


BDA
British Dental Association

KING'S College LONDON

Happiness is quiet nerves

Tara.renton@kcl.ac.uk

Northern Ireland BDA
2014

TRIGEMINAL FOUNDATION

Nerve Injuries

Helping to prevent, educate and manage

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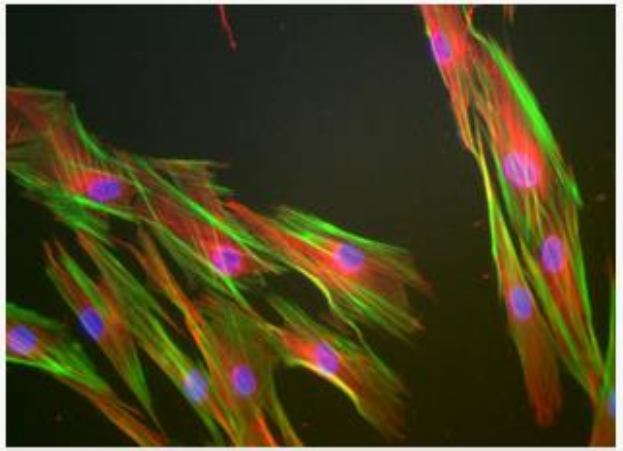

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Challenges for Oral surgery

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Ageing population
- medical complexity
- increased complications

Social circumstances

Mental health

Litigation
- poor communication-consent
- patient expectations
- Specialist training

Specific Surgical challenges
- Increased complications

Healthy longevity!

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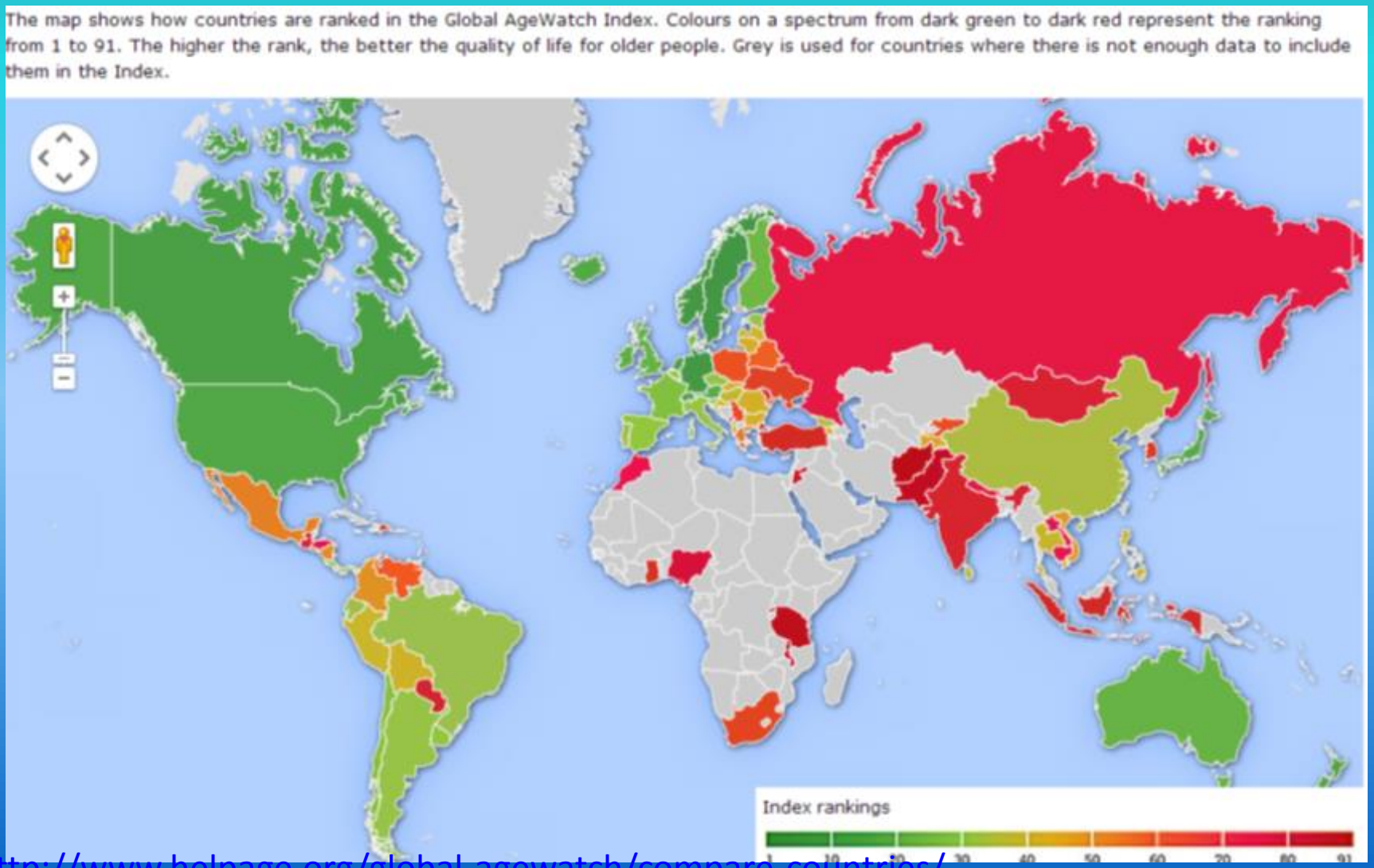

http://www.helpage.org/global-agewatch/compare-countries/

Older patient - more teeth

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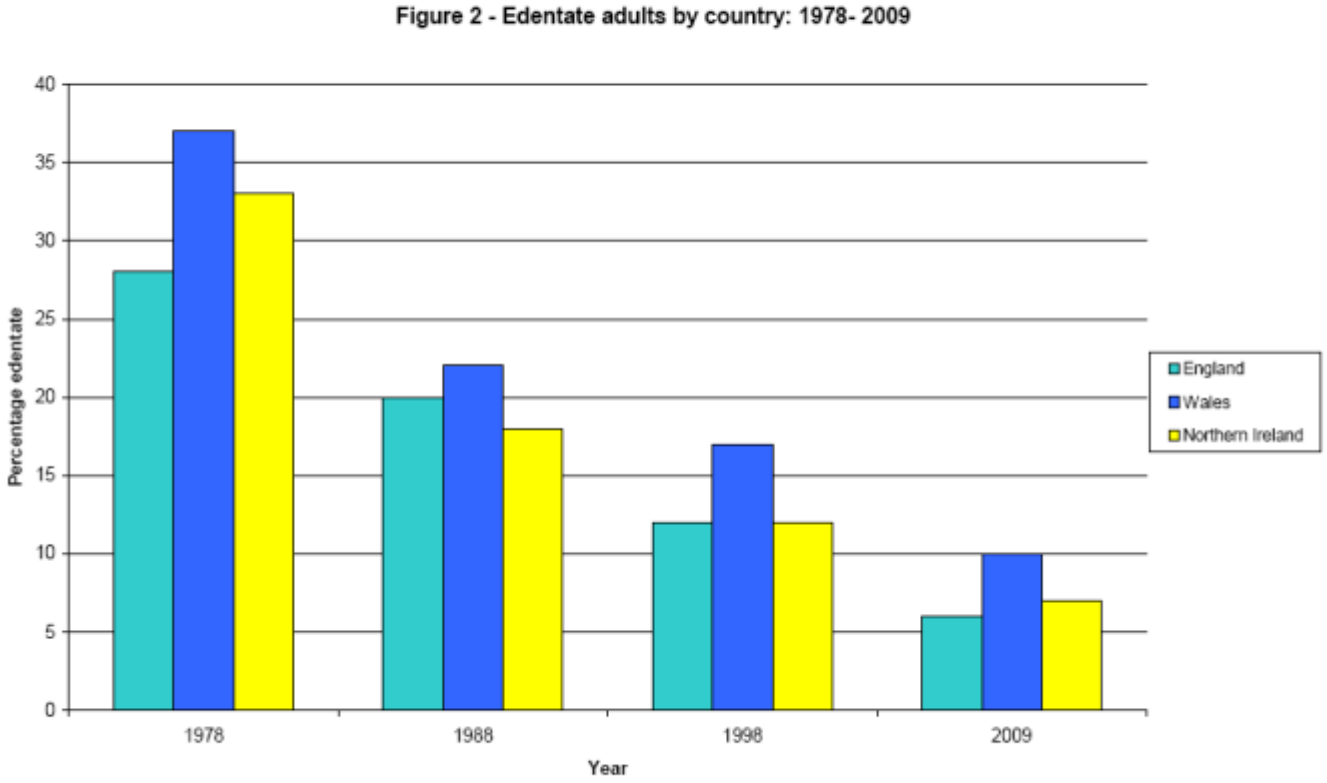
Adult Dental Health Survey 2009



Mental health

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Young Patients	Older patients
• Suicidal teenagers • Depressed housewives • Substance abuse • Self harming • OCD	• Dementia • Alzheimer's • Parkinson's • Post Stroke • IHD + minor strokes

1 in 4 people will experience a mental health problem in any given year. This is the most commonly quoted statistic, and the one which has the most research evidence to support it. It came initially from a large scale study published first in 1980, then updated again 1992[i]. This figure is further supported by the results of all three Adult Psychiatric Morbidity Surveys[ii]

Specific surgical challengs

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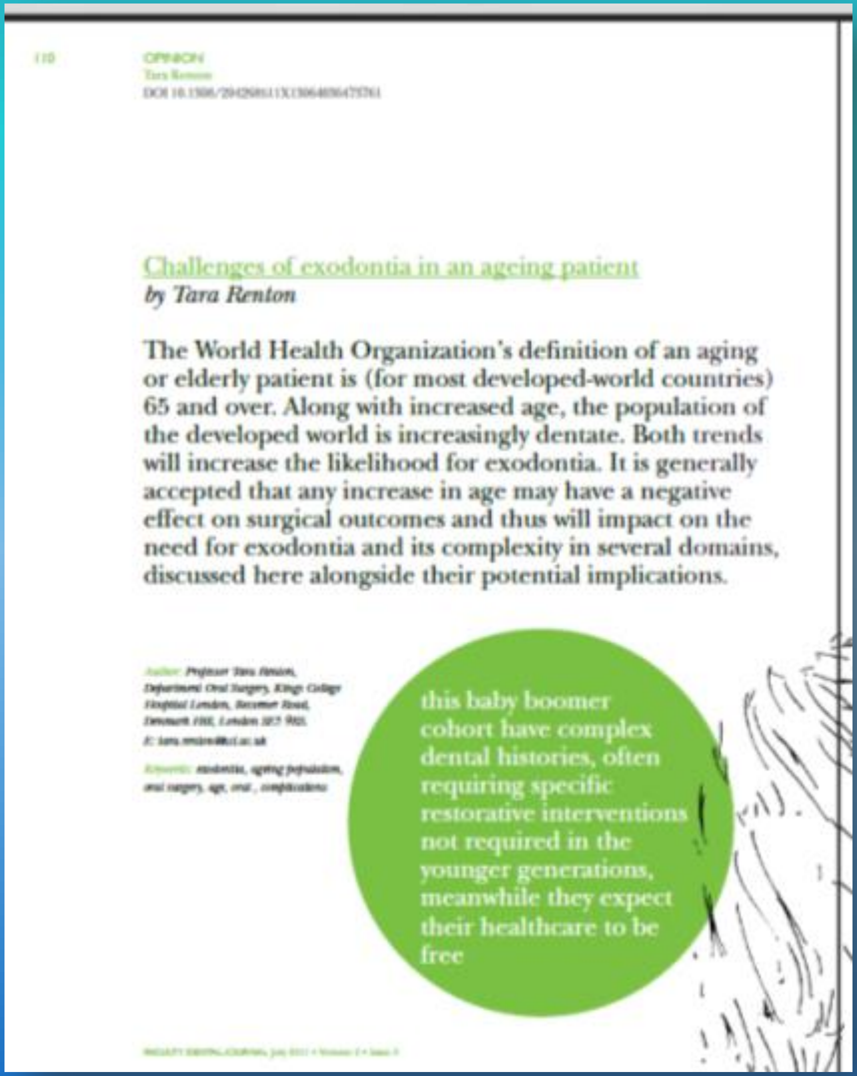
Medical

- Obesity, IHD, Stroke, Diabetes Mellitus, Metabolic syndrome, Neoplasia, Dementia
- Selection anaesthesia
  - LA, Sedation, GA
- Drugs
- Interactions, Haemorrhage, Allergies, Wound healing

Surgical

- Workforce
- Increased difficulty of surgery with age
- Increased complications with age

Royal College of Surgeons England faculty dental journal 2012



OPINION

Challenges of exodontia in an ageing patient

by Tara Renton

The World Health Organization's definition of an aging or elderly patient is (for most developed-world countries) 65 and over. Along with increased age, the population of the developed world is increasingly dentate. Both trends will increase the likelihood for exodontia. It is generally accepted that any increase in age may have a negative effect on surgical outcomes and thus will impact on the need for exodontia and its complexity in several domains, discussed here alongside their potential implications.

this baby boomer cohort have complex dental histories, often requiring specific restorative interventions not required in the younger generations, meanwhile they expect their healthcare to be free

Future patients

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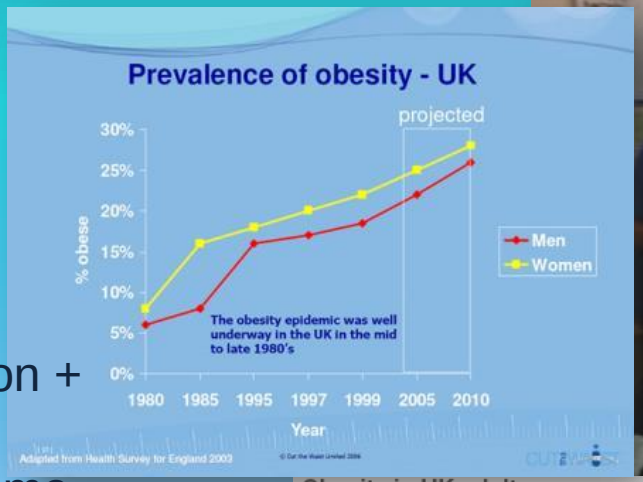
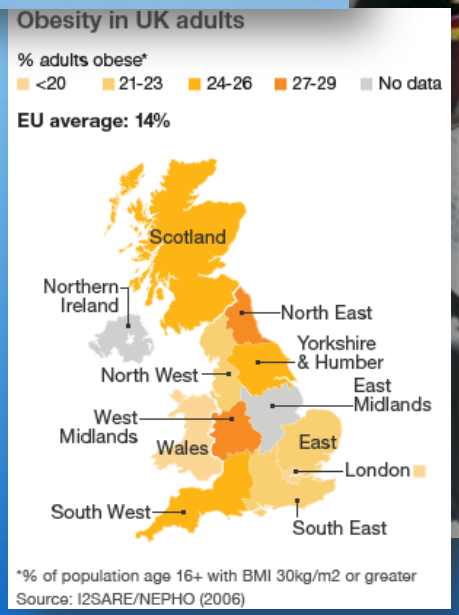
- Obese
- Phobic
- Retained carious dentition + wisdom teeth
- Cardio metabolic syndrome
  - DM
  - IHD
  - Hypertensive
  - Stroke risk





- http://www.youtube.com/watch?v=yKGmX2TElRQ

Drugs

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Anticoagulants

- anti platelet
- anti thrombotic

Steroids

Antibiotic prophylaxis?

Immunosuppressants

Interactions?

Bisphosphonates!

Haemorrhagic risk

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Congenital	Acquired	Drugs

• Haemophilia
• Won Willebrands
	• **Liver disease**
	• **Renal disease**
	• **Cancer pts**
		• **Anti thrombotics**
		  • Warfarin / Coumadin commonest anticoagulant world wide
		  • Vitamin K antagonist reducing the synthesis of factors II VII IX and X of the coagulation cascade
		  • Indications-AF, PE, DVT

No change in INR?

- **Not always safe!**

- Beware …Factor Xa and X c inhibitors replace Warfarin

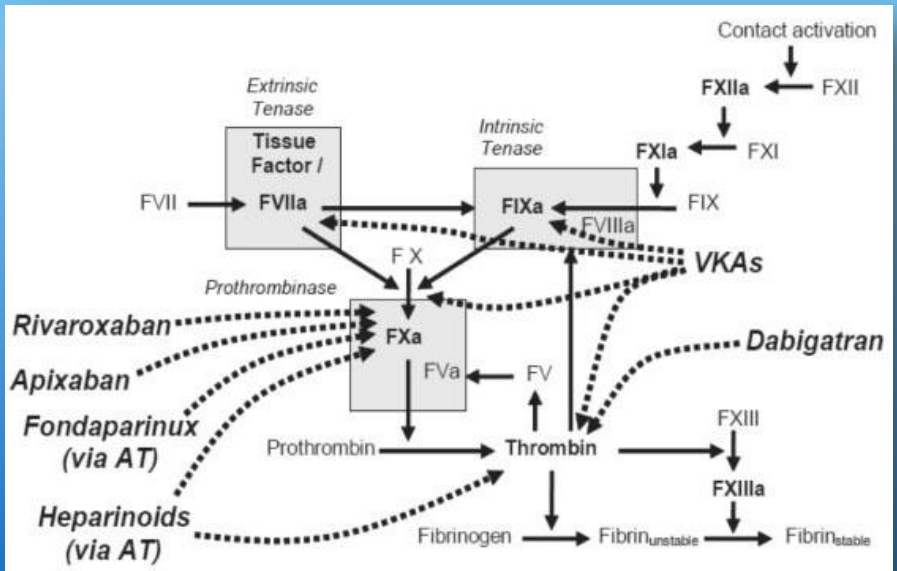

FIGURE 1 - Classic anticoagulant drugs and their targets in the coagulation cascade (Lassen, Laux, 2008).

Allergy chlorhexidine

TNI

Br Dent J. 2012 Dec;213(11):547-50. doi: 10.1038/sj.bdj.2012.1086.

Chlorhexidine and hypersensitivity reactions in dentistry.

Pemberton MN, Gibson J.

University Dental Hospital of Manchester and School of Dentistry, Higher Cambridge Street, Manchester, M15 6FH, UK. mike.pemberton@manchester.ac.uk

Abstract

Immu… …tact dermatitis/stomatitis (Type IV hyper… …well known within dentistry. The purpose of this paper… …ypersensitivity reactions and to consider this possi…

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16 September 2011 Last updated at 18:14 GMT

Mouthwash reaction killed Brighton dental patient

A woman died after suffering a fatal reaction to mouthwash during routine dental treatment in East Sussex, an inquest has heard.

Ms Rumaner suffered a reaction to the mouthwash at Morley Street Dental Clinic in Brighton

Sacha Rumaner, 30, suffered an anaphylactic shock at the Morley Street Family Dental Clinic in Brighton.

Coroner Karen Henderson said failure of staff to recognise the condition was "regrettable but understandable".

Dr Henderson recorded a verdict of death by medical misadventure at Brighton County Court.

She said she would write to the chief executive of Sussex Community NHS Trust to ask the trust to review its provisions of resuscitation

Death at the Dentist

Recently a patient died after suffering from an allergic reaction to Chlorhexidine. David Reissner discusses this issue and provides some recommendations.

The recent Coroner's Inquest into the death of a patient after suffering from a fatal reaction to mouthwash given by his dentist[1] will give dentists cause for concern, particularly because the February Inquest into the death of Graham Dalby was followed in late March 2011 by reports of the death in a Brighton dentist's chair of Sacha Rumaner[2] after a suspected fatal reaction to mouthwash..

In the case of Mr Dalby, an allergy to latex was ruled out by the coroner after hearing at the inquest that before treatment the practice had requested information regarding allergic reactions and Mr Dalby had stated that he had been allergic to rubber but not latex.

Mr Dalby's dentist, Rachael Gibson, had used chlorhexidine, a commonly used antibacterial solution contained in mouthwash, to wash his tooth socket. Unfortunately Mr Dalby suffered from anaphylactic shock inducing a cardiac arrest.

The Oxford Journal reported on 26th March 2009 that chlorhexidine has been widely reported to cause IgE-mediated allergic reactions (from urticaria and angioedema to anaphylaxis) among patients undergoing surgery/invasive procedures. The study concluded after identifying four cases of chlorhexidine allergy among heath care workers that despite its excellent antimicrobial properties, chlorhexidine is an occupational

Allergol Immunopathol (Madr). 2012 Dec 19. pii: S0301-0546(12)00262-5. doi: 10.1016/j.aller.2012.08.001. **Immediate hypersensitivity to chlorhexidine is increasingly recognised in the United Kingdom.**
Nakonechna A, Dore P, Dixon T, Khan S, Deacock S, Holding S, Abuzakouk M

