)
- Presence of sinus (48% lower)
- Presence of root perforation (56% lower)

Is our Endodontics going to work?

**Intra-operative:**
- Achieving patency (Two-fold increase)
- Canal prepared short of terminus (12% lower for every 1mm short)
- Long root filling (62% lower odds of success)
- Using Chlorhexidine as Irrigant (53% lower)
- Using EDTA (Re-RCTx) (Two-fold increase)
- Inter-appointment swelling/pain (47% lower)
A single RCT reported similar healing rates for Surg and Non Surg intervention (if done well). Therefore we have non-robust evidence for decision-making.

Apical Surgery – Strategically important teeth (Eliyas et al 2014)

- A tooth may be considered of strategic importance when it is an anterior tooth in a patient with a high lip line and thin soft tissues where implant success may be difficult to predict and achieve.
- When the tooth is a terminal abutment where extraction would leave the patient with an unbounded saddle particularly if complicating factors for OI e.g. lack of access, bone or poor anatomy.
- Financial and time limitations – e.g. NHS funding.

Restorability & Restoration – Coronal Seal

Post-operative:

- Good coronal restoration (Elevenfold increase in odds of success) Ng et al (2011) Ng, Mann & Gulabivala; International Endodontic Journal, 2011

THE ROLE OF THE CORONAL RESTORATION ON ROOT FILLED TEETH


Results: 97% of these teeth were retained after eight years following non-surgical root canal treatment.

The Failures: The majority (85%) of the extracted teeth had no complete coronal restoration, which was significantly different from those teeth will full coverage.


Ng, Mann & Gulabivala; International Endodontic Journal, 2011
Can we objectivise decision – making on tooth restorability? - we can try but - **NO!**
Can you objectivise decision – making on restorability?
Can I get an impression of a sound tooth margin & what will I need to do to get it? / What am I asking of the tooth? / If lost will the patient want the space filled?
Visible Cosmetic Zone

A 50 year old female with a symptomatic UL1 past post crown – can I resolve the ‘infection’ problem and still have a predictably restorable tooth?
Assuming the root intact, no deep localised pockets and treatment done well (5mm GP / decent post and crown) then one is looking at a very high survival of single and multi-rooted teeth supporting single fixed restorations (Salvi et al 2007).

Creugers and Mentink


The amount, height, thickness & ferrule of remaining tooth structure is the most important factor on outcome - much more so than the type & length of post and the type of core.
An assessment of endodontic re-treatment decision-making in an educational setting

Results & Discussion:
• Deciding to re-treat a tooth surgically due to the presence of a post is a safe option and doesn't balance risk squarely.
• Such practice is ‘minimising losses’ rather than ‘maximizing gains’ (Mileman & Kievit 1992)
A Briggsy tip (Abbott 2004)

**Never** ever use the presence of a post to drive decision-making – it should be the strategic worth, what you are asking of the tooth, amount of caries, remaining supragingival tooth tissue present and the risk to reward of the other options.
Greater risk of periapical infection when there is a radiographic space between the root filling and the post

(Moshonov et al 2005)
We need to get the cement right down the root not wipe it up coronally when you insert the post
Use it or lose it?

Tooth Investigation – referred case for re-restoration or extraction and implants LL67. No other major problems with an otherwise intact dentition.
Let's explore

- ODS wants to know why is the best thing to do with the symptomatic LL67
- Both teeth RCTd many years ago
- Then 'crowned' with PFM s – defective crown margins
- Caries visible LL7
- Periapical / furcation area LL7
- What do we think of the endodontic quality
What further investigation/tests would you request and why?

Use it or lose it?
Tooth Investigation – referred case for re-restoration or extraction and implants LL67. No other major problems with an otherwise intact dentition.
Use it or lose it?

Tooth Investigation – I always like to use a bitewing as you can get a perpendicular view of the coronal perio-crown interface of the teeth.
Coronal Height above the Alveolar Crest

bitewing gives you the best representation of this
What makes a molar strategically important?