Other challenges

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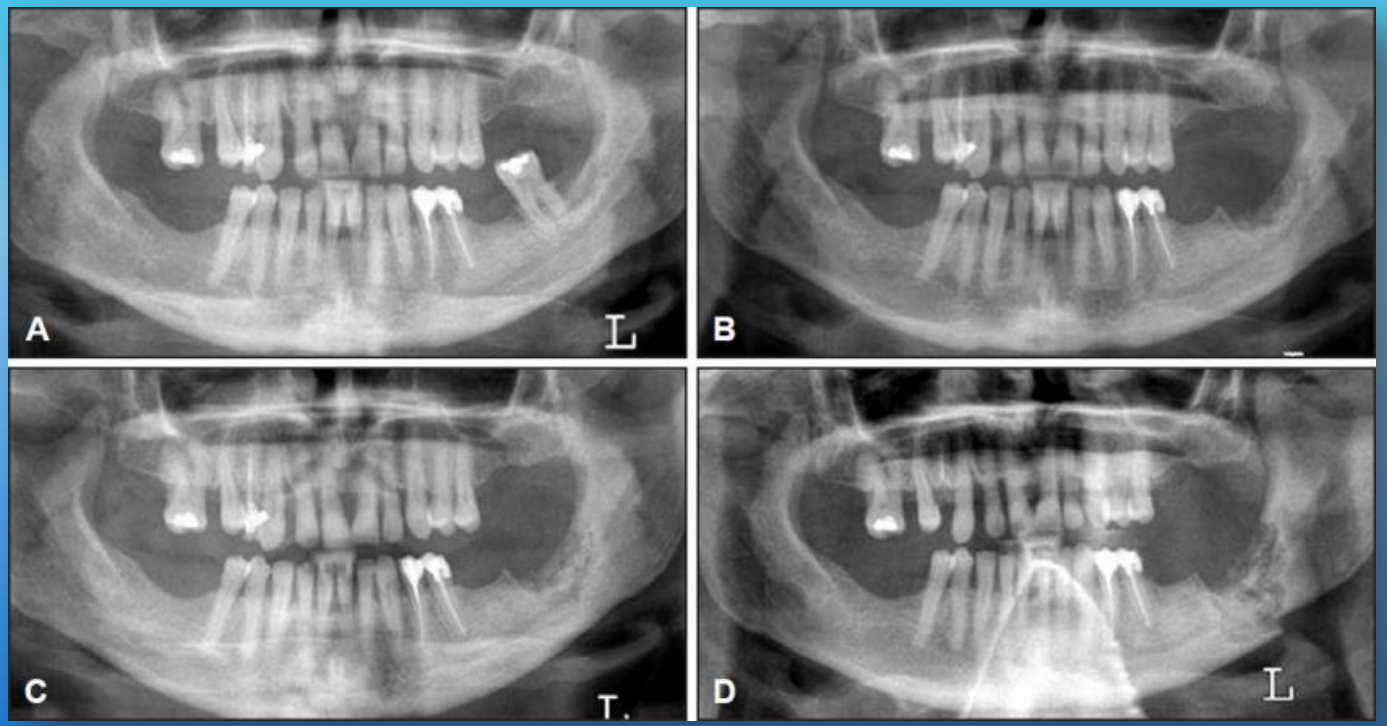
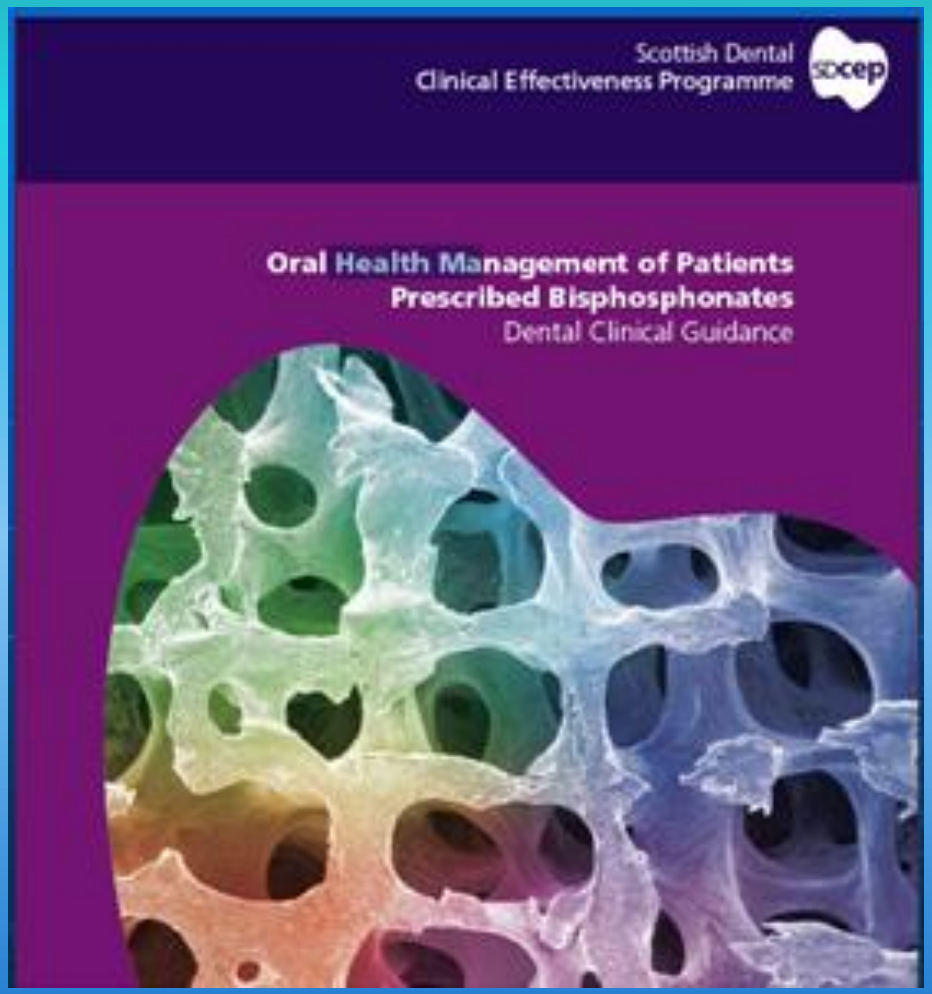
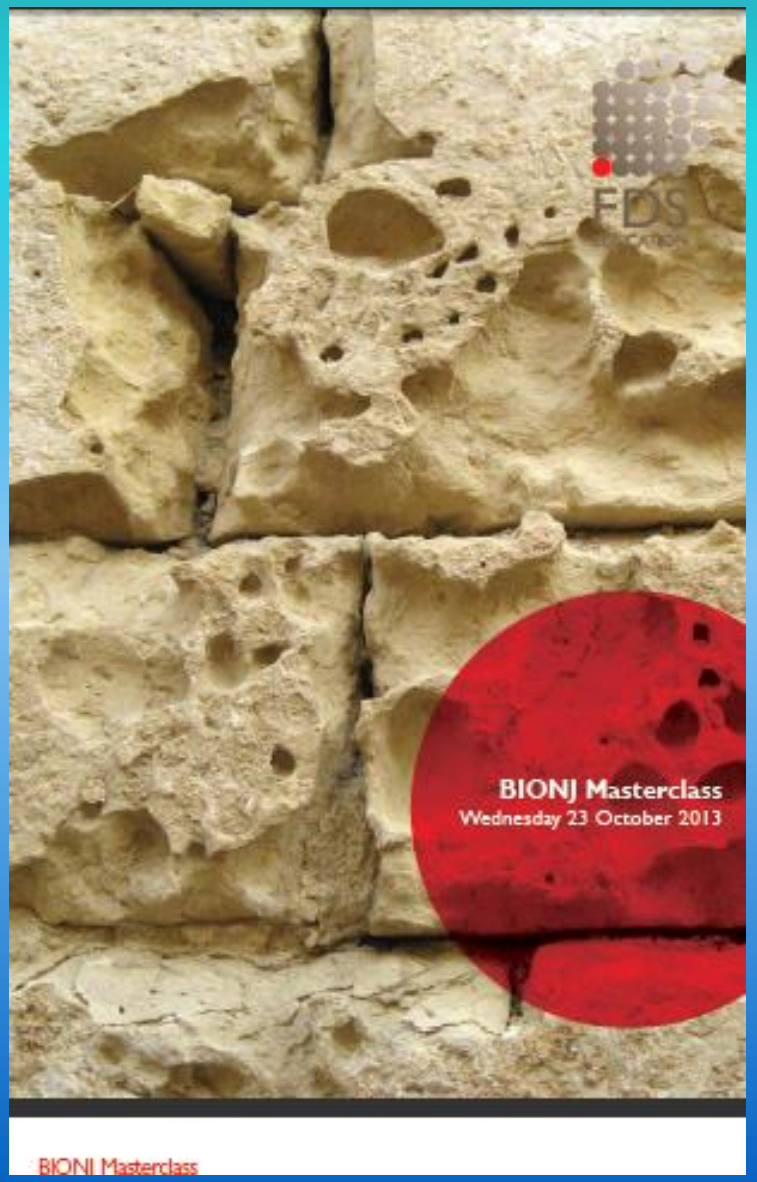
- Bisphosphonates




Scottish Dental
Clinical Effectiveness Programme
SDCEP
Oral Health Management of Patients
Prescribed Bisphosphonates
Dental Clinical Guidance


FDS
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Compromised wound healing

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Increased risk of post-operative infection

Disease

- Diabetes Mellitus (Types 1 and 2)
- Alcoholism
- Cirrhosis
- Renal failure
- Splenectomy
- Malignant tumours
- Leukaemia Lymphoma Myeloma
- Collagen disease
- HIV AIDS
- Pagets

Medication

- Steroids
- Immunosuppressants/ chemotherapy organ transplant
- Bisphosphonates

Radiation therapy

Malnutrition in the older population

- The prevalence of malnutrition is high across all community and care settings in Europe.
- Existing research suggests that 46% of all hospitalised patients are malnourished on admission.
- This figure rises to over 50% among older patients.

Litigation against dentists

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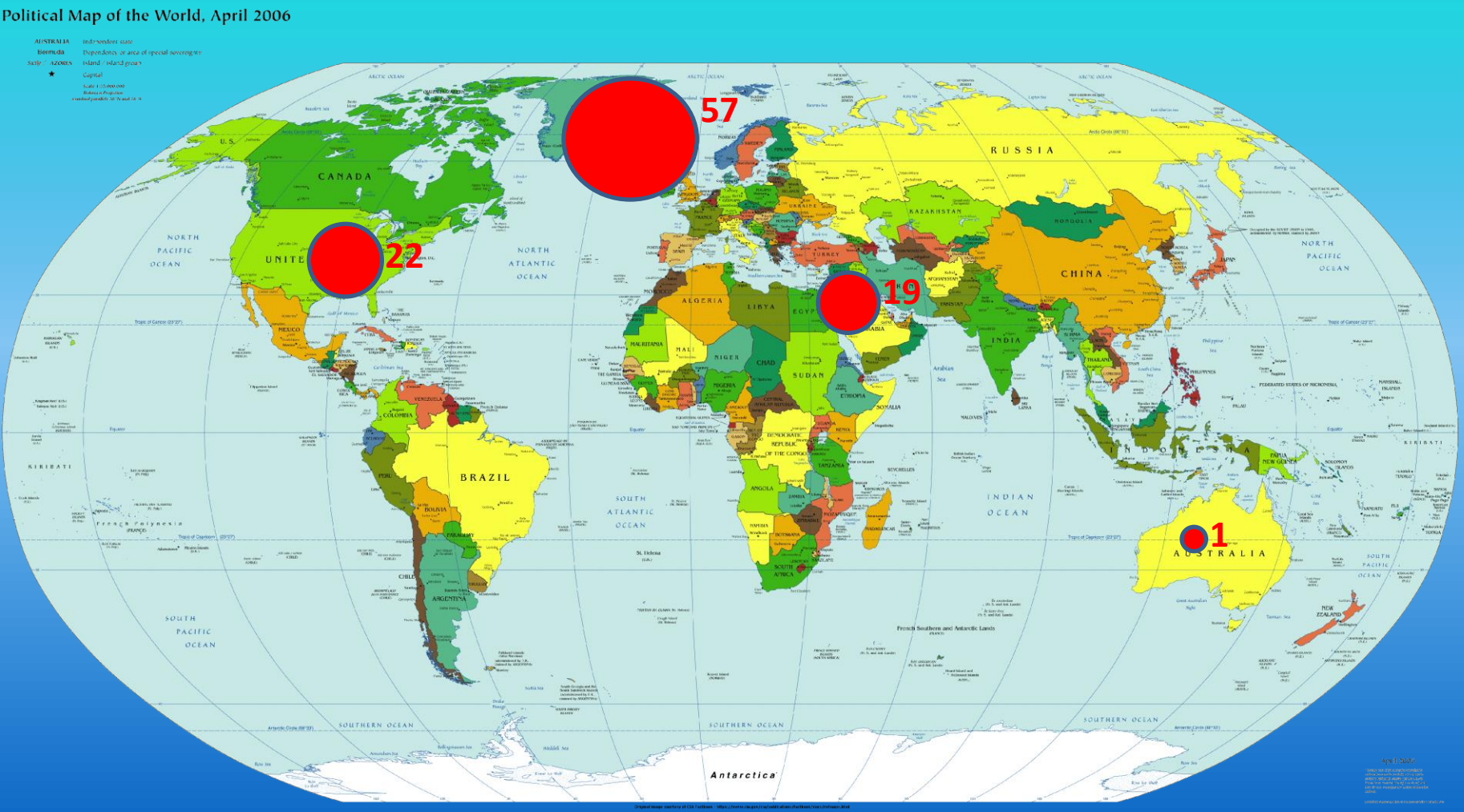

Risk / Benefit

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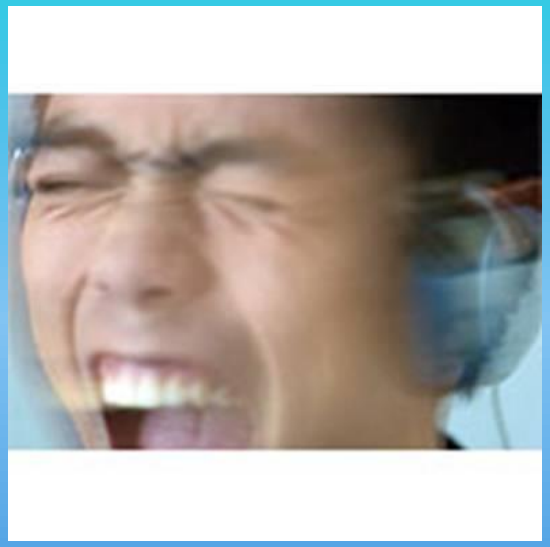
There is an element of risk inherent in all clinical decisions

+ Surgery nerve injury- risks of surgery

  70% of LN and IAN injuries present with neuropathic pain and many patients demonstrate post traumatic stress disorder in relation to the significant disability and these cannot be completely fixed – life long

- Surgery The risks may include the probability of an infection, pathology, distal seven caries and possibly systemic disease if surgery is not administered ????



Prevent WSS

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Operative checklist for Dental extraction **ONLY** (adapted from the WHO Surgical Safety Checklist)

SIGN IN (to be read out loud)

Before giving sedation/general anaesthetic

Has the patient confirmed his/her identity, site, procedure and consent?
- ▫ Yes

Have you confirmed the teeth to be extracted against the consent form?
- ▫ Yes

Is the anaesthesia machine and medication check complete?
Yes

Is the radiograph present and correctly labeled?
- ▫ Yes
- ▫ Not applicable if digital

Is planned treatment clearly displayed on white board in Palmer notation where the surgeon and assistant can see from operating position?
- ▫ Yes

Does the patient have a:
Known allergy?
- ▫ No
- ▫ Yes

Bleeding problem (Warfarin, Heparin, Hameophilia, other)?
- ▫ No
- ▫ Yes, last INR result available

Immunocompromised (Diabetes, HIV, Other) and at risk of infection?
- ▫ No
- ▫ Yes surgeon notified

Had prior radiation in the surgical field or previous IV bisphosphonates?
- ▫ No
- ▫ Yes, surgeon notified

Has the patient been advised with regard dental restoration if required?
- ▫ Yes
- ▫ Not applicable

The Operative checklist for Dental extraction ONLY This modified checklist must not be used for other surgical procedures.

TIME OUT (to be read out loud)

Before start of dental surgery

Have all team members introduced themselves by name and role?
- ▫ Yes

Surgeon and Nurse verbally confirm:
- ▫ What is the patient's name?
- ▫ What procedure, and which teeth?

Anticipated variations and critical events

Surgeon:
- ▫ Are there any special equipment requirements or special investigations?
- ▫ Are any variations to the standard procedure planned or likely?

Anaesthetist (for GA or sedation):
Are there any patient-specific concerns?
- ▫ What is the patient's ASA grade?
- ▫ Any special monitoring requirements?

Nurse/ODP:
- ▫ Has the sterility of the instrumentation been confirmed (including indicator results)?
- ▫ Are there are equipment issues or concerns?

Procedure protocol
For the multiple site surgery the grid sheet should be clearly visible for dentist and assistant. This will facilitate confirmation of dental extractions between nurse and surgeon.

Mutliple quadrant extractions should be started posteriorly lower right to the midline, then posteriorly upper right to midline then posteriorly lower left to midline then posteriorly upper left to midline (sequence LR, UR, LL, UL)

When the instrument is placed on the tooth to be extracted **verbal confirmation** should be made between surgeon and nurse before extraction continues.

Teeth to be extracted (blank out missing teeth), /=selected for extraction, **X** = extd

Sy															
			E	D	C	B	A	A	B	C	D	E			
8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8
8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8
			E	D	C	B	A	A	B	C	D	E			
Sy															

SIGN OUT (to be read out loud)

Before any member of the team leaves the surgical room

Registered Practitioner verbally confirms with the team:
- ▫ Has the name and site of the procedure been recorded?
- ▫ Has it been confirmed that instruments, swabs and sharps counts are complete (or not applicable)?
- ▫ If specimen produced please confirm it is labelled
- ▫ Is count for instruments swabs and sharps correct?
- ▫ Have any equipment problems been identified that need to be addressed?
- ▫ Are any variations to standard recovery and discharge protocol planned for this patient?
- ▫ Recovery area is ready oxygen available, lines flushed and throat pack removed (where applicable)

Sign out now complete Thank you
Post op care No/ yes
.....
Review No/ yes
.....weeks Where?.....

PATIENT DETAILS	
Last name:	
First name:	
Date of birth:	
NHS Number*:	
Procedure:	

*If the NHS Number is not immediately available, a temporary number should be used until it is

Valid consent

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- Know your patient
- Understand their expectations
- Ensure they understand the risk benefit

- If in doubt
- DON'T PROCEED!

Get Well Soon

Helping you to make a speedy recovery after removal of wisdom teeth

RCS

Content:

This leaflet is a guide to recovering from an operation to remove one or more wisdom teeth. It does not provide specific medical advice or diagnosis. Nor does it give advice about whether you should consent to an operation. All of these matters depend on individual medical advice from your consultant surgeon based on your own health, medical condition, and personal circumstances.

If only……

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RESPONSIBILITY
You made the mess, you clean it up


Sure glad the hole isn't at our end.


HIS FAULT
HER FAULT
THEIR FAULT
NOT ME

Why are nerve injuries such a big deal?

Complications best avoided

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- Fore arm the patient
  - Have an honest conversation about risks

VALID CONSENT

- Do you have the correct diagnosis?
- Can you handle the medical complexity?
- Are you able to undertake the procedure
- **DON'T overestimate your ability or talent!**
  - Would you do this on your daughter/friend????????
- Can you manage the possible complications?

- **If NO to any of the above ….**Ask for assistance get training or even better……REFER ?

Honesty

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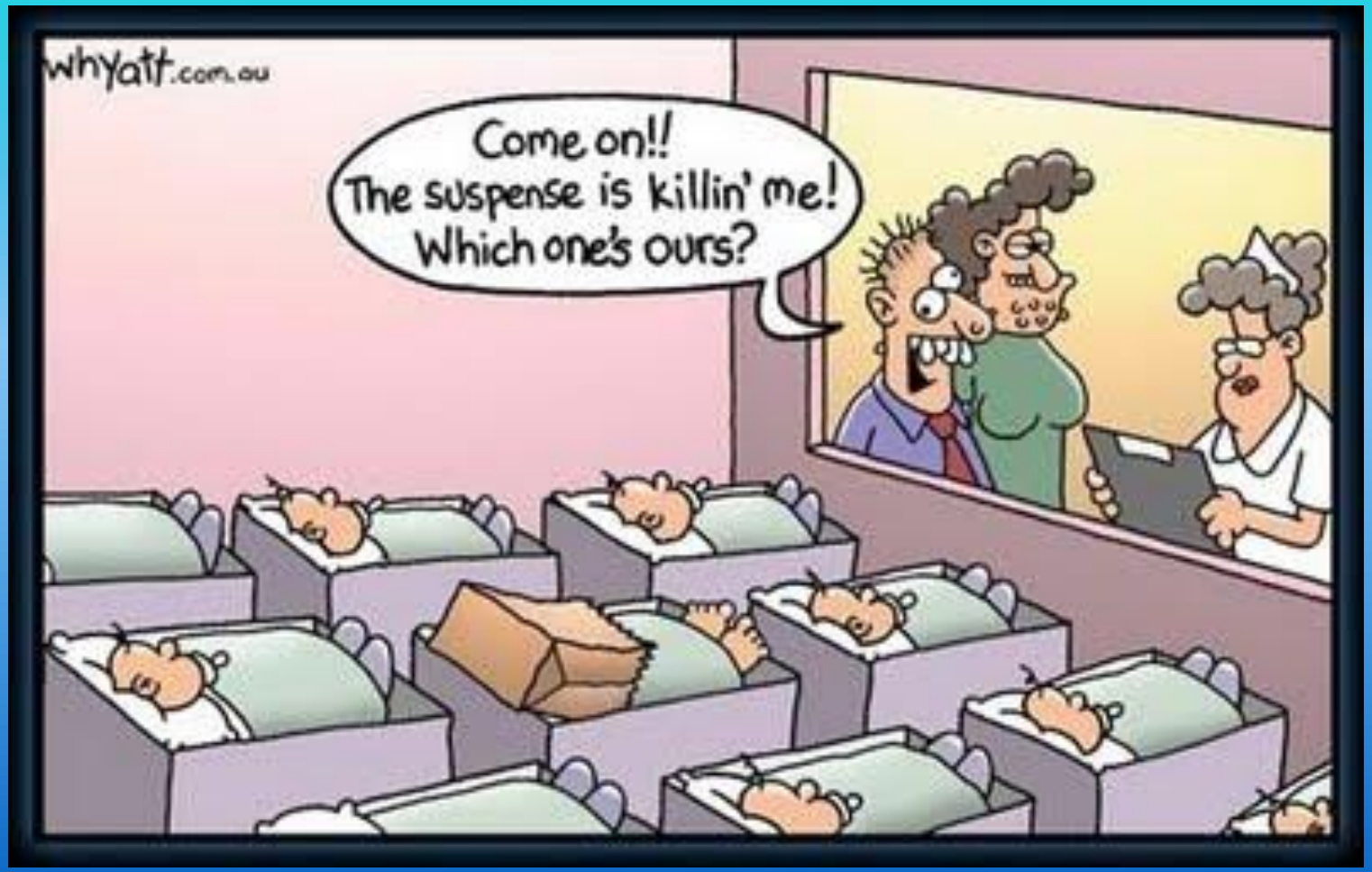

whyatt.com.au
Come on!!
The suspense is killin' me!
Which one's ours?

Why are nerve injuries such a big deal?

Trigeminal nerve

Complex region

Consequences

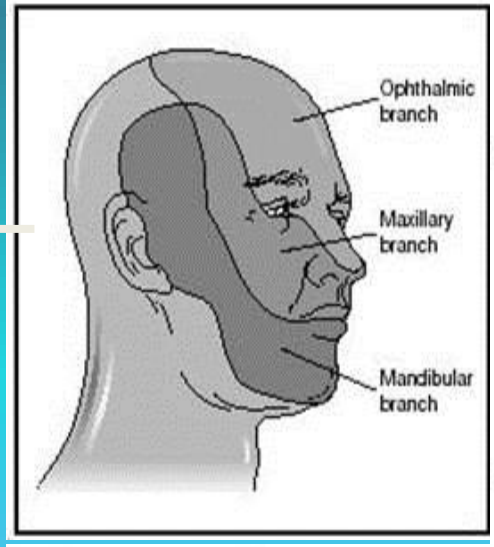
- Social function
- Eating
- Drinking
- Speaking
- Kissing
- Make up / shaving
- Sleeping

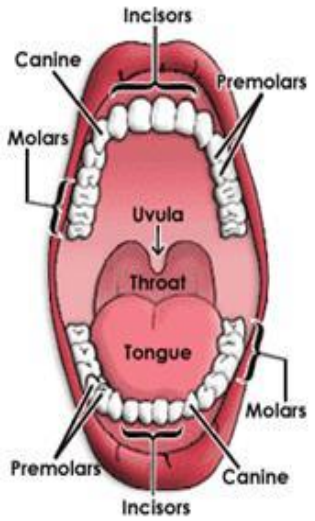
IDENTITY?

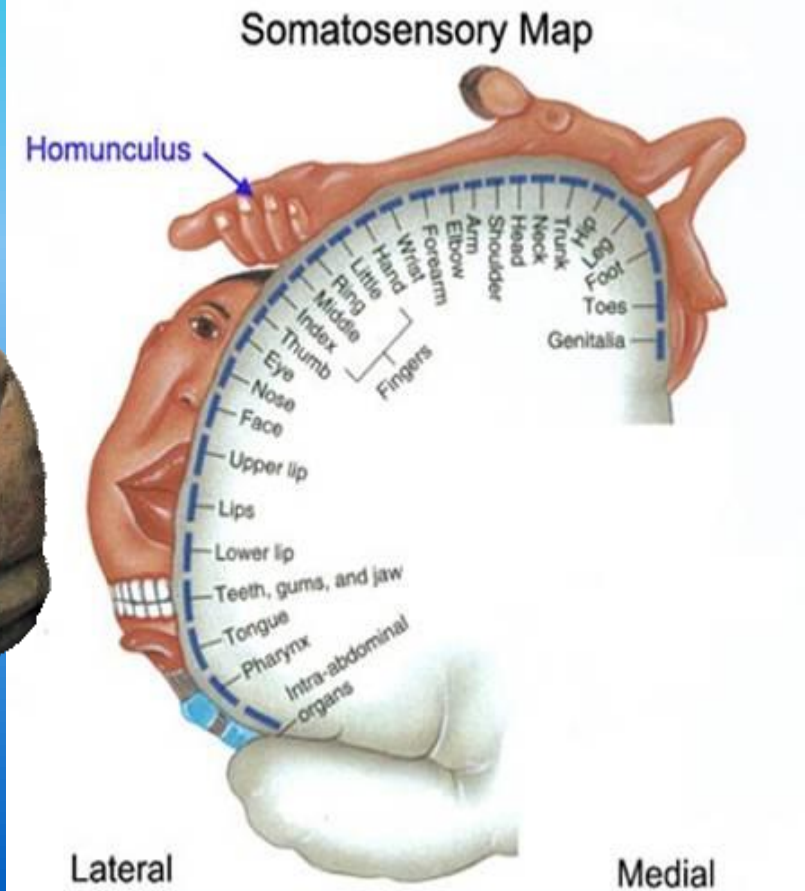
Trigeminal nerve

- Consent
- Closed injury
- Most resolve
- Type of nerve injury
- Type of patient
- Neuroplastici

- Current surgical
- management is inadequate







Editorial

Painful Posttraumatic Trigeminal Neuropathy: A Recently Recognized Entity

An unusual event recently occurred in the field of chronic orofacial pain. A new entity has been established through a few research papers and meetings of experts. Different specialists have known for some time that surgery and other traumatic events may injure the trigeminal nerve and provoke symptoms. Nerve damage may occur during Caldwell-Luc intervention, orthognathic mandibular advancement surgery, extrusion of root canal filling materials, implant surgery, and various traumatic events such as facial fractures and therapeutic radiation; third molar removal is the most frequent cause.[1] Several branches of the mandibular or maxillary division of the trigeminal nerve could be involved, such as the infraorbital nerve, the superior alveolar nerves, and most frequently the lingual and inferior alveolar nerves. The signs and symptoms are similar to those in neuropathic pain conditions elsewhere in

indicated that the 20 cases of PPTTN found among 245 cases of chronic orofacial pain tended to cluster.[7] This was in line with a recent study performed on 328 patients with chronic orofacial pain that indicated that over 12% of the cases were PPTTN.[8] These two studies pointed to a much larger prevalence than what was previously suspected, even if these samples were far from being representative of the general population since they came from tertiary care centers. The contribution of the different specialties to the incidence of PPTTN has been recently detailed.[2,9,10]

2. *Description of diagnostic criteria for PPTTN:* This has much improved due to recently performed studies. Quantitative sensory testing associated with electrophysiological exploration have better delineated the disease characteristics.[1,11,12] In a recent paper, diagnostic criteria, first proposed at the

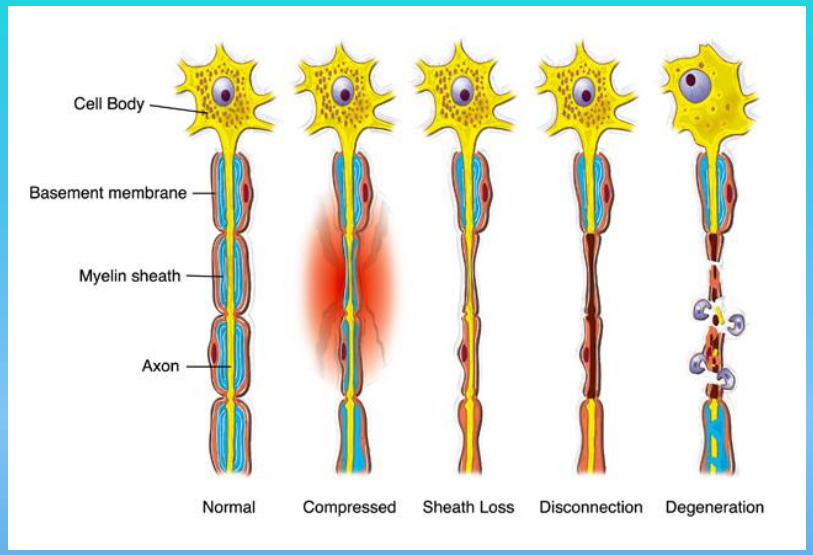
Painful Posttraumatic Trigeminal Neuropathy: A Recently Recognized Entity.**Woda A**. J Orofac Pain. 2013 Spring;27(2):97-98

Post traumatic neuropathic pain

Viral
Herpes Zoster
PHN
HIV

Chemotherapy

Diabetes



Alcoholism

Vitamin deficiency
B 1,3,6,12, E

Radiation, Burns

Demyelination
CTD, MS, GB

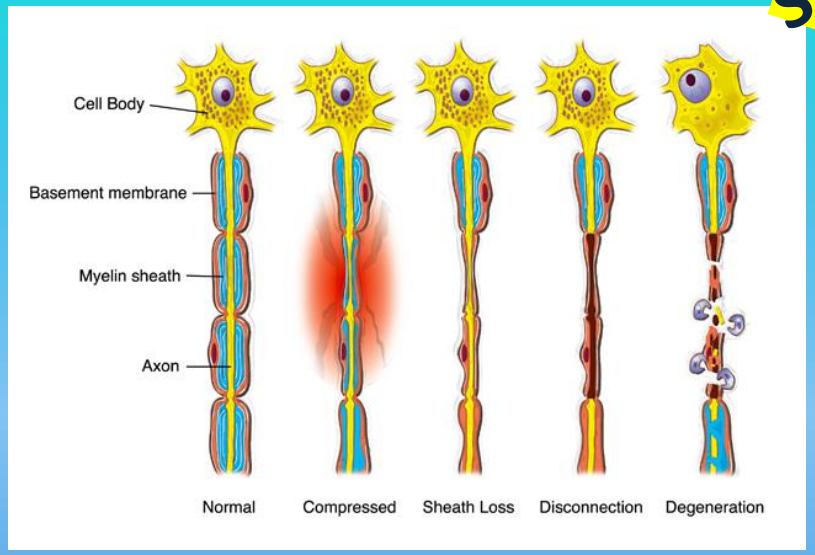
Post traumatic Peripheral sensory nerve injury
PTN

Post traumatic neuropathic pain

Viral
Herpes Zoster
PHN
HIV

Chemotherapy

Diabetes



SURGERY & LA

Alcoholism

Vitamin deficiency
B 1,3,6,12, E

Radiation, Burns

Demyelination
CTD, MS, GB

Post traumatic Peripheral sensory nerve injury
PTN

Risk factors for PTN

- >50years
- Multiple insults
- Non respondent to anti inflammatory pain killers (NSAIDs Paracetamol)
- Better in mornings
- Does not disturb sleep
- Worsens during day
- Worsens with stress, tiredness and illness
- Either
  - Constant burning
  - Elicited neuralgic
  - Or combination

Table 2
Definitions of common features suggestive of neuropathic pain[29]

Paresthesia	An abnormal sensation, whether spontaneous or evoked
Dysesthesia	An unpleasant sensation, whether spontaneous or evoked
Hypoesthesia	Decreased sensitivity to stimulation (tactile or thermal; both are frequent)
Hyperesthesia	Increased sensitivity to stimulation (tactile or thermal; both are rare)
Hypoalgesia	Diminished pain response to a normally painful stimulus
Hyperalgesia	An increased response to a stimulus that is normally painful
Allodynia	Pain due to a stimulus that does not normally activate the nociceptive system

Consequences of Trigeminal nerve injury

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Damage to sensory nerve

Wheal and flare

- Pain **hyperaesthesia**
- allodynia pain with non noxious stimulus
- pain on touch/cold/hot
- hyperalgesia increased pain to painful sti
- Altered sensation
- paraesthesia –pins and needles, formication, many descriptions
- dysaethesia – uncomfortable sensations often burning
- Numbness- **hypoaesthesia**

Consequences for the patient

620 patients with nerve injuries seen over 4 years at KCH

Pain

70% of Lingual or Inferior Alveolar Nerve injuries

Functional

Eating, speaking, drinking, sleeping, kissing, make-up, shaving, tooth brushing

Psychological

50% chronic pain sufferers are depressed

Causes of peripheral nerve injury

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- Diabetes
- HIV
- PHN
- Chemotherapy
- MS
- Post surgical traumatic neuropathy
- Parkinson's
- Malignancy
- Drugs - Growth hormone injections

Kehlet *et al*, 2006

in Lancet

	Estimated incidence of chronic pain	Estimated chronic severe (disabling) pain (>5 out of score of 10)	US surgical volumes (1000s)†
Amputation[2]	30–50%	5–10%	159 (lower limb only)
Breast surgery (lumpectomy and mastectomy)[3]	20–30%	5–10%	479
Thoracotomy[4–7]	30–40%	10%	Unknown
Inguinal hernia repair[8–10]	10%	2–4%	609
Coronary artery bypass surgery[11–13]	30–50%	5–10%	598
Caesarean section[14]	10%	4%	220

*Gall bladder surgery not included, since preoperative diagnosis of pain specifically from gall bladder is difficult and persistent postoperative pain could therefore be related to other intra-abdominal disorders. †National Center For Health Statistics, Ambulatory and Inpatients Procedures, USA, 1996.

Table 1: **Estimated incidence of chronic postoperative pain and disability after selected surgical procedures***

30% get persistent pain**10% are severely affected**

? 0.02% of trigeminal severely affected (Nixdorf 2010)

Neuropathic pain

Not only numbness!!!!!!!

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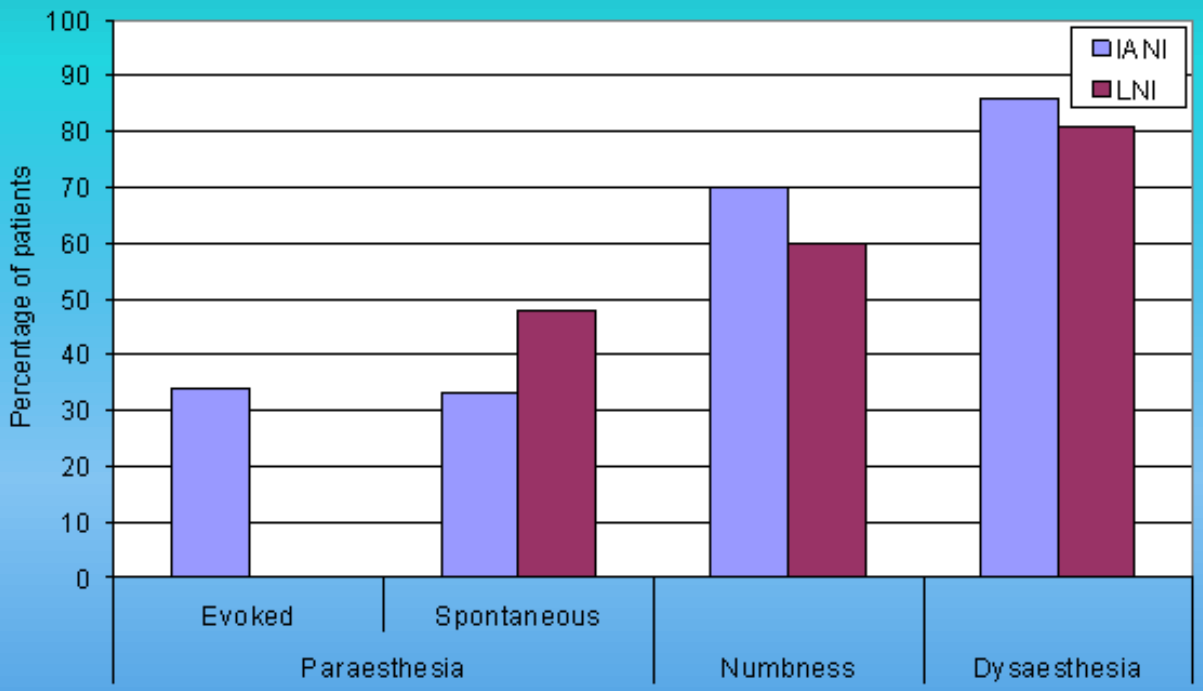

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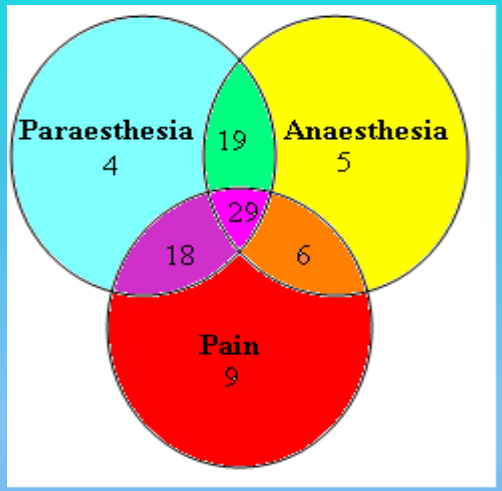
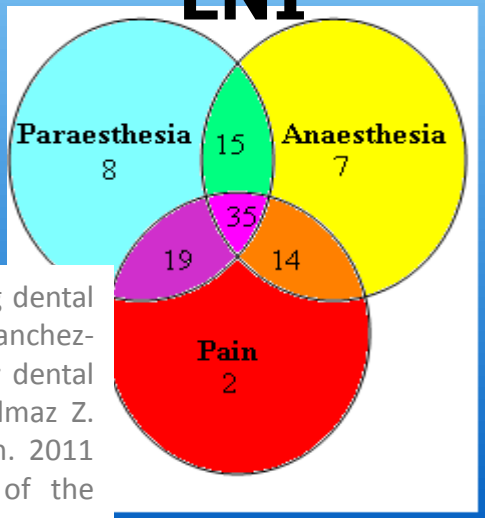


LNI

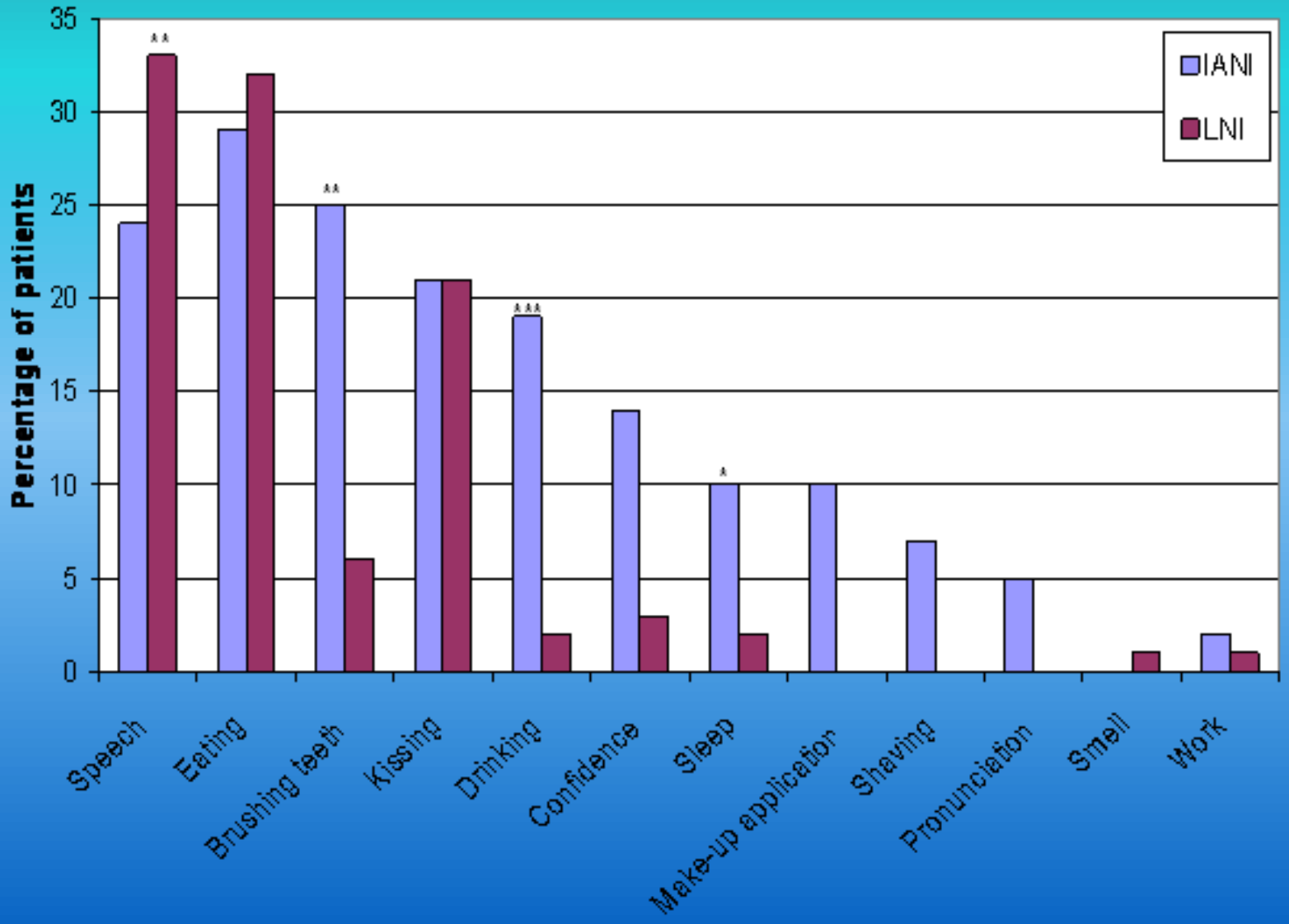


70 % of IRTNI patients have pain pain

Queral-Godoy E, Vazquez-Delgado E, Okeson JP, Gay-Escoda C. Persistent idiopathic facial pain following dental implant placement: a case report. Int J Oral Maxillofac Implants 2006; **21:** 136-40. Rodriquez-Lozano F, Sanchez-Perez A, Moya-Villaescusa MJ, Rodriguez-Lozano A, Saez-Yuguero MR. Neuropathic orofacial pain after dental implant placement: review of the literature and case report. OOOE 2010; **109:** e8-e12. Renton T, Yilmaz Z. Profiling of patients presenting with posttraumatic neuropathy of the trigeminal nerve. J Orofac Pain. 2011 Fall;25(4):333-44. Renton T, Dawood A, Shah A, Searson L, Yilmaz Z. Post-implant neuropathy of the trigeminal nerve. A case series. Br Dent J. 2012 Jun 8;212(11):E17. doi: 10.1038/sj.bdj.2012.497

Functional problems

TNI

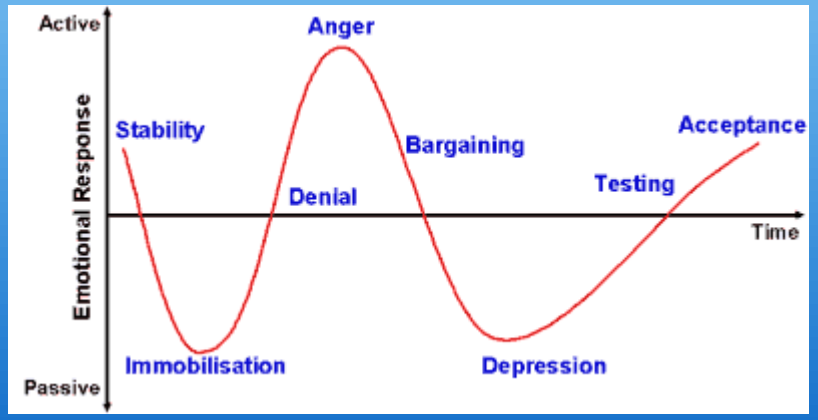


Psychological consequences

TNI

- Depression
- Anger
- Post traumatic stress disorder
- Victim of abuse
- Loss of ability to trust

- *Kubler Ross*



International Journal of Oral & Maxillofacial Surgery

Article in Press

PainDETECT: a suitable screening tool for neuropathic pain in patients with painful post-traumatic trigeminal nerve injuries?

L.-A. Elias, Z. Yilmaz, J.G. Smith, M. Bouchiba, R.A. van der Valk, L. Page, S. Barker, T. Renton

Accepted 3 July 2013. published online 07 August 2013.
Corrected Proof

Abstract

The PainDETECT questionnaire (PD-Q), originally developed and validated in a multicentre study of neuropathic pain (NeP) patients with back pain, is increasingly being applied to other pain conditions. The present study assessed whether the PD-Q would be a suitable screening tool for detecting NeP in patients with post-traumatic inferior alveolar nerve injury (IANI) and lingual nerve injury (LNI). A prospective cohort of patients with clinically diagnosed neuropathy was given the PD-Q at their clinic appointment, or it was sent to them after their consultation. Eighty-nine patients (IANI = 56, LNI = 33) were included in the study, 75 of whom suffered from painful neuropathy. Of the patients who completed the questionnaire fully (n = 56), allowing a summary score to be calculated, 34% were classified as having 'likely NeP' according to the PD-Q; 41% of patients scored in the uncertain classification range and the remaining quarter in the 'likely nociceptive' classification. There

Valid consent?

- Know your patient
- Understand their expectations
- Ensure they understand the risk benefit

- If in doubt
- DON’T PROCEED!

Valid consent

TNI

- Recent study @ KCL on 60 implant nerve injury patients
  70% experienced Dysaesthesia / Pain (95%implant pts)
- 70% of patients suffer from a combination of numbness, altered sensation and neuropathic pain
- **Less than 30% of patients are appropriately warned** of nerve injury in high risk procedures

- Renton T, Dawood A, Shah A, Searson L, Yilmaz Z. Post-implant neuropathy of the trigeminal nerve. A case series. Br Dent J. 2012 Jun 8;212(11):E17. doi: 10.1038/sj.bdj.2012.497

Valid consent

TNI

Patient's perspective

So how do we avoid nerve injuries?

What are the risk factors?

- Acta Odontol Scand. 2013 Jul 4. [Epub ahead of print]
- The importance of a good evaluation in order to prevent oral nerve injuries: A review.Céspedes-Sánchez JM, Ayuso-Montero R, Marí-Roig A, Arranz-Obispo C, López-López J.
- 662 were obtained from the search, from which 25 were selected accomplishing the inclusion criteria. Moreover, seven important articles were selected from the references of the ones mentioned, obtaining a total of 32 articles for the review.

- **LNI & IANI**
  - **Age of the patient**
  - **Time of surgery**
  - **Intra-operatory exposure of the nerve**
  - **Un-erupted tooth**

  - **LNI**
  - **Technique access for the lower third molar extraction**
  - **the surgeon's inexperience.**

- **IANI**
  - **The radiological examination is useful to evaluate the nerve damage and to decide on the surgical technique**

When can they happen?

TNI

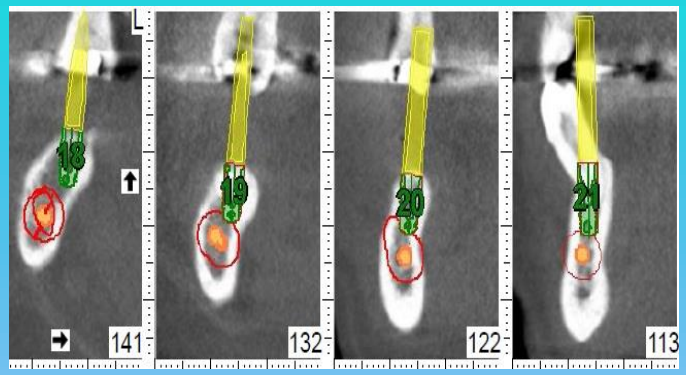
- Pre operative assessment
- Local anaesthesia
- Operative factors
- Post operative care

How do they happen?

TNI

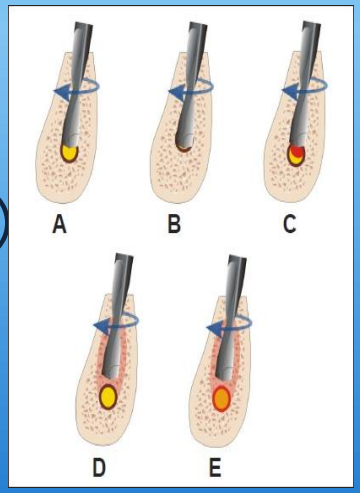
Nerve injuries occur due to:

- LA IDBs
  - Articaine as infiltration only with no ID blocks?
  - Peterson 2004; Heller & Shankland 2001
- Poor Planning
- Poor Placement/execution
- Inadequate Post operative care

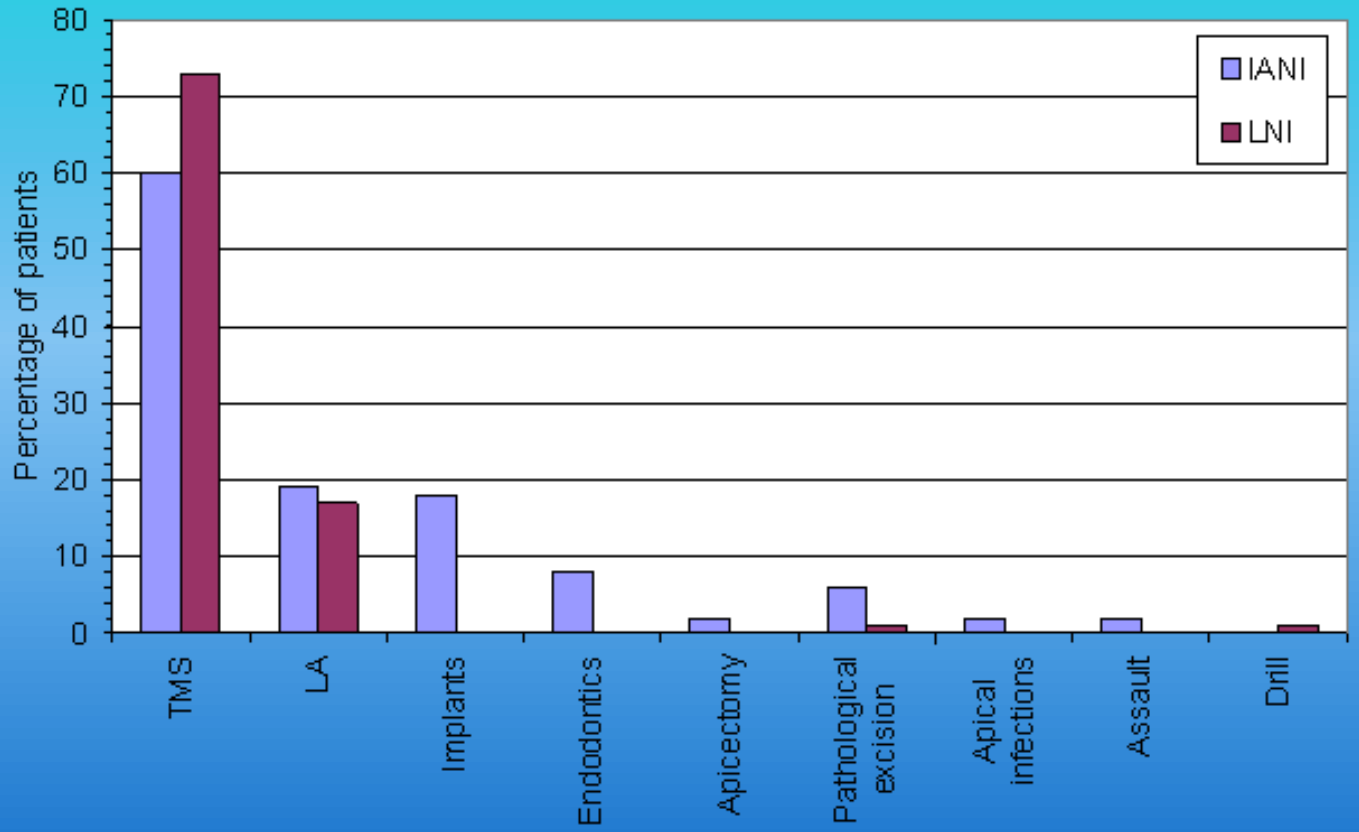


Why do they happen?