- Function – occlusal value
- Aesthetic role – smile width
- Attitude of Patient
- General dental health, condition and motivation of the patient
Use it or lose it?

What is the reason for symptoms / infections

Coronal Leakage:
Ng et al 2011
Ng et al 2008
Ray & Trope 1995
Briggs & Scott 1997

Van Nieuwenhuysen et al 1994 IEJ 27:75-81
Use it or lose it?

Tooth Investigation

• We need to **strip down** to the remaining **sound tooth** tissue to confirm or deny the **amount, type and quality** of sound tooth tissue **above the alveolar crest**.

• A coronal evaluation and restorative decision should precede any re-endo and post removal.

• If endodontic Rx necessary we need to find root canal(s) and obturate them

• Our endodontic technique needs to preserve as much tooth-tissue as possible
Strip down, investigate - plan restorative strategy/coro/coronal coverage

Tooth Restorability Index

McDonald & Setchell. Dental Update. 2005;32:343-348

- Height & width of axial dentine after restoration removal + crown prep
  - 0 = None (no axial dentine above finishing line)
  - 1 = Inadequate (dentine walls <1.5mm thick or more than 2x as high as their thinnest part)
  - 2 = Questionable (between 1 and 3)
  - 3 = Adequate (adequate height, thickness and distribution of axial dentine walls)

Clinical Decision:
- Tooth with a TRI of 12 and greater: Acceptable
- Teeth with scores of 9–12: Questionable and dependent on number of sextants with a score of 3. Acceptable if 2–3 sextants have achieved a comfortable 3 score.
- Score < 9: Unacceptable to retain a plastic core. Consider: crown lengthening; cast post and core.
What did I do and why?

- Following crown removal and microscopic examination of both teeth with caries removed I felt that LL7 could be re-restored with cores and new crowns (after endodontic infection control)
What I did and why?

- I feel that these restorations in combination with good OH & carbohydrate control will perform well – The amount of remaining tooth tissue above the alveolar crest is the key to my decision.
With good patient motivation, good OH & diet carbohydrate control (frequency) the teeth should perform well – The amount of remaining tooth tissue above the alveolar crest is the key to my decision

Van Nieuwenhuysen et al 1994 IEJ 27:75-81
Cores – which and why?
proven biological context
LL7 suddenly becomes a very strategically important molar tooth that also needs RCT & effective coronal re-restoration.
2014 control of proven biological context
The more skills you have the more difficult it can get - The GDP / Prosthodontist should make the restorability call not the endodontist or an implantologist
Visible Cosmetic Zone -
A 35 year old female with a symptomatic UL1 past post crown failure – poor coronal tooth tissue, high lip line – not restorable - immediate implant or CRRB to replace UR1

Bone quality
Implant length & diameter
Immediate placement & stability
Soft tissue anatomy / Lip line
Early loading / same day teeth?
Biological risks
Blasted v Smooth surface
Maxilla v Mandible (ant or post)
Risk to reward with Implants

- IV bisphosphonates
- Radiotherapy
- Uncontrolled Diabetes
- Immune disorders and steroids
- Uncontrolled Periodontitis
- Smoking
- Heavy alcohol
- Past OI and / or Graft failure
- Reason for Tooth Loss

- Poor OH / Chronic Perio
- Parafuction
- State and position of neighbouring teeth / CAP
- Anatomy – sinus / floor of nose / dimensions of socket / ID / Mental
- Soft tissue type and form
- Keratinised tissue deficit
Peri-implantitis – my case – dentist and patient factors
Appearance 12 years later
March 2014

Over 12 years of controlled peri-implantitis UL2 Implant – dentist (PB) and patient factors
OK we all know that patients get periodontal problems with their natural teeth – so how do implants fit in with this risk?