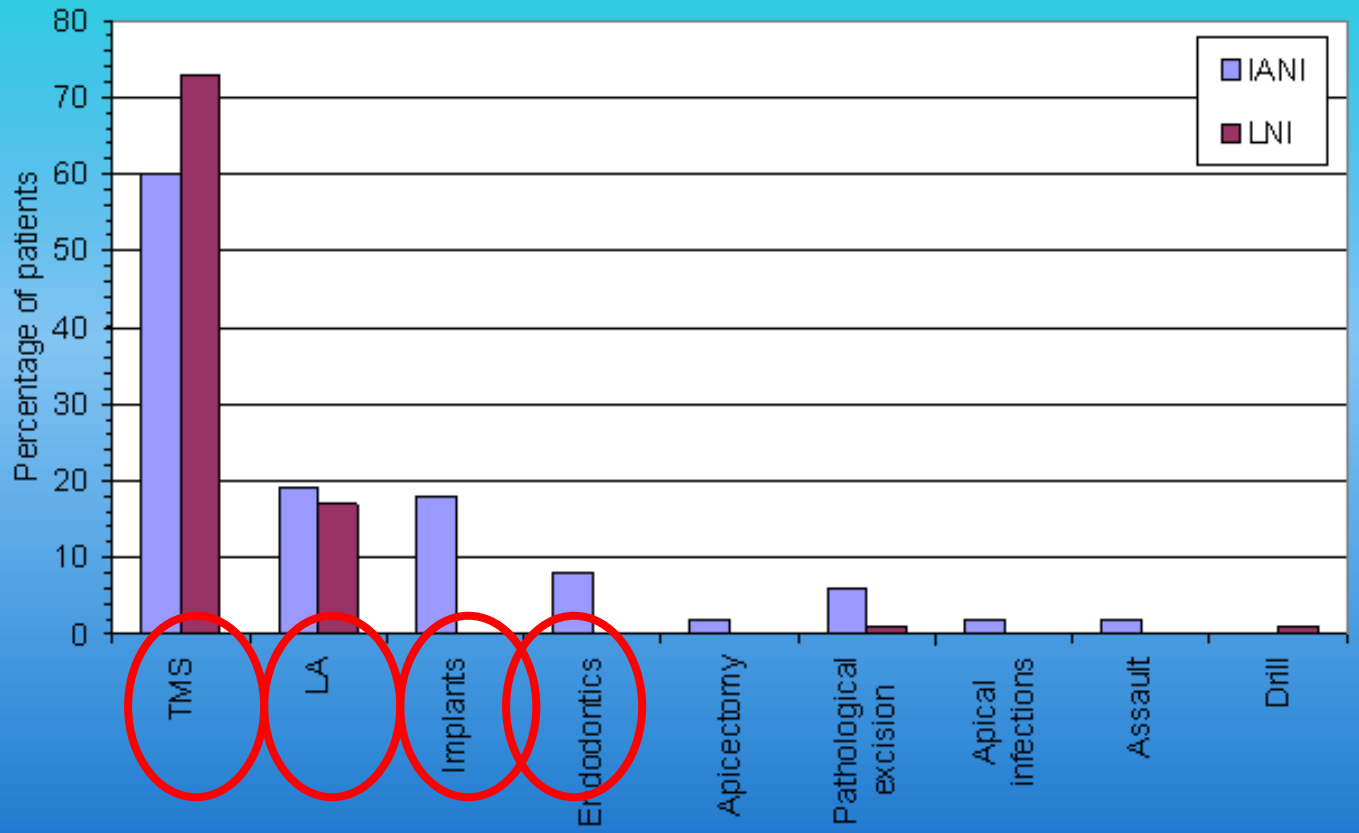
- Chemical (local anaesthetic, haemorrhage, BIOSS,)
- Physical trauma
- (preparation of implant bed, over torqueing implant during placement)
- Heat
- Prolonged neural inflammation (local and patient factors)



What procedures?



What procedures?



LA nerve injuries

Research

British Dental Journal **214**, 633 - 642 (2013)
Published online: 21 June 2013 | doi:10.1038/sj.bdj.2013.583

Subject terms: Anaesthesia and sedation | Oral surgery | Medical matters

UK dentists' experience of iatrogenic trigeminal nerve injuries in relation to routine dental procedures: why, when and how often?

T. Renton[1], H. Janjua[2], J. E. Gallagher[3], M. Dalgleish[4] & Z. Yilmaz[5]

- The majority of dentists use Lidocaine 2% for inferior dental blocks (IDBs) and many are already using Articaine Buccal infiltration technique.
- The incidence of nerve injury related to dental IDBs is 1 in 14,000 patients undergoing routine dentistry and 1 in 3,300 undergoing care by specialists.
- Notes the lack of knowledge by dentists on where to seek advice and report these injuries.

Local anaesthesia

- If a patient has sharp neuralgic intense pain during delivery of the IDB they are 60% more likely to experience persistent neuropathy

OUCH!

- Smith and Lung 2006

Local anaesthesia

TNI

No difference in efficacy between Lidocaine 2 % and Articaine 4% inferior dental blocks

- Claffey E, Reader A, Nusstein J, Beck M, Weaver J. Anesthetic efficacy of articaine for inferior alveolar nerve blocks in patients with irreversible pulpitis. J Endod. 2004 Aug;30(8):568-71.
- Sierra Rebolledo A, Delgado Molina E, Berini Aytís L, Gay Escoda C. Comparative study of the anesthetic efficacy of 4% articaine versus 2% lidocaine in inferior alveolar nerve block during surgical extraction of impacted lower third molars. Med Oral Patol Oral Cir Bucal. 2007 Mar 1;12(2):E139-44.
- *Mikesell P,Nusstein, Reader A,Beck M,WeaverJ.* A Comparison of Articaine and Lidocaine for Inferior Alveolar Nerve Blocks. J EndodonticsVolume 31, Number 4, April 2005
- *Isabel Peixoto Tortamano, DDS, MSc, PhD, Marcelo Siviero, DDS, MSc, Carina Gisele Costa, DDS, MSc, PhD, Inês Aparecida Buscariolo, DDS, MSc, PhD, and Paschoal Laércio Armonia.* A Comparison of the Anesthetic Efficacy of Articaine and Lidocaine in Patients with Irreversible Pulpitis. J Endodontics Volume 35, Number 2, February 2009
-

Actual LA nerve injury incidence

- GDP restorative procedures
- 1 in 14K
- 25% permanent

- Oral surgery
- 1 in 3.3K
- 29% permanent

Compare this with anaesthetic LA block procedures.
NAP3 reports the estimated that nerve injury resulting from neuroaxial blocks (epidurals, spinals and combined epidural with spinals) resulted in sensory or motor nerve injury in 1 in 24-54K patients
(and paraplegia or death in 1 in 50-140K patients)

Smart LA

- Articaine 4% Buccal Infiltration
- +/- IDB Lidocaine 2%

- Articaine 4% Buccal Infiltration
- Post + ant near Mental forame
- +/- Lingual Inf Lidocaine 2%

- Buccal infiltration + Lingual bo Lidocaine 2%

Meechan JG The use of the mandibular infiltration anesthetic technique in adults. J Am Dent Assoc. 2011 Sep;142 Suppl 3:19S-24S.

Local anaesthesia

TNI

No palatal blocks required!

- Anesth Prog. 2013 Summer;60(2):42-5. doi: 10.2344/0003-3006-60.2.42. Comparison of buccal infiltration of 4% articaine with 1 : 100,000 and 1 : 200,000 epinephrine for extraction of maxillary third molars with pericoronitis: a pilot study.
- Lima JL Jr, Dias-Ribeiro E, Ferreira-Rocha J, Soares R, Costa FW, Fan S, Sant'ana E. Prospective, double-blind, controlled clinical trial involved 30 patients between the ages of 15 and 46 years who desired extraction of a partially impacted upper third molar with pericoronitis

Prospective audit 280 extractions by dental UGs

-no palatal blocks given

- Articaine infiltration
- Lidocaine IDB rescue

Successful extractions in

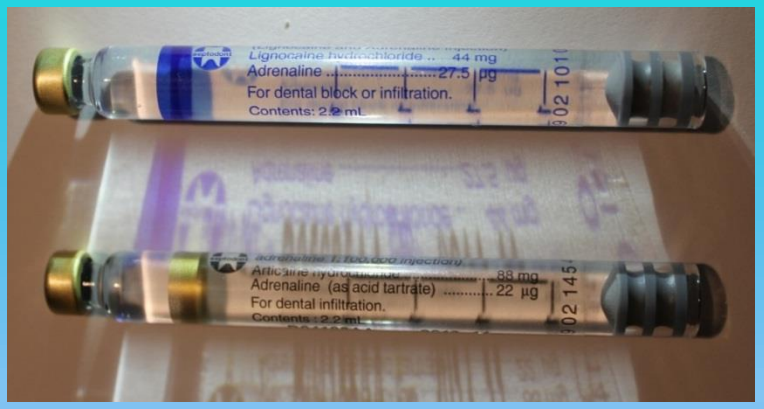
Incisors-premolars 90%
M1Ms 60%
M2Ms 75%

87% success!

Local anaesthesia

TNI

Prevent Local anaesthesia induced nerve injuries by;



- Avoid multiple blocks
- No IDBs under GA
- Avoid high concentration IDBs (Articaine,Mepivacaine,Prilocaine)
- Stick to Lidocaine ID blocks for now!
- Is the future Articaine as infiltration only with no ID blocks????????

- Renton T, Adey-Viscuso D, Meechan JG, Yilmaz Z. Trigeminal nerve injuries in relation to the local anaesthesia in mandibular injections. Br Dent J. 2010 Nov;209(9):E15

Local anaesthesia

TNI

- Reduce nerve injury risk during surgery by using infiltrative anaesthesia
- If the patient feels pain during elevation of tooth, endo prep or implant preparation……
- Stop surgery
- Reassess re x ray and reassess safety zone

Supraperiosteal infiltration anesthesia safe enough to prevent inferior alveolar nerve during posterior mandibular **implant** surgery?
Etoz OA, Er N, Demirbas AE.Med Oral Patol Oral Cir Bucal. 2011 May 1;16(3):e386-9

Elective M3M surgery

TNI

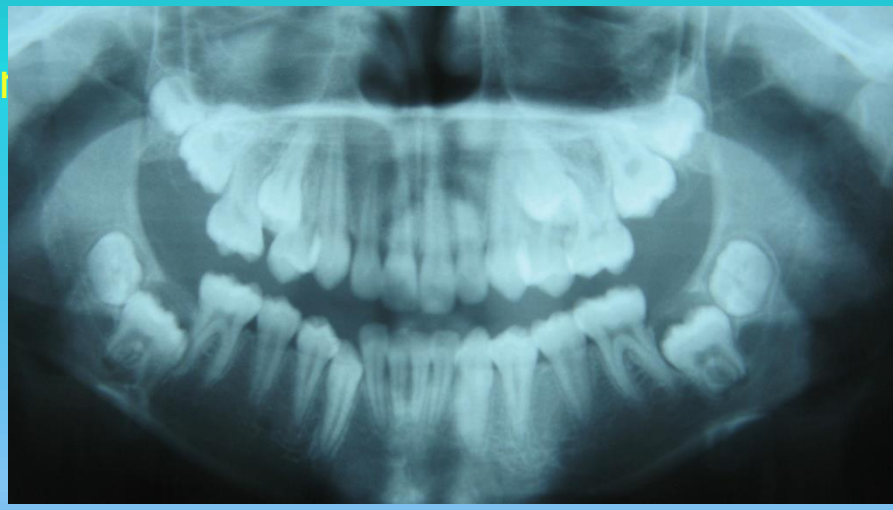
10 million M3Ms removed USA per year
60% elective surgery

Costing **$US 4.2 billion**

11000 pts permanent nerve injury!

'Silent epidemic' of iatrogenic nerve injury

No evidence substantiates prophylactic removal. Freidman J Am J Public Health 2007;97:1554

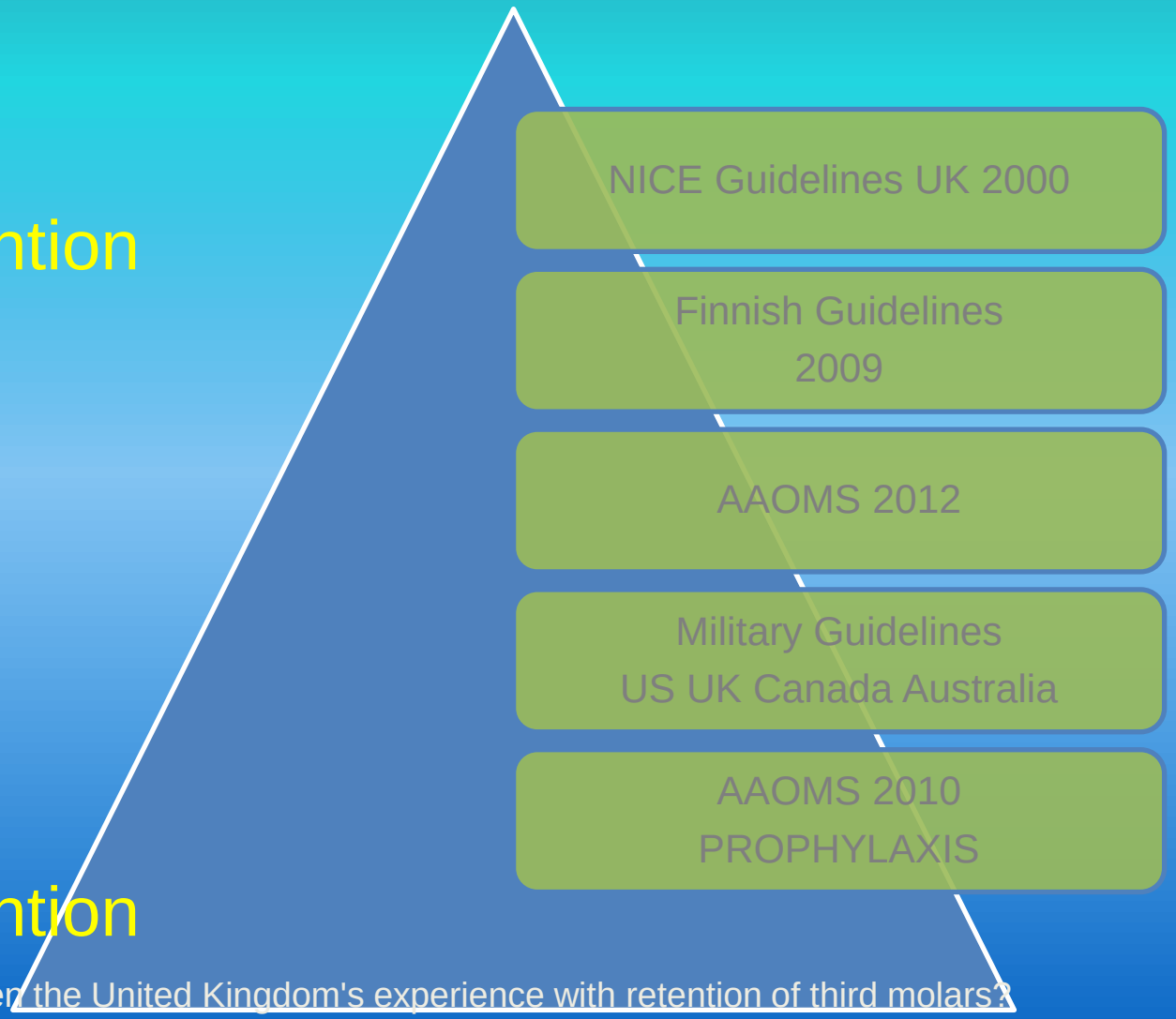


- Mythology of 8s
- Overall 12% associated with pathology
  - same as apendicitis and cholecystitis
  - 8% pericoronitis
  - 3% caries lower 7s
  - 0.048% resorption of adjacent tooth
  - 0.0085% internal resorption
  - 0.0165% cyst formation

Timing of M3M surgery

TNI

Low intervention

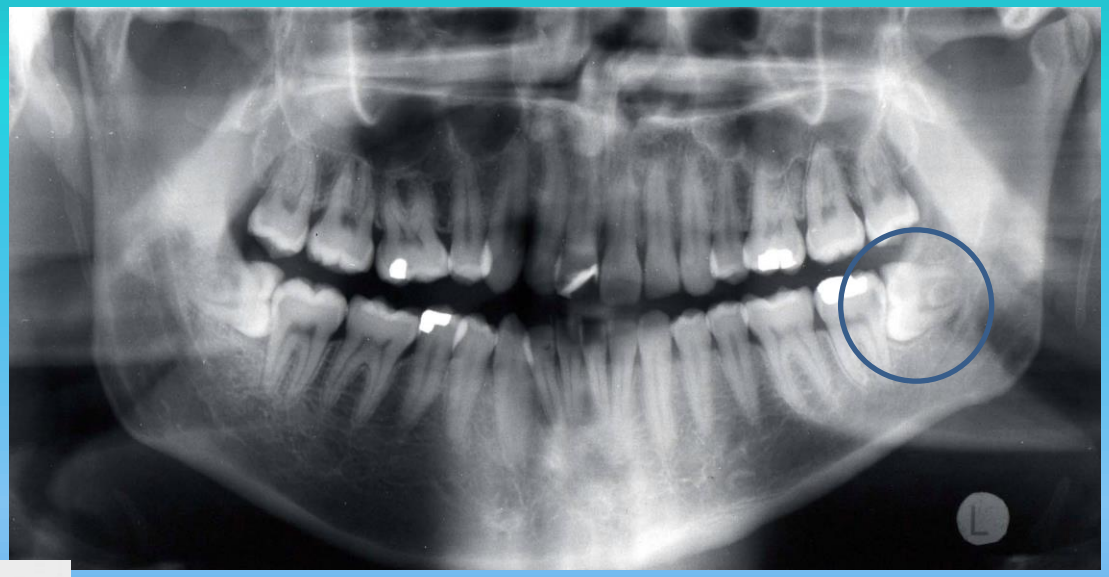


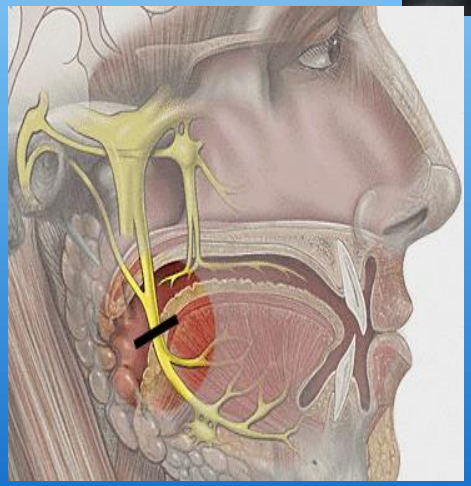
High intervention

What has been the United Kingdom's experience with retention of third molars?
Renton T, Al-Haboubi M, Pau A, Shepherd J, Gallagher JE.
J Oral Maxillofac Surg. 2012 Sep;70(9 Suppl 1):S48-57. doi: 10.1016/j.joms.2012.04.040. Epub 2012

M3M related nerve injury

TNI





Inferior alveolar nerve

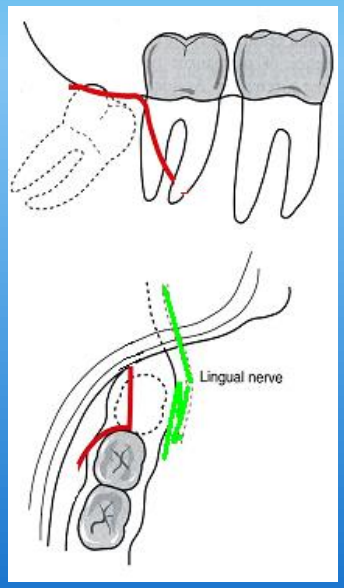
Lingual nerve

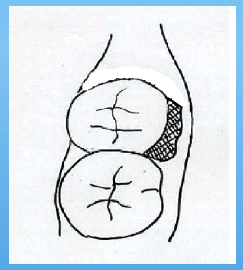
Prevention of lingual nerve injury in

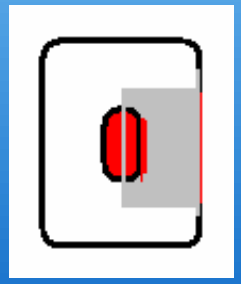
TNI

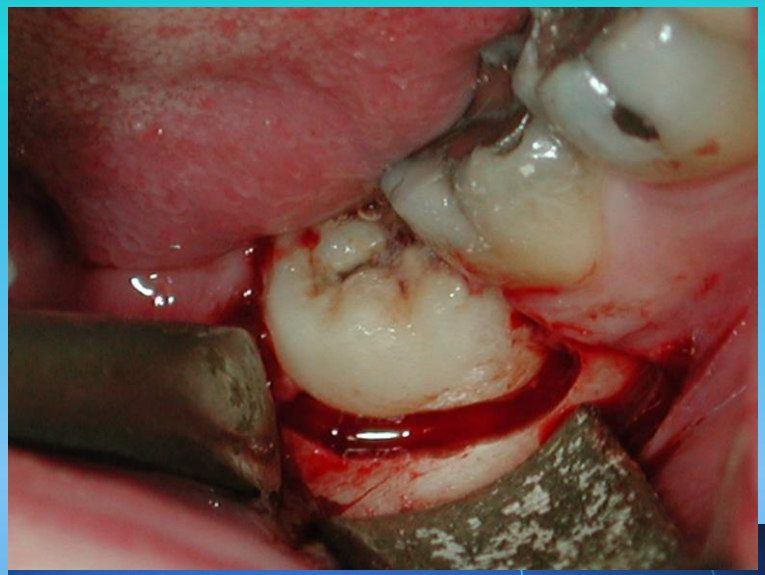
99% US oral surgery practitioner

52% after defining the buccal approach





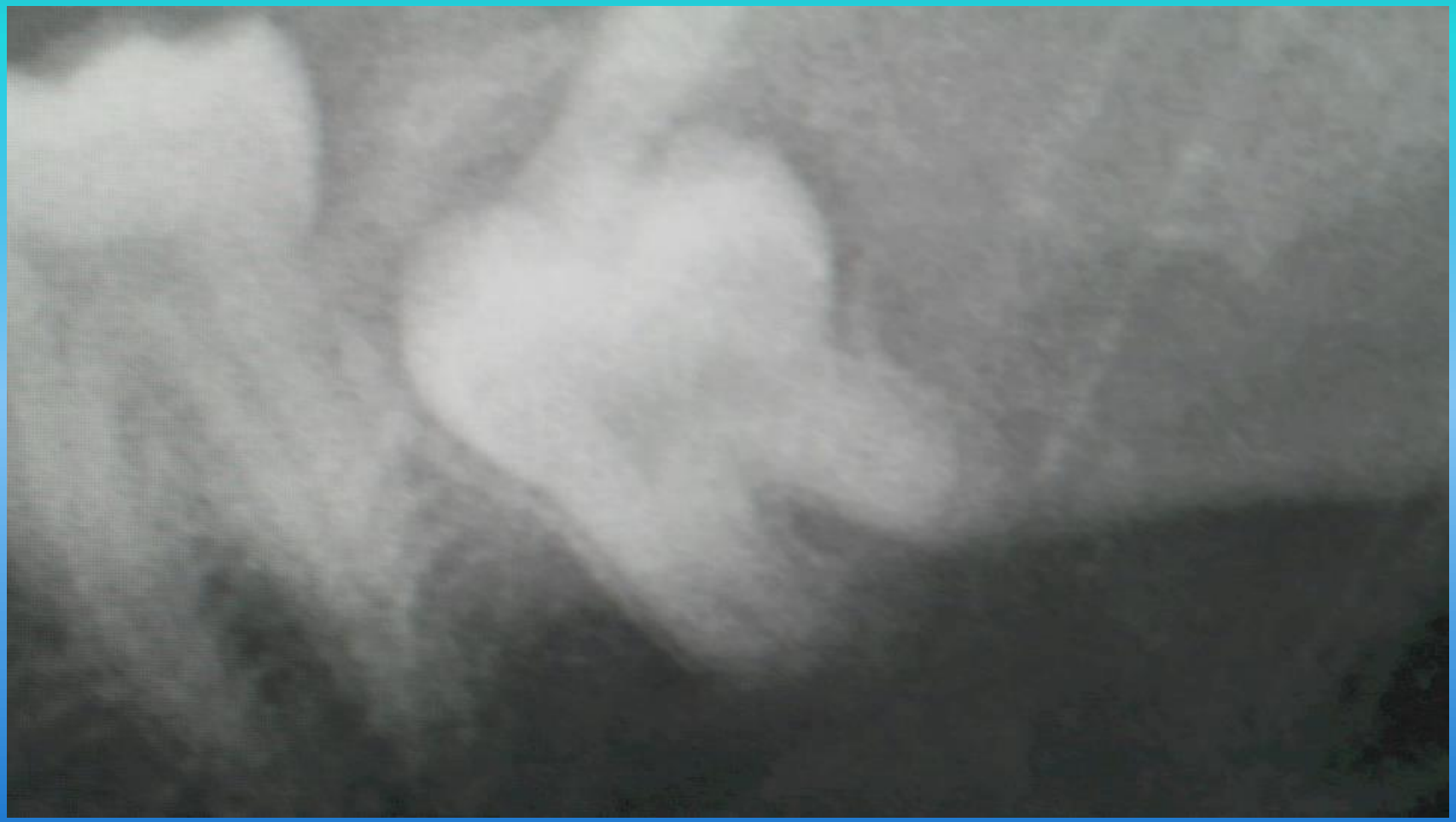




Evaluation of trigeminal nerve injuries in relation to third molar surgery in a prospective patient cohort. Recommendations for prevention. **Renton T**, Yilmaz Z, Gaballah K. Int J Oral Maxillofac Surg. 2013 Dec;41(12):1500-18

Prevention of lingual nerve injury in

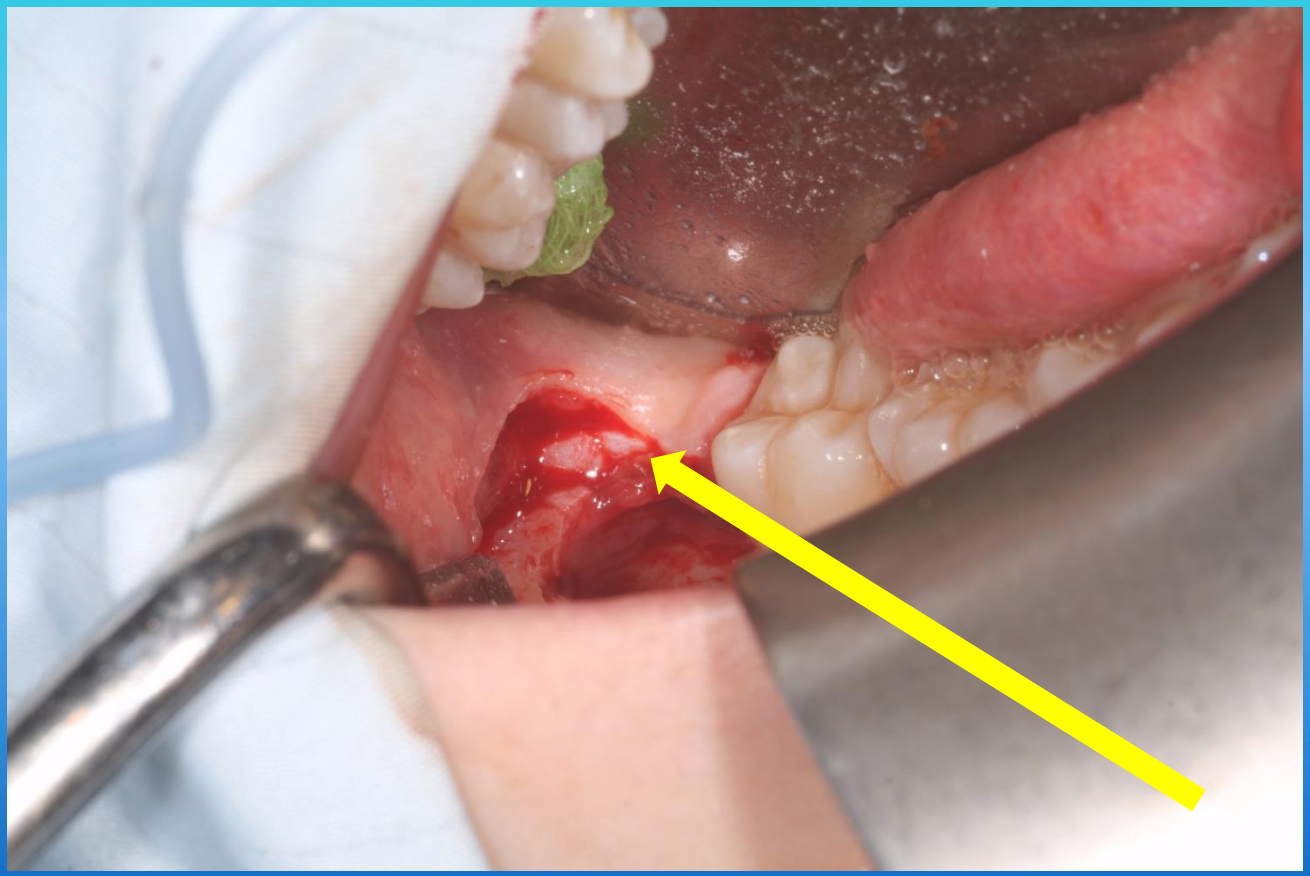
TNI



Prevention of lingual nerve injury in

TNI

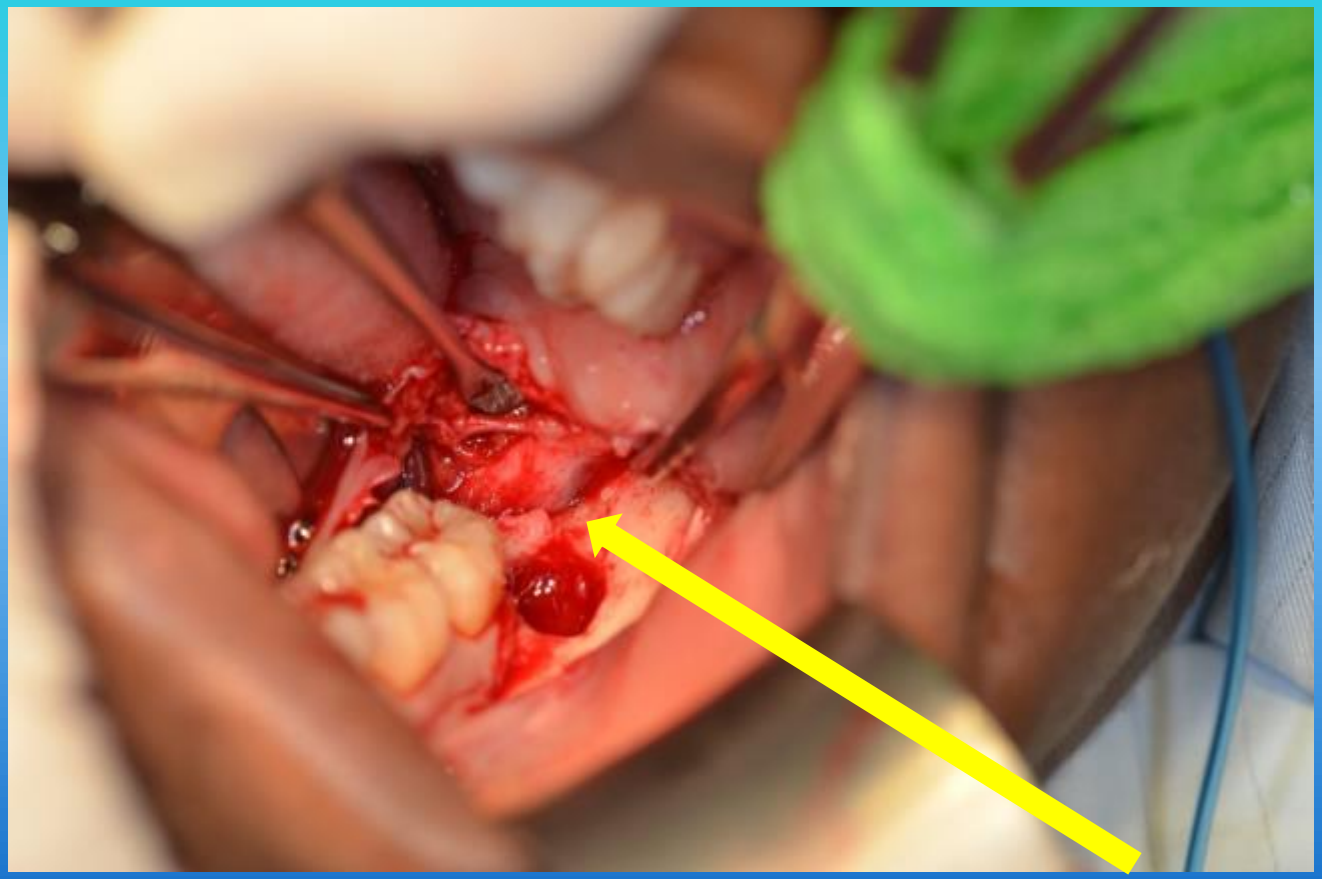
Spot the lingual nerve!



Prevention of lingual nerve injury in

TNI

During lingual nerve exploration



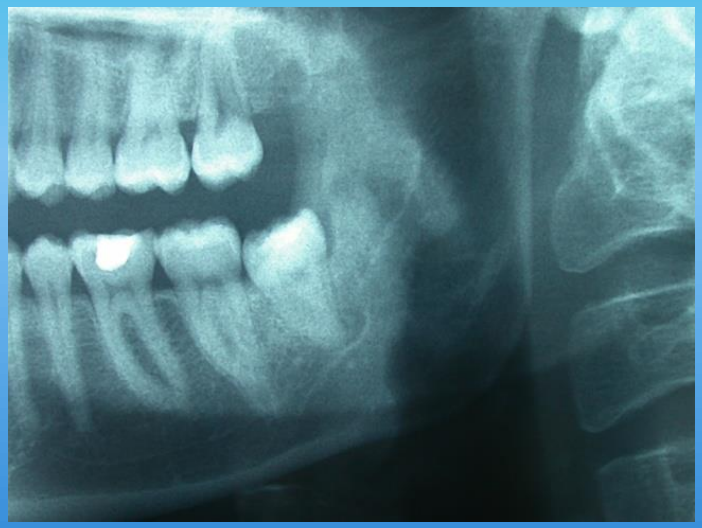
Prevention of IAN injury

- Is the M3M high risk?
- Prevention of Inferior alveolar nerve injuries

Prevention of IAN injury

Remember other teeth can be high risk crossing

IDC……



Prevention of IAN injury

Risk

- 0.5% of cases permanently
- 2% of cases temporarily

BUT if the teeth are superimposed on the IAN canal

- 20% temporary
- 2% permanent

10 x

Risk factors

- increased age
- difficulty of surgery
- proximity to the IAN canal

USA-If a lower third molar is high risk -----CBCT

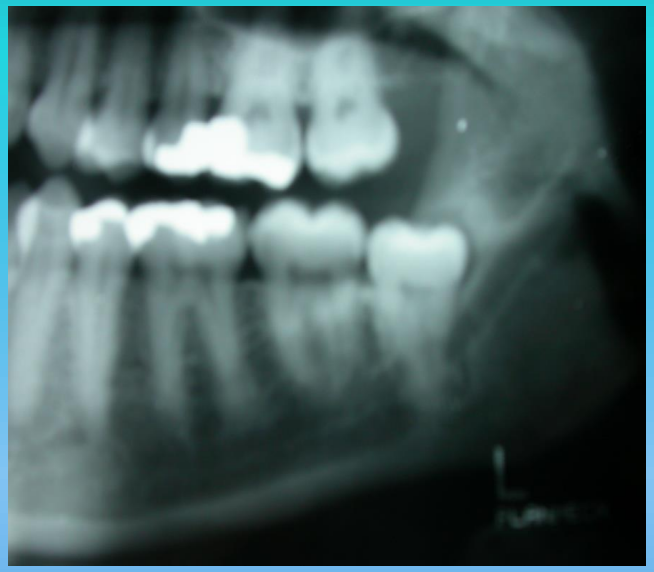
Prevention of IAN injury

TNI

Radiographic factors

OLD

- Diversion of the canal
- Darkening of the root
- Interruption of the canal LD



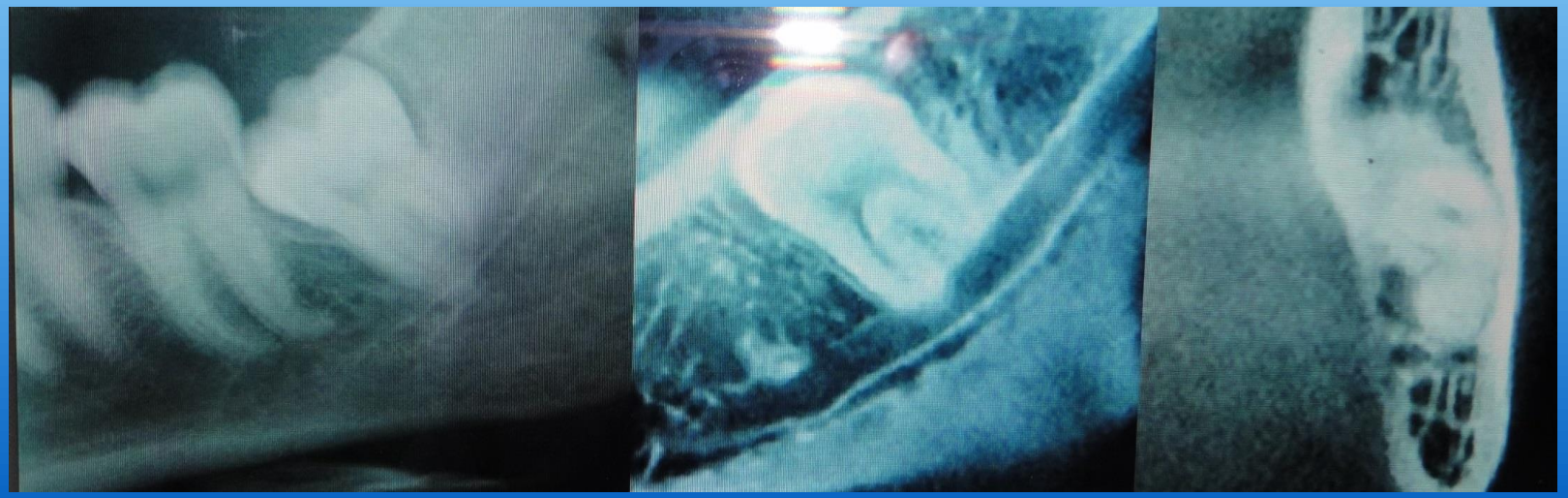
NEW

- Juxta-apical area
- Deviation of canal
- Narrowing / darkening of roots

Prevention of IAN injury

Assessment nerve ‘at risk’

- Tooth crossing lamina dura of IAN canal on plain film?
- Associated radiographic signs?
- Tooth requires extraction consider CBCT



Prevention of IAN injury

Tooth sectioning

- If the tooth is **high risk and non vital**
- then roots should be sectioned to minimise IAN injury

Prevention of IAN injury

Coronectomy

- Prospective randomised study196 M3M procedures
- Factors associated with failed coronectomy
  - Female patient
  - Conical roots
  - Age

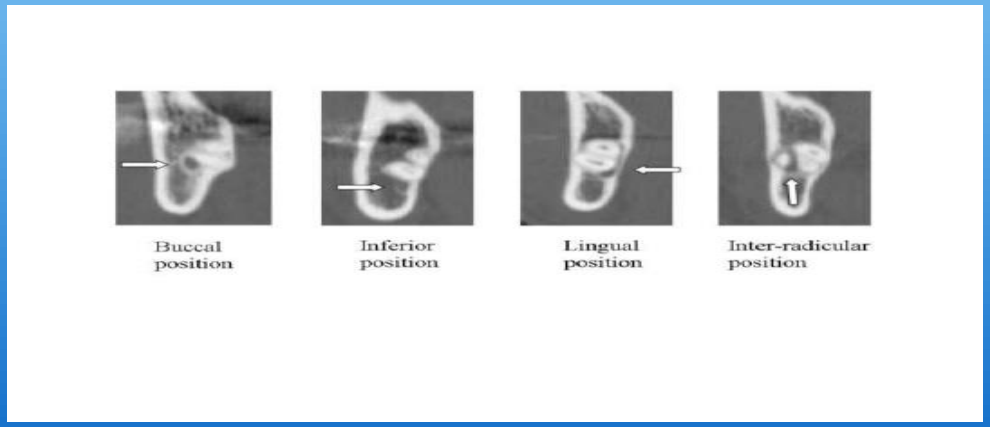
128 patients
196 teeth

Surgical removal 102 teeth	Coronectomy 56	Attempted coronectomy 36
Temp IAN 20% Perm IAN 2% AO 11%	Temp IAN 0% Perm IAN 0% AO 9%	Temp IAN 9% Perm IAN 0% AO 10%

Renton T *et al*. A prospective randomized study assessing coronectomy versus removal in third molar surgery. BJOMS 2005

Prevention of IAN injury

Can we avoid root removal?



Prevention of IAN injury

TNI

Incidence of nerve ‘at risk’

Reference	No of cases	Buccal	Inferior	Lingual	Inter radicular
Kaeppler et al 2000	345	53.6	6	13	26.8
Mahasantipiya et al 2000	202	15.3	42.6	30.2	12.4
Ito et al 1994	47	55.3	36.2	2.1	6.4
Tanaka et al 2000	209	39.2	47.4	10	3.3
Hashizume et al 2004	68	23.5	33.8	39.7	2.9
Maegawe et al 2003	47	51.1	19.1	25.5	4.3

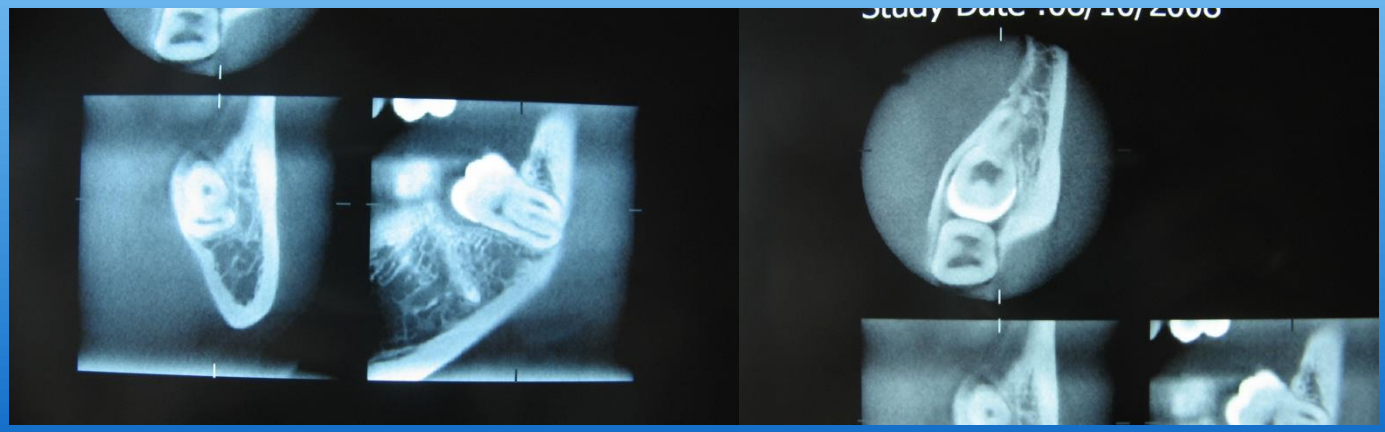
Still 15-100% of High risk M3Ms coronectomied ?????????

Prevention of IAN injury

TNI

Role CBCT in localising IAN

- Localising IAN proximal
- to lower teeth
- DISTANT from nerve??????



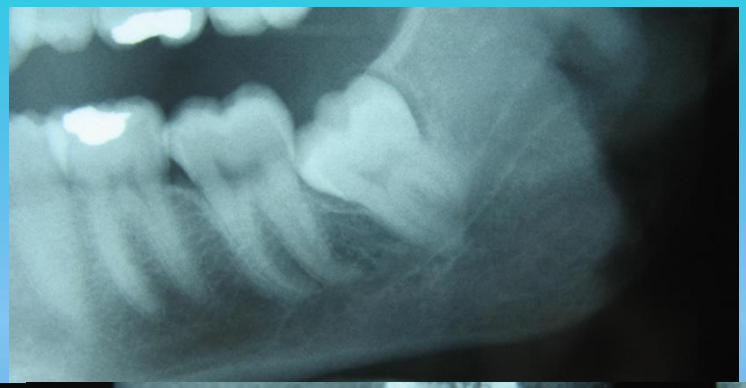
Prevention of IAN injury

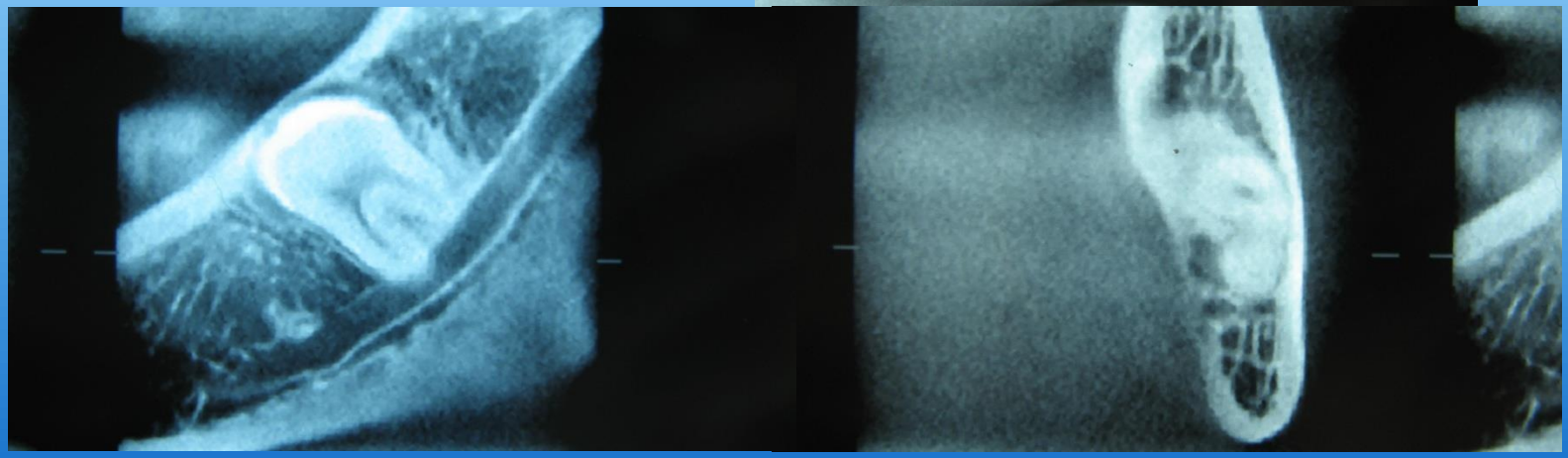
TNI

Role CBCT localising IAN

Localising IAN proximal to lower teeth

PROXIMAL to nerve





Prevention of IAN injury

TNI

DO not rely on radiologists report

Read the CBCT your self!

CBCT Radiation dose reduction
J Brown, A Darwood, C Gleeson T Renton. Minimising radiation exposure during assessment of high risk M3Ms.