- Concluded that Implants used to replace teeth lost due to: Trauma, Caries & Hypodontia do best
• For Smoking and Perio = 20% greater failure & 7 times greater complications compared to smokers without perio
• Smokers with history of Periodontitis = Survival rate: 80% - problems mostly after 6 years
• Smokers with no history of periodontitis over a 10 year period = Survival rate: 100%
Roccuzzo et al (2012)

- Total number of implants 146
- Implants lost during the study period = 18 – 12.3%
How did the periodontally-involved teeth perform in the same study period?
During the 10-year SPT, 129 teeth were extracted, corresponding to 6.0% of the 2143 teeth

**Table 3. Demographic and clinical parameters at the 10-year follow-up**

<table>
<thead>
<tr>
<th>Patients</th>
<th>mFMPS</th>
<th>mFMBS</th>
<th>Mean number of lost teeth</th>
<th>Patients within SPT</th>
<th>Patients out of SPT</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHP</td>
<td>28</td>
<td>23.2 ± 10%</td>
<td>19.1 ± 11.3%*</td>
<td>0.9 ± 1.2</td>
<td>24</td>
</tr>
<tr>
<td>Moderate PCP</td>
<td>37</td>
<td>24.1 ± 12.4%</td>
<td>21 ± 8.2%*</td>
<td>1.3 ± 1.6</td>
<td>26</td>
</tr>
<tr>
<td>Severe PCP</td>
<td>36</td>
<td>25.2 ± 9.8%</td>
<td>26.6 ± 12.9%*</td>
<td>1.5 ± 1.7</td>
<td>29</td>
</tr>
</tbody>
</table>

*pStatistically significant difference between PHP and severe PCP and between moderate PCP and severe PCP (P < 0.05).

SPT, Supportive Periodontal Therapy; PHP, periodontally healthy patients; PCP, periodontally compromised patients; mFMPS, mean full mouth plaque score; mFMBS, mean full mouth bleeding score.
The more complex the Rx (i.e. large grafts) then there will be more complications and long-term problems

Retrospective case series. Complications in 17.4% of implants up to 11.8 years of service (mean 5 years)

Intermediate RBBs at 4 months after iliac bone grafting – look at the shrinkage! Can be up to 25 -30%
It’s a good job that we have things like Neo-Biotech Implant Fixture Removal Kit – Cost (Incl. VAT) = £1,440.00 when we need it for these patients
• The periodontal patient needs earn their implants with proof of long-term compliance to both plaque control and a maintenance programme (are they able to eliminate bleeding & inflammation?)

• We must be honest and do not de-value the importance of even significantly periodontally compromised teeth

• Smoking & periodontitis – a big, big risk

• I find that such patients also often drink more than 30 units of alcohol a week and approach the control of their type II diabetes as a bit of a joke – they also pressure for same day teeth, all-on-4 etc. and always want fixed!

From Roccuzzo et al (2012)
Conclusions

- Aesthetics are more unpredictable – lip line must be carefully assessed
- May need to create more bone and soft tissue to make it look tooth-like
- Recession = Metal
- Less good at resisting periodontal disease compared to natural teeth
- Final prosthodontic option that does not buy the patient time
- Still learning how to resolve the biological complications
- Potential violation of important anatomical structures
- Easier to remove than in the past
- Survival is good in decent bone with adequate length and diameter – but the implications from subsequent biological loss are potentially dire – we need to know where the risks lie

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Conclusions

Endodontics & Tooth Preservation

• Aesthetics is more predictable as you have a root, intact socket bone and soft-tissues to play with
• Survival & Integration: bone is already present as long as we can control periapical periodontitis – remaining coronal tooth tissue the key
• Periodontal disease can be predictably controlled for most patients
• Recession shows root-dentine
• Seems better at withstanding future periodontal bone loss than titanium
• Keeps options open and buys time
• Most of us can resolve most (not all) tooth / restoration complications
• Avoids grafts and potential anatomical violation
• What is the worst that can happen?
It’s your call – we must shout loud and not allow the loss of basic traditional prosthodontics foundation skills on the back of: ‘just take it out and stick in an implant’ – it’s one of several factors leading to industrial levels of dental de-skilling in the UK.

Which is easier Prosthodontically?