Prevention of IAN injury

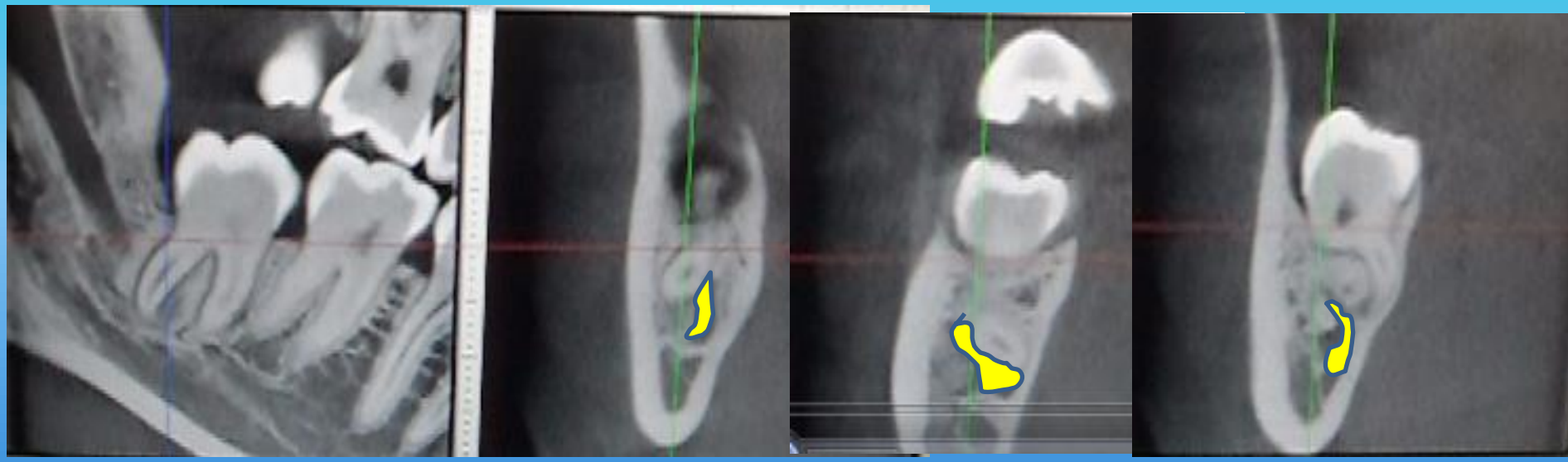
Remove the tooth or coronectomy?

Distant- remove

‘Snake like’ or Perf-Coronectomy

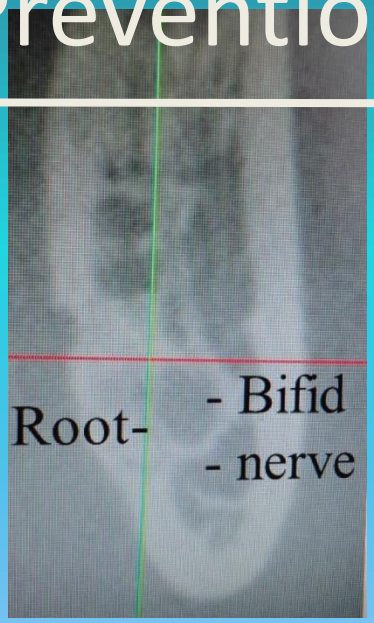
Prevention of IAN injury

The nerve doesn't have to 'perforate' tooth…….



'Snake' nerves

Prevention of IAN injury



- IAN canal cortication loss
- Bifid IDC
- Loss of lingual plate

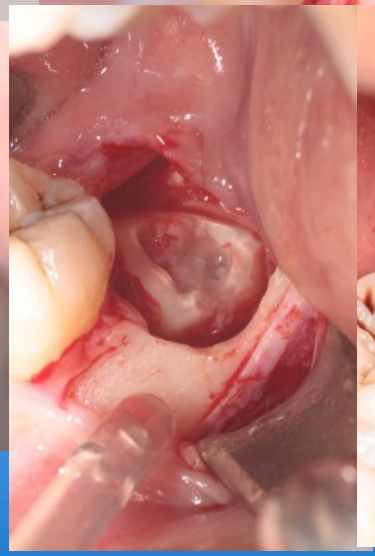
30%

. Notes on coronectomy. **Renton T**. Br Dent J. 2012 Apr 13;212(7):323-6

Prevention of IAN injury





Prevention of IAN injury

Coronectomy

Prevention of IAN injury

TNI

Coronectomy Risks

Intra-operative mobilisation of M3M roots
Early post operative infection
Late post operative infection (with eruption)
Second surgery

•Frafjord R & **Renton T.** 7 A review of coronectomy. J Oral Surgery;2010:vol3 (1-2) 1
•Article first published online: 14 JUN 2010 DOI: 10.1111/j.1752-248X.2010.01079.x

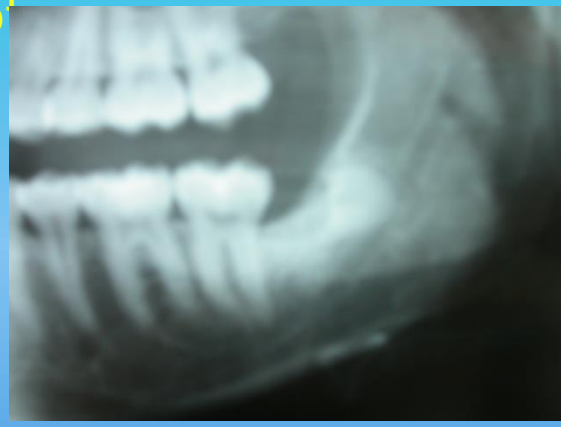
Prevention of IAN injury

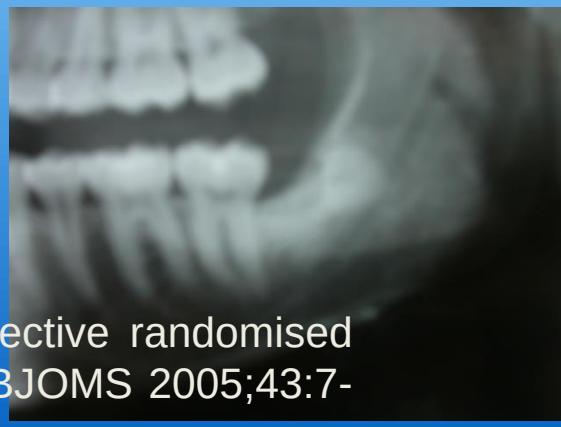
TNI

Coronectomy complications

Recent case complications

- Eruption
- Infection >2 episodes of 'dry socket' Remove roo
  - Take care with iodoform products
- Infection plus IAN paraesthesia
  - Remove roots





•**Renton T**, Thexton A, Hankins M, Sproate C, McGurk M. A prospective randomised study assessing coronectomy versus removal in third molar surgery. BJOMS 2005;43:7-12

Prevention of IAN injury

Coronectomy complications

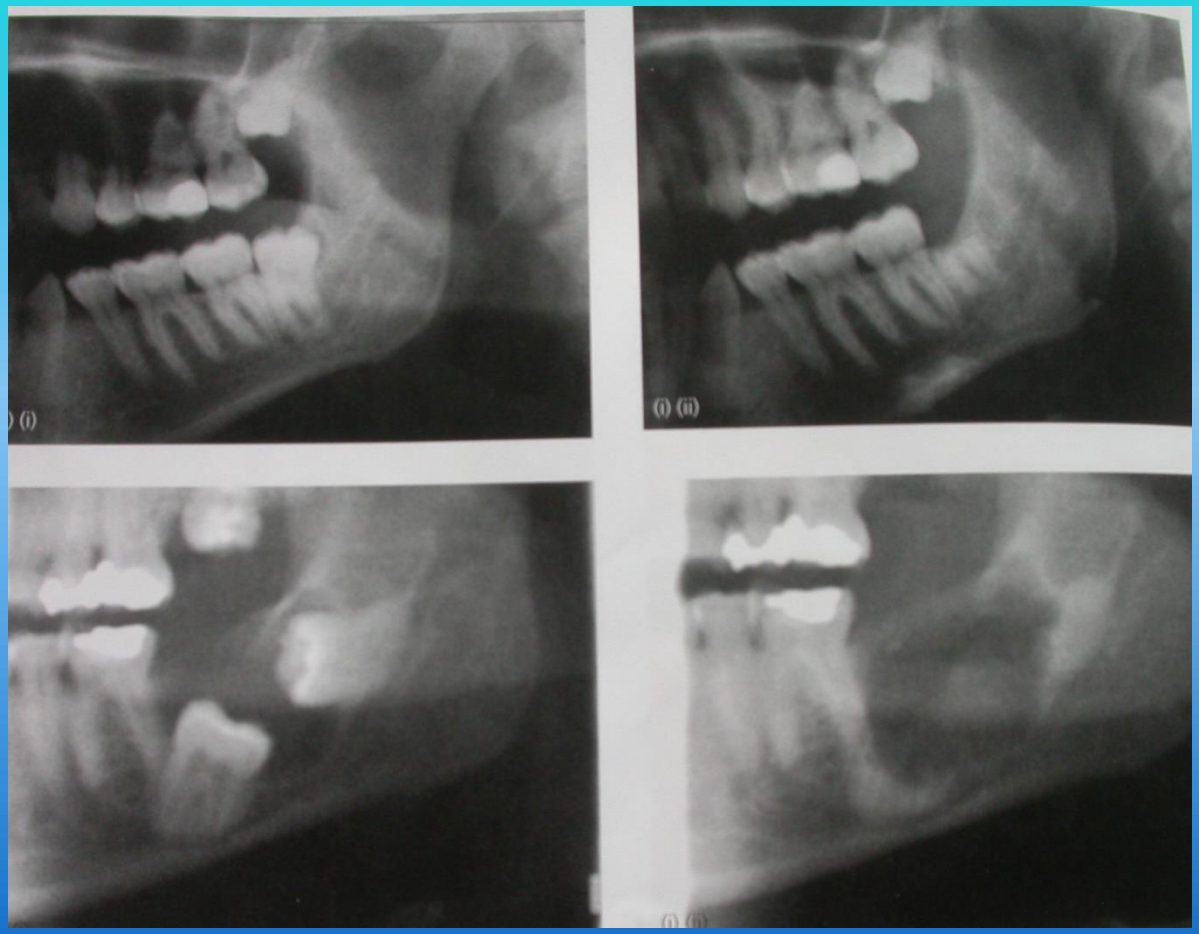
- Dry socket – treat as dry socket
- Recurrent dry socket +/- intermittent IAN neuropathy (= inflammatory neuritis)
- Late eruption ??

Leung YY, Cheung LK **Coronectomy of the Lower Third Molar Is Safe Within the First 3 Years** J Oral Maxillofac Surg. 2012 Apr 9. **98 pts 3 years 3% eruotion rate**

Prevention of IAN injury

TNI

Coronectomy other applications



Prevention of IAN injury

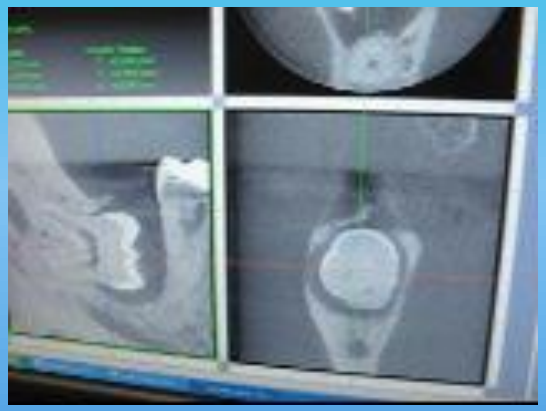
TNI

Coronectomy ankylosed teeth

Prevention of IAN injury

How CBCT has modified my approach?

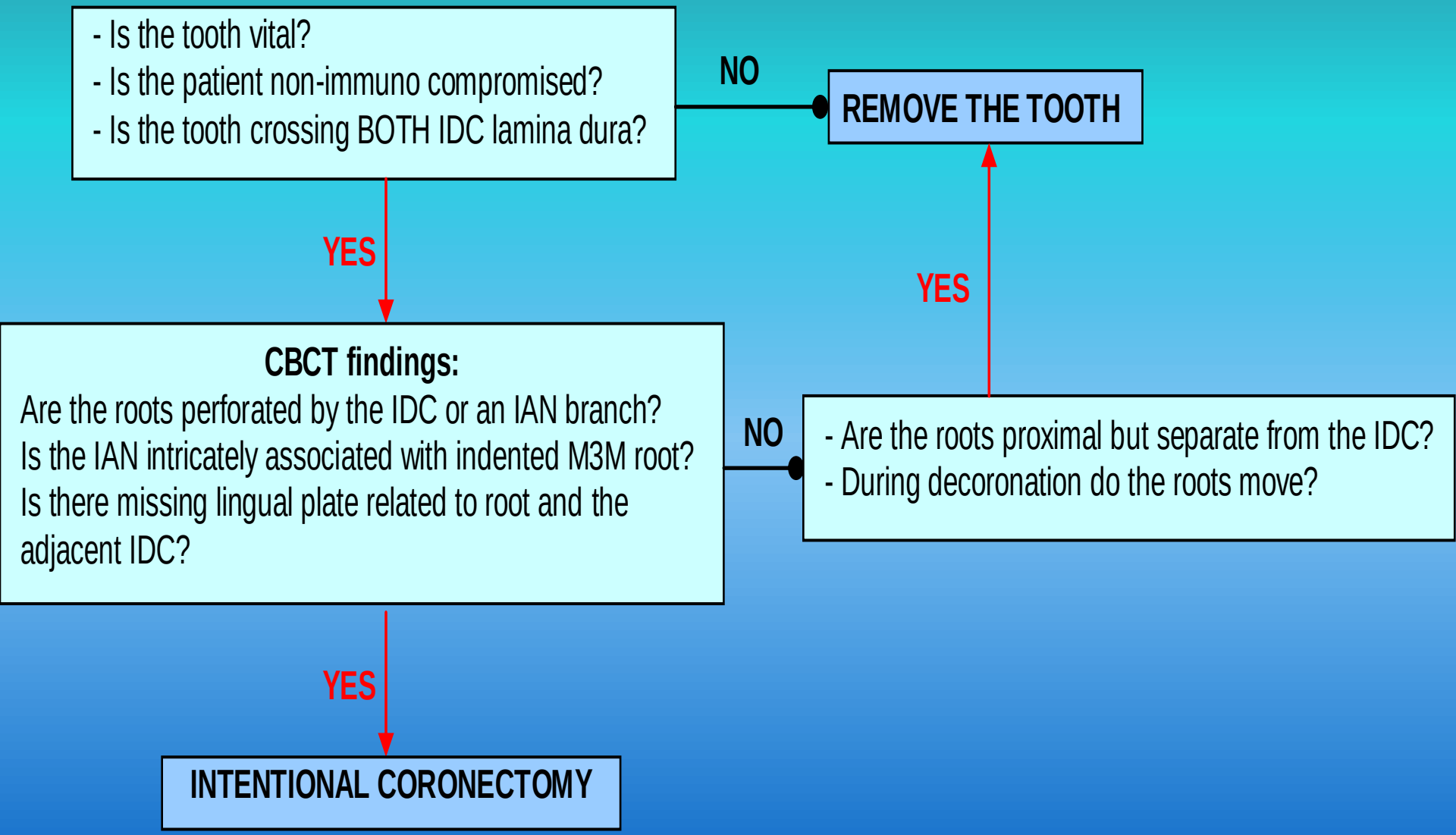
CBCT assessment of IAN position



No inferior alveolar nerve injuries
Another indication for elective coronectomy
Reduced necessary coronectomies by > 80%
Elective section of roots with no intraoperative mobilisation of roots
NEW indication for

. Notes on coronectomy. **Renton T**. Br Dent J. 2012 Apr 13;212(7):323-6

Algorithm for coronectomy decision.



Coronectomy, spare the IAN! Dental Update 2013 in press

Dent Update. 2013 Jun;40(5):362-4, 366-8.

Update on coronectomy. A safer way to remove high risk mandibular third molars.

Renton T.

King's College London Dental Institute, King's College Hospital Foundation Trust, Denmark Hill Campus, Bessemer Road, London SE5 9RS, UK.

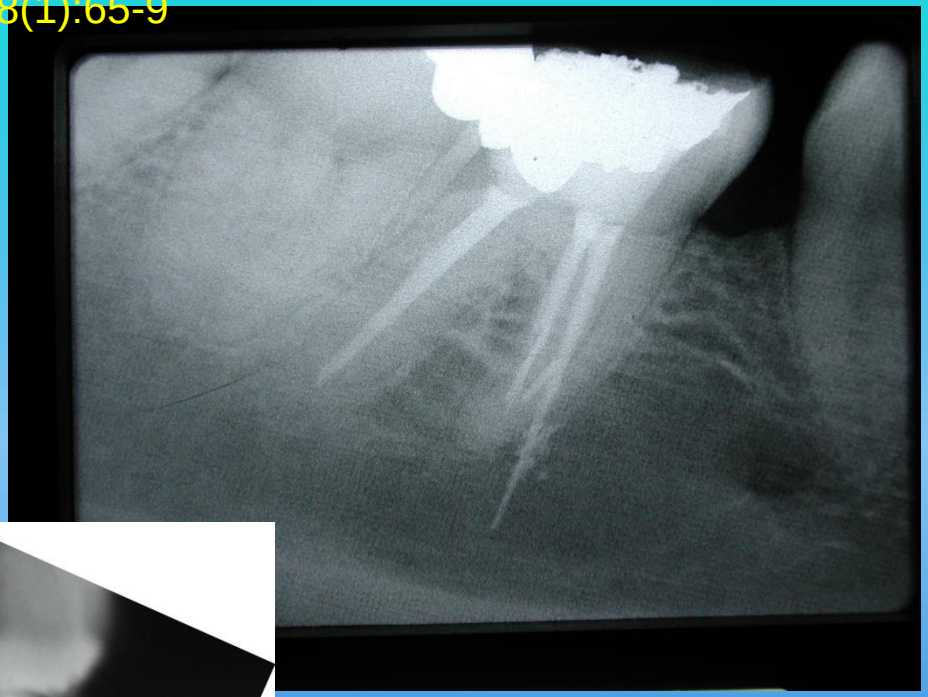
Abstract

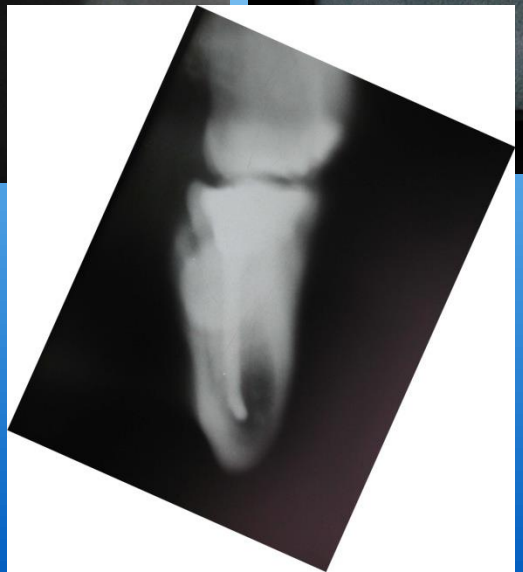
Decoronation of high risk mandibular third molars (M3Ms) has become common practice in parts of UK and USA. With the introduction of Cone Beam CT scanning, there has been an evolution in the practice, with avoidance of unnecessary coronectomies based on CBCT findings. Also, additional anatomical features found only on CBCTs have introduced possible additional indications to undertake intentional coronectomy. Trigeminal nerve injury is the most problematic consequence of dental surgical procedures with major medico-legal implications. Iatrogenic injuries to the third division of the trigeminal nerve remain a common and complex clinical problem. Altered sensation and pain in the orofacial region may interfere with speaking, eating, kissing, shaving, applying make-up, toothbrushing and drinking; namely just about every social interaction we take for granted. Usually after oral rehabilitation, the patient expects and experiences significant improvements, not only regarding jaw function, but also in relation to dental, facial, and even overall body image. Thus these injuries have a significant negative effect on the patient's self-image and quality of life and the iatrogenesis of these injuries lead to significant psychological effects. Clinical Relevance: Coronectomy is an alternative procedure to complete removal of a mandibular third molar in situations where there is high risk of damage to the inferior alveolar nerve.

PMID: 23909229 [PubMed - in process]

Prevention of Endo IAN injury

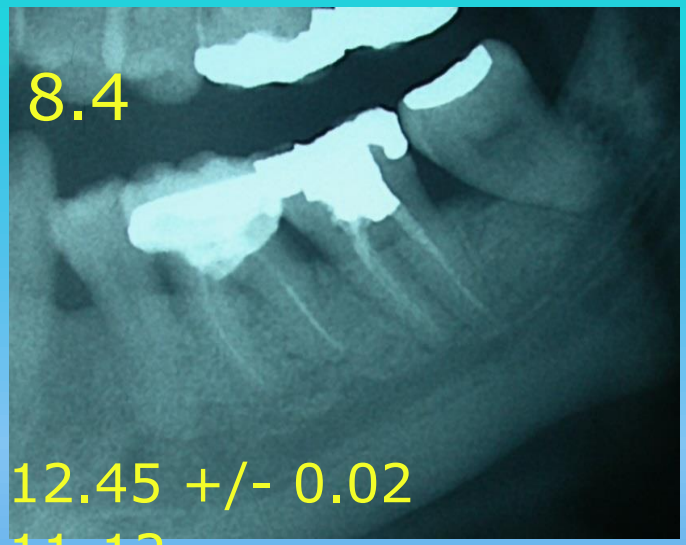
Damage to the inferior alveolar nerve as the result of root canal therapy.
Pogrel MA.J Am Dent Assoc. 2007 Jan;138(1):65-9





Prevention of Endo IAN injury

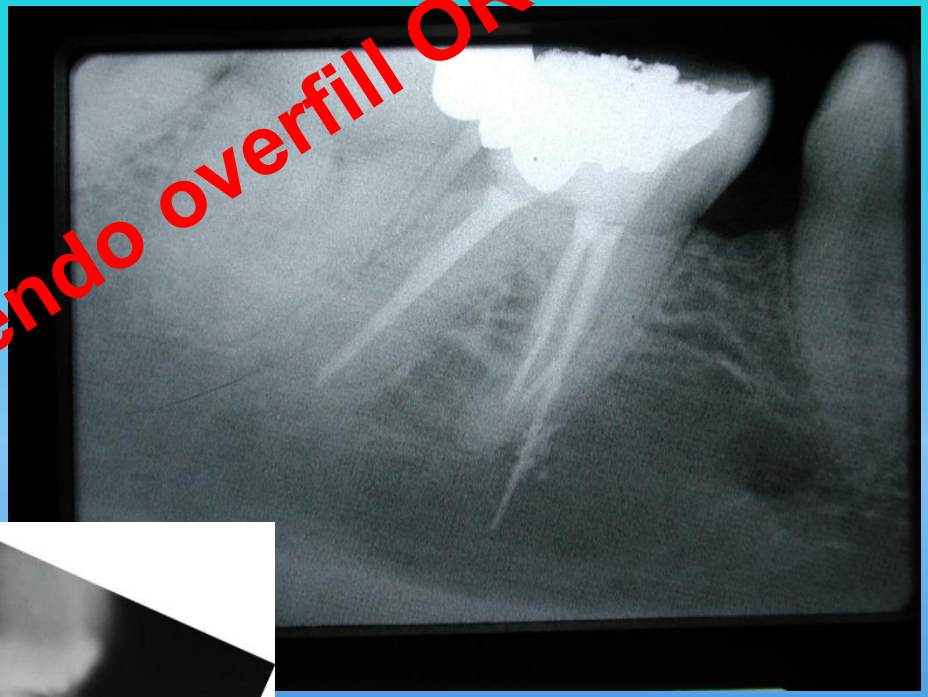
Toxicity of commonly used dental products

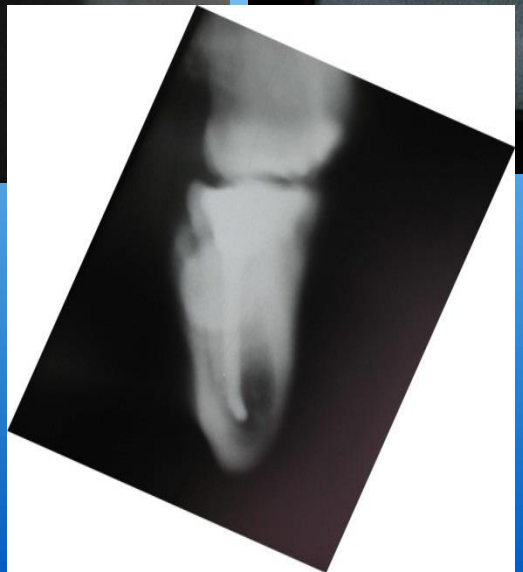


- BioOss — pH 8.4
- Socket Medicaments
  - Alvogyl, Whiteheads varnish, Corsodyl and Surgicel (pH 5.8)
- Endo Medicaments
  - Formocresol — pH 12.45 +/- 0.02
  - Sodium hypochlorite — pH 11-12
  - Calcium hydroxide (Calyxl). — pH 10-14
  - Antibiotic-corticosteroid paste (Ledermix) — pH 8.13 +/- 0.01
  - Neutral — pH 7.35-7.45
  - Eugenol — pH 4.34 +/- 0.05
  - Iodoform paste — pH 2.90 +/- 0.02

Prevention of Endo IAN injury

TNI





30 hours to remove endo overfill OR tooth

Prevention of Implant nerve injury

TNI

Dental implant nerve injury

Inferior alveolar nerve injury

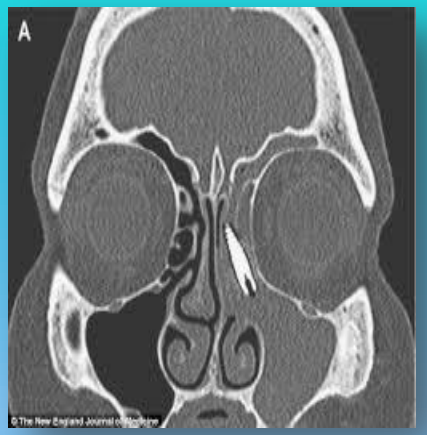
- occurs in relation to dental implant treatment

Implant surgery

- is ELECTIVE

Thus any evidence of poor practice;

- Informed consent
- Planning/negligence
- Execution
- Post operative follow up/ advice and referral



Implant related cases

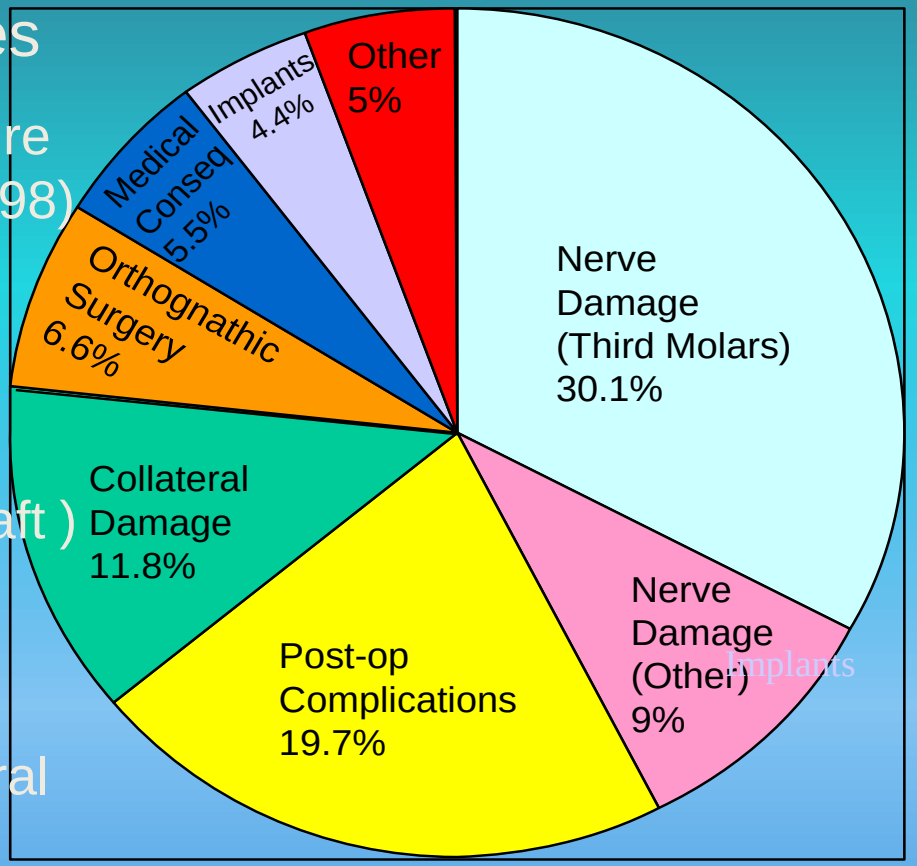
Wrong position and failure (current $164,000 i/d 1998)

placed into ID nerve (current $126,000)

failure associated procedures (eg bone graft)

Ireland $3.6 million

Pre-op assessment and communication, collateral damage (sinus lift)



Other	1.5%	TMJ Surgery
	1.2%	Consent Only
	0.5%	Failure to diagnose/treat
	0.3%	Maxillary Sinus
	1.5%	Misc
	5%	

Prevention of Implant nerve injury

TNI

GDC warns general dental practitioners on implantology.

Br Dent J. 2008 Apr 26;204(8):425.

Post-implant neuropathy of the trigeminal nerve. A case series.

T. Renton,[1] A. Dawood,[2] A. Shah,[3] L. Searson[4] and Z. Yilmaz[5]

IN BRIEF

- This paper highlights some of the risks of causing nerve injury during planning, preparation and placement of mandibular implants.
- Highlights potential pitfalls and problems.
- Provides tips on how to prevent these implant related trigeminal injuries.

RESEARCH

Background The incidence of implant-related inferior alveola
population. **Aims** This study prospectively reviewed thirty cas
a specialist nerve injury clinic. **Methods** Neurosensory examin
of the perception, pain profiling and functional difficulties. Da
were aware of signing consent forms for the surgery in 11 cas
nerve injury. Over 70% of patients were referred after six mon
films only (30%), CBCT (10%), dental pantomograph (50%) an
radiographic evidence pre- or postoperatively was provided b
problems included bleeding and neurological symptoms. Proxi
canal was evident radiographically. This showed contact with
into the canal in 20% of cases, crossing of the canal in 20% c
anaesthetic injury. All patients presented with a demonstrable
interfered with speaking, kissing and socialising. **Conclusions**
awareness of the incidence of neuropathic pain following imp
prevent future injuries.

INTRODUCTION

Trigeminal nerve injury is a frequent problematic consequence of dental surgical procedures with major medico-legal implications.[1] The incidence of lingual nerve injury has remained static in the UK over the last 30 years, however, the incidence of inferior alveolar nerve injury has increased as a result of implant surgery and endodontic therapy.[2]

Altered sensation and pain in the orofacial region may interfere with speaking, eating, kissing, shaving, applying make-up, tooth brushing and drinking. In fact, just about every social interaction we take for granted.[3] These injuries therefore have a significant effect on the patient's quality of life and the iatrogenesis of these injuries may lead to further significant psychological effects.[4]

The inferior alveol
greater risk from inj
lingual nerve (LN), as
a bony canal, predisp
trauma and a higher ir
damage. Implant surg
to the nerve within
anaesthetic injections
though neuropathy r
tions is usually tempo
ally persist and becor

There are rare rep
implant related IAN
four years,[5] but these
normal reports of per
injuries.[6] Another stu
ral of injuries after
may be too late for m
sensory nerve injuries. We now understand that after three months, permanent central and peripheral changes occur within the central nervous system subsequent to injury, which are unlikely to respond to surgical intervention.[8]

The incidence of implant related IANI's varies from 0–33.2% (Table 1).[7,9–16] Bone

cohort of patients seen on a specialist pain clinic, hoping to form recommendations to reduce injury related to implant surgery.

METHODS

Subjects

A total of 287 patients with trigeminal nerve injuries collected over three years

[1,2,3,4]King's College London Dental Institute, Bessemer Road, London, SE5 9RS; [2]Dawood & Tanner Dental Practice, 45 Wimpole Street, London, W1G 8SB
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Email: tara.renton@kcl.ac.uk; Tel 0203 299 2313

Refereed Paper
Accepted XXX
DOI: 10.1038/sj.bdj.XXX

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8 June 2012 Last updated at 16:08

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Dental implants can cause nerve damage, warns study

Dentists are not being vigilant when carrying out implant surgery and are failing to inform patients about the risks of nerve damage, a study in the British Dental Journal says.

Dental implant procedures have risen in number in recent years

Researchers from King's College London Dental Institute analysed 30 patients with nerve injuries and found problems with pain, speech, eating and kissing.

Around 1% of implant procedures carried out each year result in nerve injuries.

Dentists should improve care before and after implant surgery, the study says.

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Does terrorist threat to Olympics justify missiles being deployed?

Prevention of Implant nerve injury

TNI

- Renton T, Dawood A, Shah A, Searson L, Yilmaz Z. Post-**implant** neuropathy of the trigeminal **nerve**. A case series.Br Dent J. 2012 Jun 8;212(11):E17. doi: 10.1038/sj.bdj.2012.497
- Brook I. Summary of: Post-**implant** neuropathy of the trigeminal **nerve**. A case series.Br Dent J. 2012 Jun 8;212(11):544-5.
- Park YT, Kim SG, Moon SY. Indirect compressive injury to the inferior alveolar **nerve** caused by **dental implant** placement. J Oral Maxillofac Surg. 2012 Apr;70(4):e258-9. Epub 2012 Feb 4
- Palma-Carrió C, Balaguer-Martínez J, Peñarrocha-Oltra D, Peñarrocha-Diago M. Irritative and sensory disturbances in oral implantology. Literature review.Med Oral Patol Oral Cir Bucal. 2011 Nov 1;16(7):e1043-6. Review
- Jensen OT, Cottam J, Ringeman J. Avoidance of the mandibular **nerve** with **implant** placement: a new "mental loop". J Oral Maxillofac Surg. 2011 Jun;69(6):1540-
- Givol N, Rosen E, Bjørndal L, Taschieri S, Ofec R, Tsesis I. Medico-legal aspects of altered sensation following endodontic treatment: a retrospective case series.Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2011 Jul;112(1):126-31. Epub 2011 Mar 3
- Bagheri SC, Meyer RA. Management of mandibular **nerve injuries** from **dental implants**. Atlas Oral Maxillofac Surg Clin North Am. 2011 Mar;19(1):47-61
- Barrowman RA, Grubor D, Chandu A. **Dental implant** tourism. Aust Dent J. 2010 Dec;55(4):441-5
- Misch CE, Resnik R. Mandibular **nerve** neurosensory impairment after **dental implant** surgery: management and protocol. **Implant** Dent. 2010 Oct;19(5):378-86

Prevention of Implant IAN injury

TNI

What Quality assurance?

- **Training**
- RCS Training standards
- GDC Policy Statement
- Registerable Qualifications???

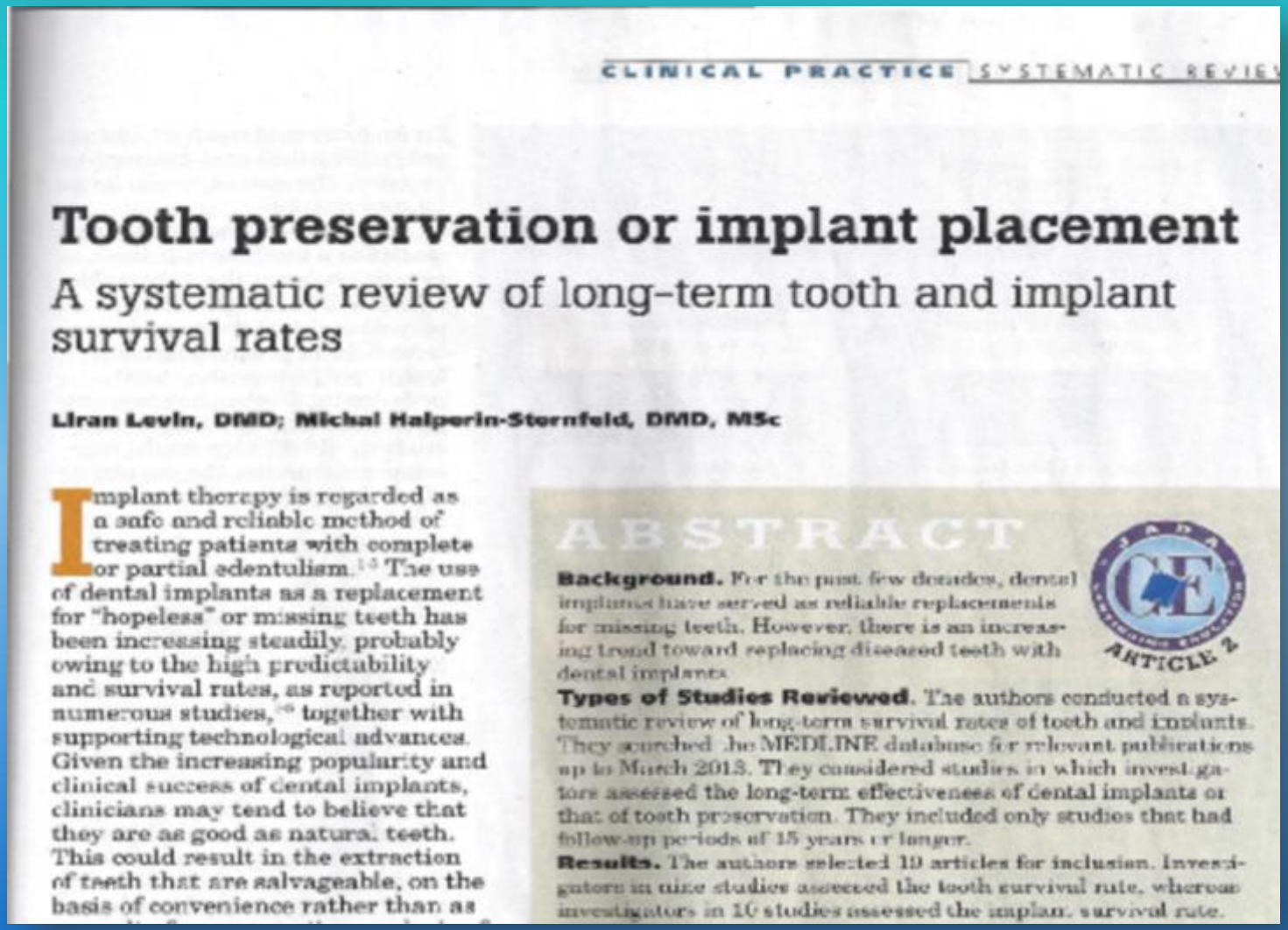
- Equipment - MHRA

- Patient information guidance

- **Treatment Guidelines**
- RCS 2011
- EAO Radiographic Guidelines 2010
- ADI Implant sand BPs 2012
- Guidelines for selecting appropriate NHS patients to receive treatment 2012

Prevention of Implant nerve injury

TNI



CLINICAL PRACTICE | SYSTEMATIC REVIEW

Tooth preservation or implant placement

A systematic review of long-term tooth and implant survival rates

Liran Levin, DMD; Michal Halperin-Sternfeld, DMD, MSc

Implant therapy is regarded as a safe and reliable method of treating patients with complete or partial edentulism.[1-3] The use of dental implants as a replacement for "hopeless" or missing teeth has been increasing steadily, probably owing to the high predictability and survival rates, as reported in numerous studies,[4-6] together with supporting technological advances. Given the increasing popularity and clinical success of dental implants, clinicians may tend to believe that they are as good as natural teeth. This could result in the extraction of teeth that are salvageable, on the basis of convenience rather than as

ABSTRACT

ARTICLE 2

Background. For the past few decades, dental implants have served as reliable replacements for missing teeth. However, there is an increasing trend toward replacing diseased teeth with dental implants.

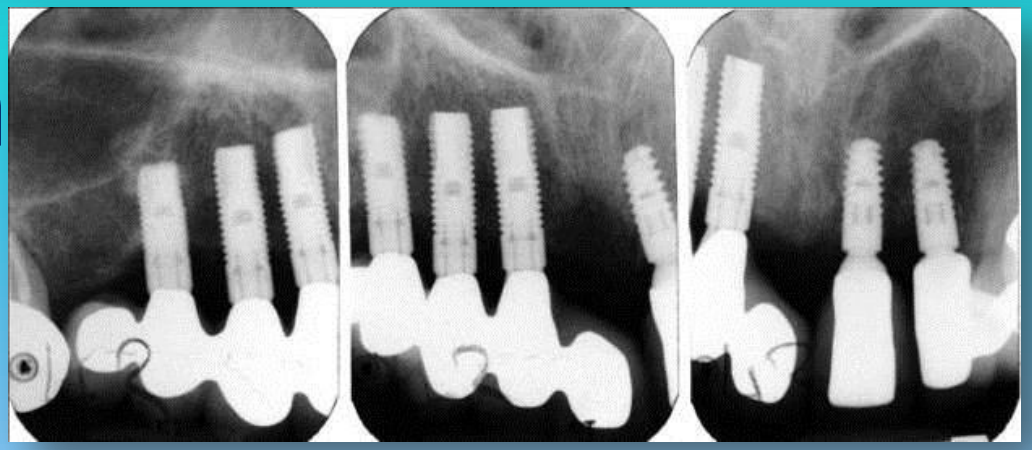
Types of Studies Reviewed. The authors conducted a systematic review of long-term survival rates of tooth and implants. They searched the MEDLINE database for relevant publications up to March 2013. They considered studies in which investigators assessed the long-term effectiveness of dental implants or that of tooth preservation. They included only studies that had follow-up periods of 15 years or longer.

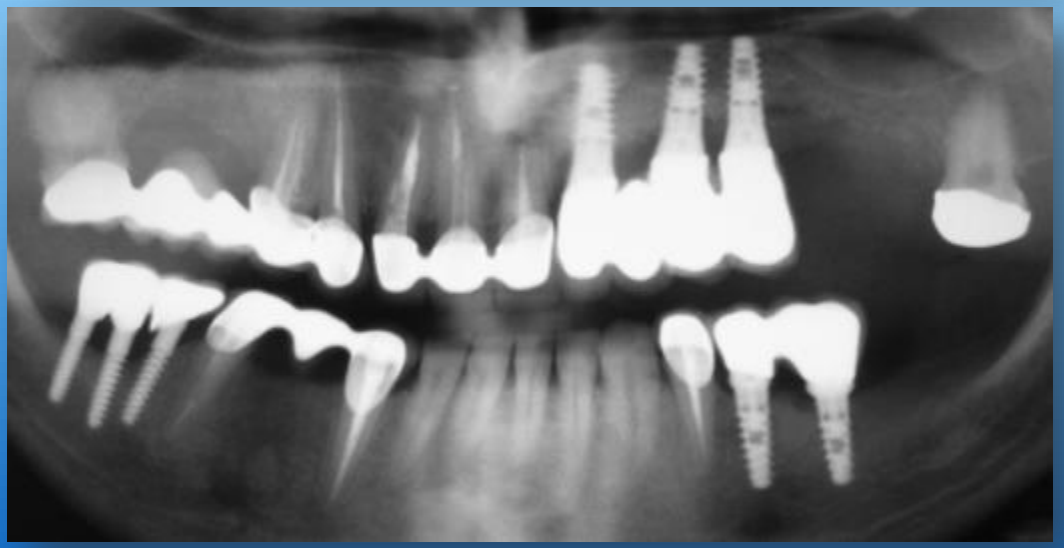
Results. The authors selected 10 articles for inclusion. Investigators in nine studies assessed the tooth survival rate, whereas investigators in 10 studies assessed the implant survival rate.

Prevention of Implant nerve injury

TNI

Over prescription

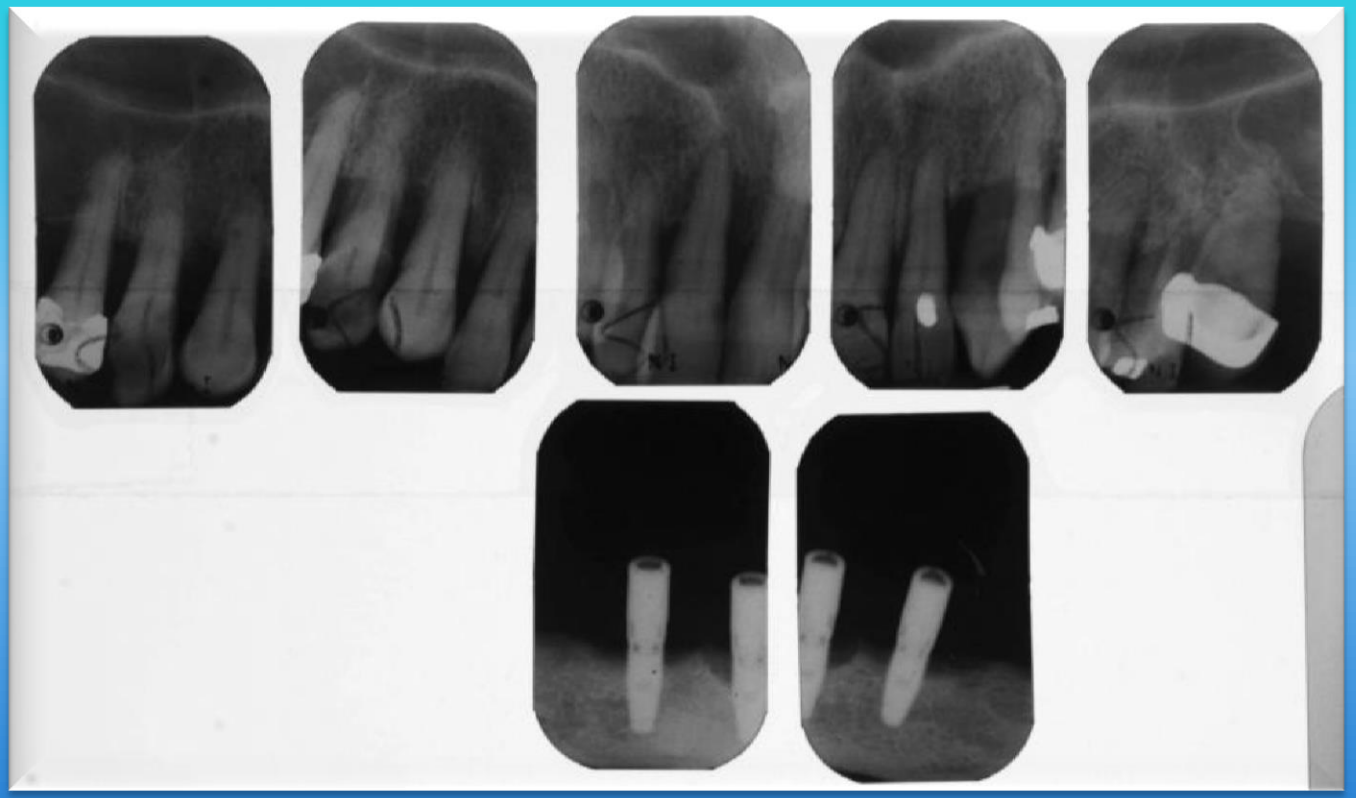




Prevention of Implant nerve injury

TNI

Wrong prescription



The system = broken so need independent review (Steele et al 2009)

Peri-implantitis

Fransson et al.2005

- BOP &/or pus + ≥ 3 threads (1.8mm) bone loss & at least 0.1mm bone loss after 1st year in function

- 25%

Roos-Jansåker et al.2006

- BOP &/or pus ≥ 3 threads (1.8 mm) bone loss after 1st year in function

- 16 %

Zitzmann et al.2009

- BOP & bone loss ≥ 2.5 mm up to

- 55 %

Koldsland et al.2010

- BOP & PPD ≥ 4 mm + Bone loss ≥ 2 mm

- 25%

Prevention of Implant nerve injury

TNI

Risk factors for peri implantitis

Poor Oral Hygiene

History of Periodontitis

Cigarette smoking

Heitz-Mayfield LJA. Peri-implant diseases: diagnosis & Risk Indicators. *Clin Oral Implants Res* 2008:35:214-222

Peri-implant lesions don't respond predictably to either non-surgical or surgical treatments unlike the treatment of periodontitis. It seems that progression of peri-implantitis is more akin to that seen for deep furcations than other periodontal lesions. This may be due to accessibility difficulties in both situations – Renvert & Polyzois 2014

Prevention of Implant nerve injury

TNI

One certainty!

Increased medico legal indemnity charges!

Prevention of Implant nerve injury

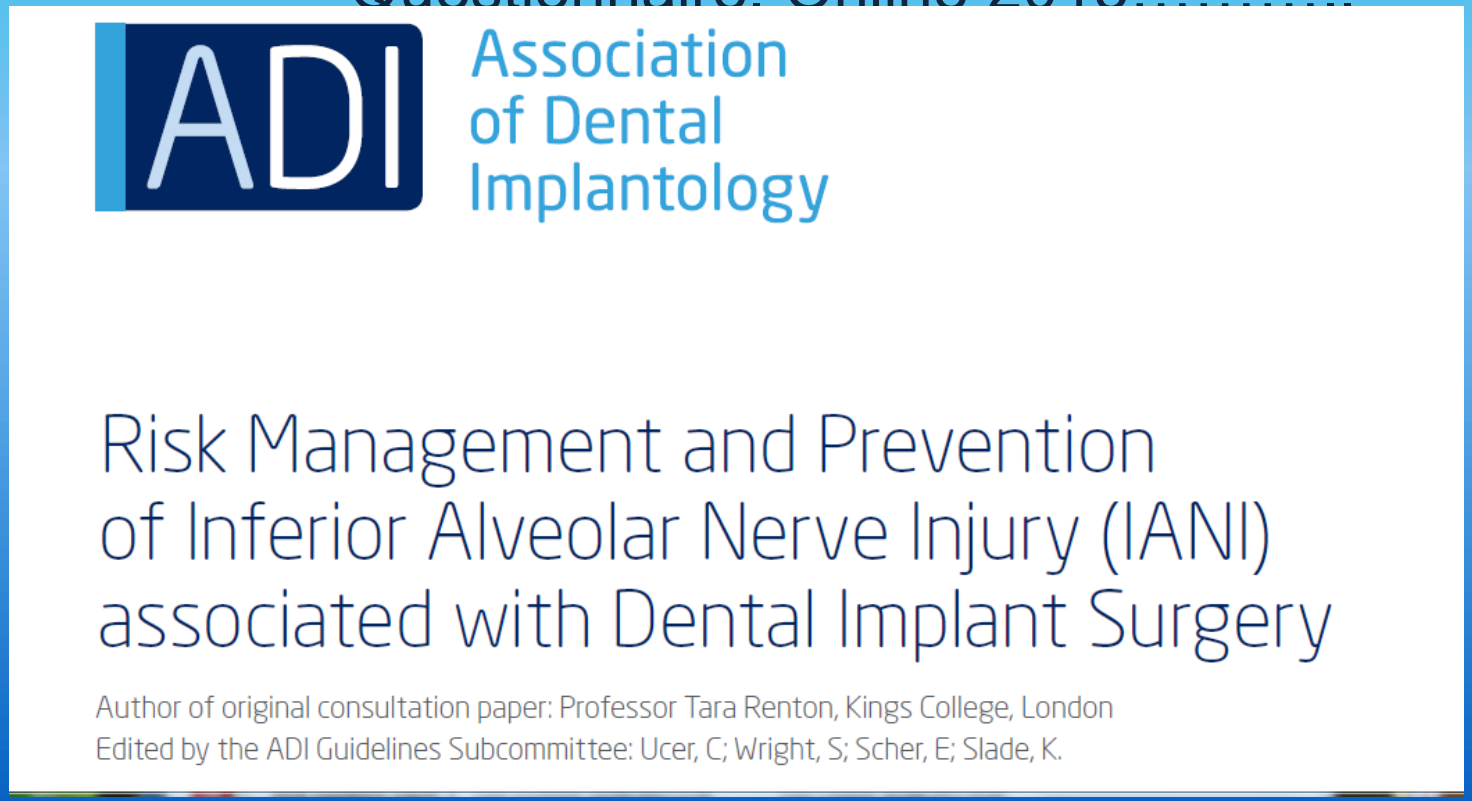
TNI

What is the incidence of IRNIs?

? 3%

- https://www.surveymonkey.com/s/IANI_SURVEY

- **ADI Consultation paper on prevention and management of dental implant related nerve injury**…2013 online
- Risk management if IRNIs 2013 (below)
- Assessment and management of IRNIs
- Questionnaire. Online 2013……..



Diagnosis and Management of Inferior Alveolar Nerve Damage Associated with Dental Implant Surgery

Tara Renton, Maria Devine

Prof. Tara Renton, BDS, MDSc, PhD, FDS, RCS, FRACDS (OMS), FHEA (Specialist in Oral Surgery) is a dentist with a particular interest in trigeminal nerve injuries and pain. She was awarded her chair at King's College London in 2006. She has established an academic training program, which has taught 5 Academic Oral Surgery SpRs, of whom 3 are undertaking PhDs. She was recently appointed lead for orofacial pain at INPaT, a nationally recognized pain management program based at St Thomas' Hospital. Tara is the national advisor for oral surgery. She is an elected council member for BAOS and is an elected member of the RCS England FDS Board.

Maria Devine, BDS (Nd), MFDS, RCSEd is an Academic Clinical Fellow Specialty Registrar in Oral Surgery at Kings College Hospital. Her current research activity involves iatrogenic trigeminal nerve injury. She qualified from Newcastle University in 2009 and worked in a variety of hospital dentistry, general practice and maxillofacial surgery posts before taking up her specialty training in Kings College Hospital.

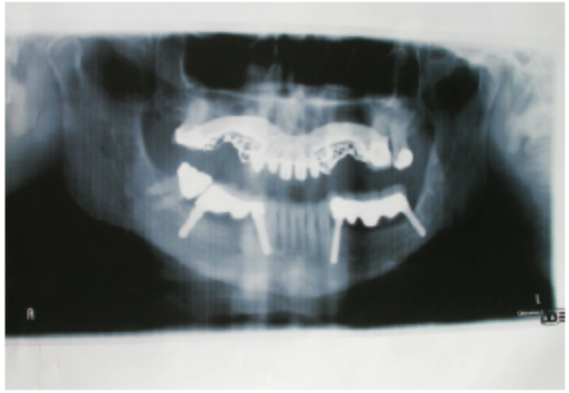


Fig. 1: OPT of patient with bilateral inferior alveolar nerve injury due to implant surgery

INTRODUCTION

Minimizing adverse events related to patient care is paramount. Trigeminal nerve injuries related to dentistry are a recognized complication and avoidable in most instances. Implant treatment and nerve injuries are an increasingly common cause for medico-legal complaints and resultant compensation to patients with lifelong orofacial neuropathy (Fig. 1).

The inferior alveolar nerve (IAN) is at risk from a variety of dental procedures as it is contained within a bony canal predisposing it to ischaemic trauma and a higher incidence of permanent damage. Causes of inferior alveolar nerve injury (IANI) include local anaesthetic injections, third molar surgery, implants, endodontics, ablative surgery, trauma and orthognathic surgery. IAN neuropathy related to third molar surgery or inferior alveolar block injections is usually temporary but can persist and become permanent.

The trigeminal nerve is the largest sensory nerve in the body, supplying the orofacial region. Iatrogenic (caused by doctors or dentists) trigeminal nerve injuries (TNI) result in pain in 70% of patients resulting in interference with speaking, eating, kissing, shaving, applying makeup, tooth brushing and drinking; in fact just about every social interaction we take for granted. Thus these injuries have a significant negative effect on the patient's self-image, and quality of life as well as significant psychological effects (Renton & Yilmaz 2011).

At the same time the predictability of dental implants and the expectations and demands of patients have moved to a position where dental implants are now seen as a routine treatment option when considering the restoration of missing teeth (Ghivi et al. 2011). More recently, complaints and legal action against dentists in the United Kingdom have increased significantly and many of these arise from implant-related treatment (Ghivi et al. 2011), which in part is contributed to by 'implant tourism' (Barrowman et al. 2010).

Although nerve injury occurs in a minority of patients undergoing implant therapy, the consequences can be devastating for both patient and clinician (Renton & Yilmaz 2011).

The most significant issue with implant-related nerve injuries is that they are entirely avoidable as this is elective surgery and potentially permanent with or without surgical intervention (Renton et al. 2012, Brook 2012). Published guidelines pertaining to dental implant therapy are relatively scarce and mainly address the prescription of implants rather than their application (Gottfredsen et al. 2008, Dawson & Cardaci 2006, van Waas et al. 1991, Academy of Osseointegration 2010).

The incidence of implant-related nerve injury is not fully established and is generally based on empirical estimates or rare prospective case series (Renton et al. 2012, Rubenstein & Taylor 1997, Wismeijer et al. 1997, Dao & Mellor 1998, Bartling et al. 1999, Walton 2000, Ziccardi & Assael 2001, von Arx et al. 2005, Abarca et al. 2006, Greenstein & Tarnow 2006, Hegedus & Dlacidue 2006, Tay & Zuniga 2007, Hillerup 2007, Misch et al. 2008, Alhassani & Alghamdi 2010, Misch 2010, Juodzbalys et al. 2011, Palma-Carrio et al. 2011, Juodzbalys et al. 2011, Park et al. 2012, Balshi 1989, Barberi et al. 1993, Delcanho 1995, Fukuda & Ichinohe 2012). The incidence of implant-related IANI varies from 0-40% (Dawson & Cardaci 2006, van Waas et al. 1991, Academy of Osseointegration 2010, Balshi 1989, Barberi et al. 1993, Delcanho 1995, Rubenstein & Taylor 1997, Wismeijer et al. 1997, Dao & Mellor 1998, Bartling et al. 1999, Walton 2000, Ziccardi & Assael 2001, von Arx et al. 2005, Abarca et al. 2006, Greenstein & Tarnow 2006, Hegedus & Dlacidue 2006, Tay & Zuniga 2007, Hillerup 2007, Misch et al. 2008). Adjunctive proca-

Prevention of Implant nerve injury

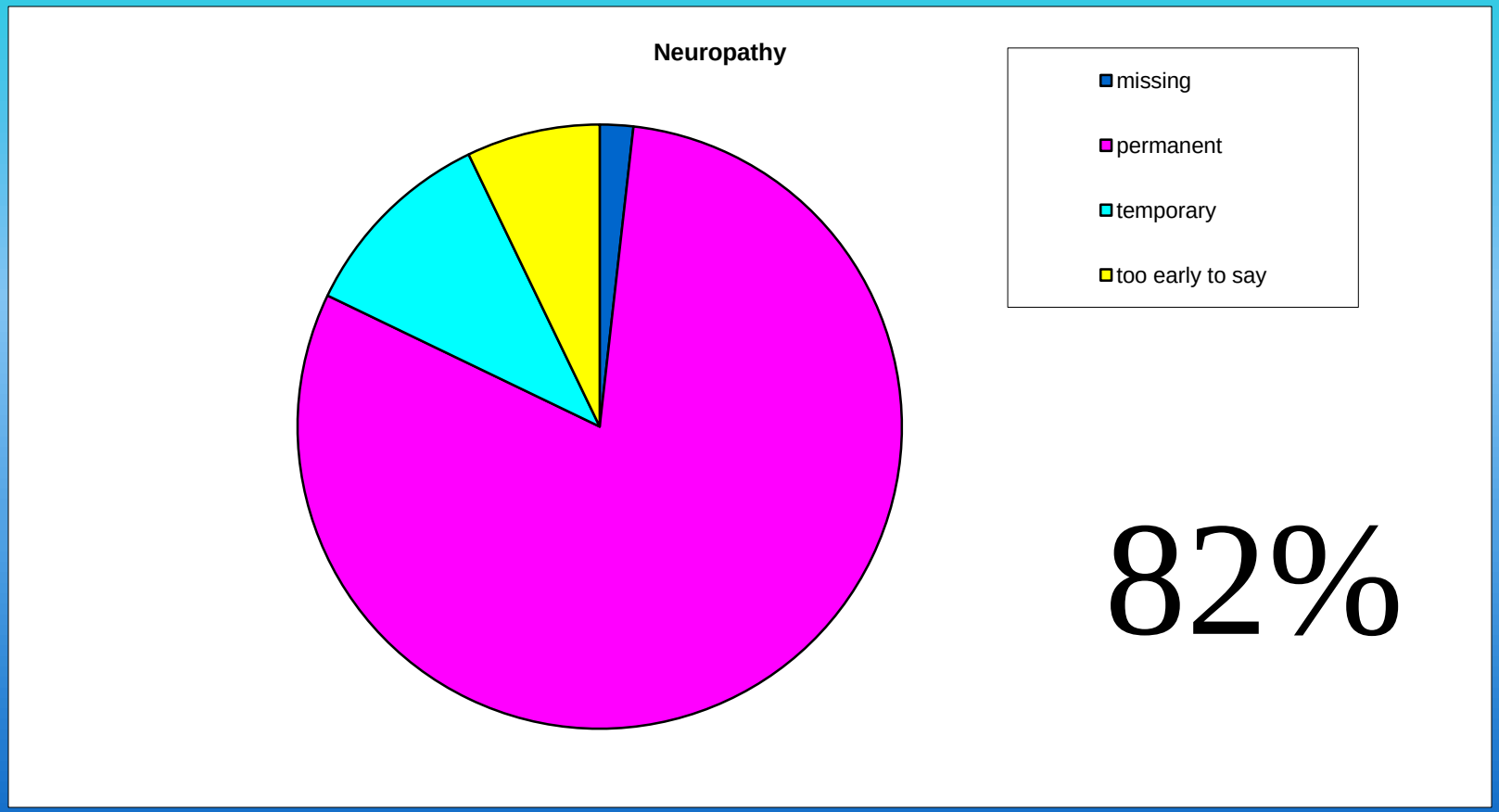
TNI

- The incidence of implant related inferior alveolar nerve (IAN) nerve injuries vary from 0-40%. Bone graft harvesting is also associated with IAN injuries
- Delcanho RE. 1995; Rubenstein & Taylor 1997;Wismeijer D et al1997;Bartling et al 1999; Walton J 2000; von Arx T, et al. 2005; Hegedus & Diecidue 2006; Hillerup S 2007

- Patients attending my nerve injury clinic
- 10% of patients presenting with iatrogenic trigeminal nerve injury in 2000 now 37% in 2013!

Prevention of Implant nerve injury

Permanency of 60 IRNIs



TNI

Effects of injury on IAN

- The IAN is contained within a bony canal which predisposes it to compression and possible ischaemic type injury. **Compression of peripheral sensory nerves over 6 hours can evoke nerve fibre atrophy**
- Shimpo T, Gilliatt RW, Kennett RP, Allen PJ. Susceptibility to pressure neuropathy distal to a constricting ligature in the guinea-pig. J Neurol Neurosurg Psychiatry. 1987 Dec;50(12):1625-32
- **Ischaemia alone without direct nerve damage will cause sufficient neural inflammation and damage to cause permanent nerve injury**.
- Park YT, Kim SG, Moon SY. Indirect compressive injury to the inferior alveolar nerve caused by dental implant placement. J Oral Maxillofac Surg. 2012 Apr;70(4):e258-9.
- **Three months after the IAN injury**, **permanent central and peripheral changes** occur within the nervous system subsequent to injury, that are unlikely to respond to surgical treatment intervention
- Yekta SS, Smeets R, Stein JM, Ellrich J. Assessment of trigeminal nerve functions by quantitative sensory testing in patients and healthy volunteers. J Oral Maxillofac Surg. 2010 Oct;68(10):2437-51.

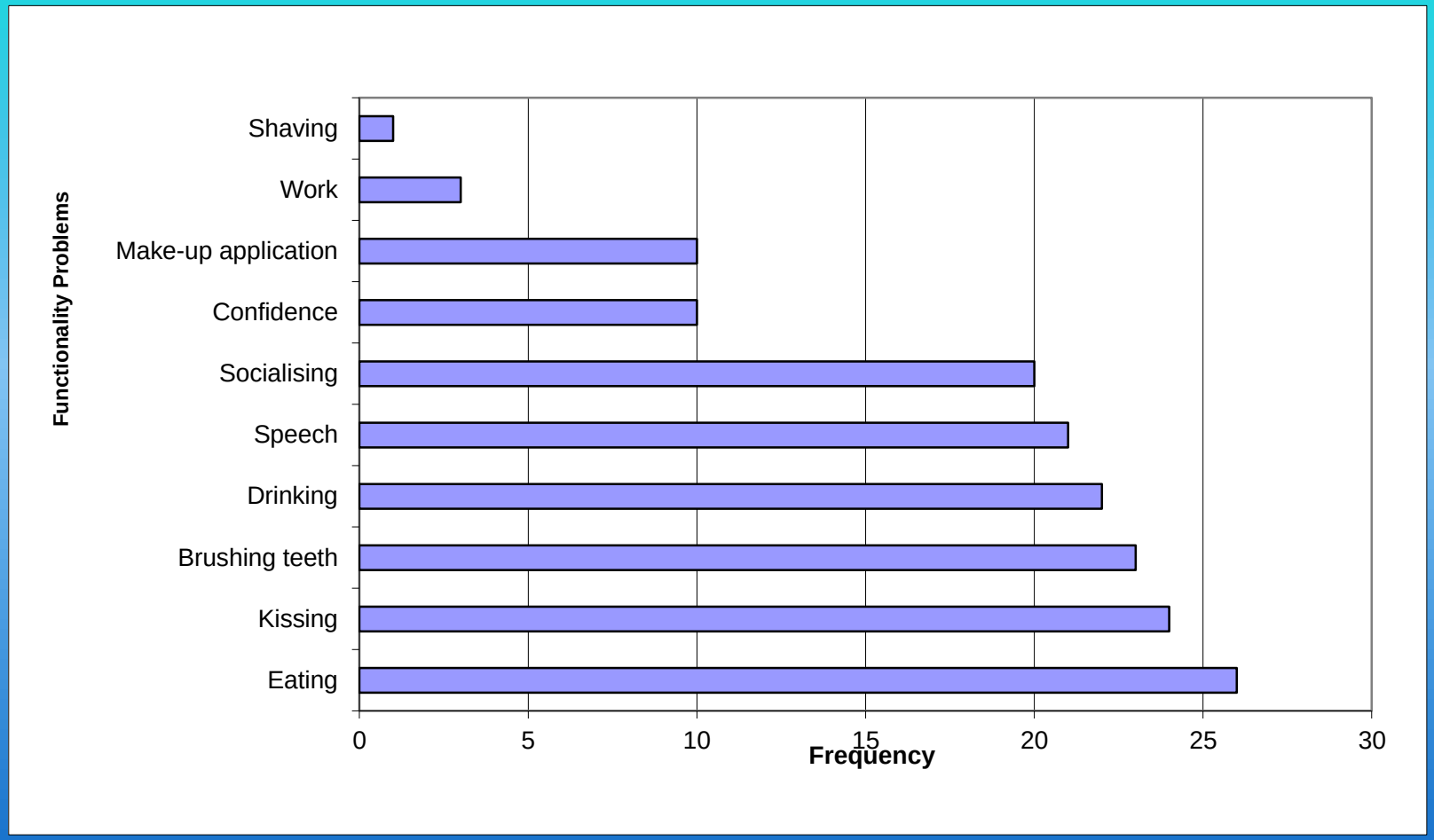
Prevention of Implant nerve injury

TNI

Prevention of Implant nerve injury

TNI

Interference of symptoms with the lifestyle for IRNIs.



Prevention of Implant nerve injury

TNI

Prevention of Implant nerve injury

TNI

Informed consent

- Recent study @ KCL on 60 implant nerve injury patients

95% experienced Dysaesthesia / Pain

- 70% of patients suffer from a combination of numbness, altered sensation and neuropathic pain
- Less than 24% of patients are appropriately warned of nerve injury in high risk procedures

- Renton T, Dawood A, Shah A, Searson L, Yilmaz Z. Post-implant neuropathy of the trigeminal nerve. A case series. Br Dent J. 2012 Jun 8;212(11):E17. doi: 10.1038/sj.bdj.2012.497

Prevention of Implant nerve injury

TNI

Every patient should understand their choices!

The good the bad and the ugly!

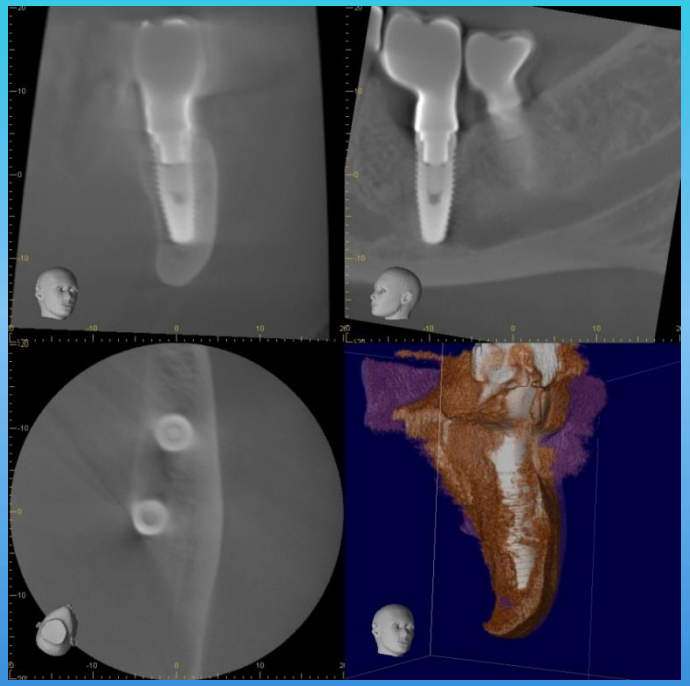
Prevention of Implant nerve injury

TNI

Issues……

- Consent
- LA protocol
  - Articaine as infiltration only with no ID blocks?

  Peterson 2004; Heller & Shankland 2001
- Planning
- Placement/execution
- Post operative care
- Management of IRTNI
- Post implant pain
- Litigation



Renton T. Prevention of iatrogenic inferior alveolar nerve injuries in relation to dental procedures. SADJ. 2010 Sep;65(8):342-4, 346-8, 350-1

Prevention of Implant nerve injury

TNI

Preoperative assessment

- **Radiographic**

Clin Oral Implants Res. 2012 Nov;23(11):1243-53. doi: 10.1111/j.1600-0501.2012.02441.x. Epub 2012 Mar 21.

E.A.O. guidelines for the use of diagnostic imaging in implant dentistry 2011. A consensus workshop organized by the European Association for Osseointegration at the Medical University of Warsaw.

Harris D, Horner K, Gröndahl K, Jacobs R, Helmrot E, Benic GI, Bornstein MM, Dawood A, Quirynen M.
Dublin Dental School and Hospital, Trinity College, Dublin 2, Ireland. david@drdavidharris.com

Abstract
Diagnostics imaging is an essential component of patient selection and treatment planning in oral rehabilitation by means of osseointegrated implants. In 2002, the EAO produced and published guidelines on the use of diagnostic imaging in implant dentistry. Since that time, there have been significant developments in both the application of cone beam computed tomography as well as in the range of surgical and prosthetic applications that can potentially benefit from its use. However, medical exposure to ionizing radiation must always be justified and result in a net benefit to the patient. The as low a dose as is reasonably achievable principle must also be applied taking into account any alternative techniques that might achieve the same objectives. This paper reports on current EAO recommendations arising from a consensus meeting held at the Medical University of Warsaw (2011) to update these guidelines. Radiological considerations are detailed, including justification and optimization, with a special emphasis on the obligations that arise for those who prescribe or undertake such investigations. The paper pays special attention to clinical indications and radiographic diagnostic considerations as well as to future developments and trends.

- **Clinical**
- 25% of edentul
  function, thus reinforcing the guidelines on the necessity of preoperative neurosensory evaluation.

- CHECK PREOP!!

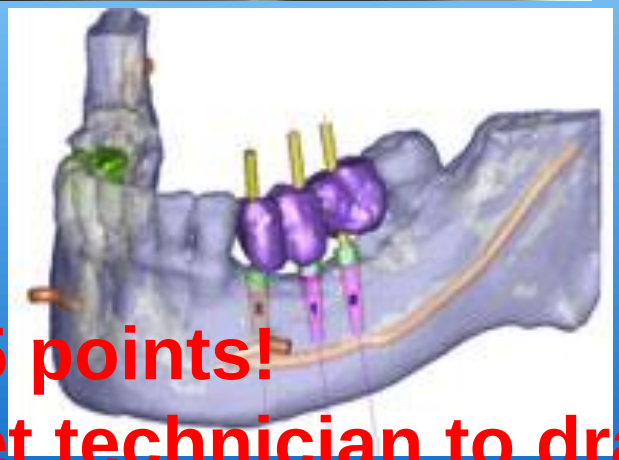
Chanavaz M.Patient screening and medical evaluation for implant and preprosthetic surgery.J Oral Implantol. 1998;24(4):222-9. Review

Prevention of Implant nerve injury

TNI

Imaging

- **What radiography?**
  - Cone Beam CT Scan
- **Planning**
  - Software
    - Simplant
- **Assessment of IAN position**
  - –Safety zone >2mm IAN canal
  - –? Should be >4mm
  - –What is the actual position of nerve?????



IAN plotted on Simplant using 5 points!

80% of clinicians questioned get technician to draw in Can you read the full CBCT??

Prevention of Implant nerve injury

TNI

Smart LA

- Articaine 4% Buccal Infiltration
- NOT IN but near Mental foramen
- +/- Lingual Infiltratio
- Or IDB Lidocaine 2%

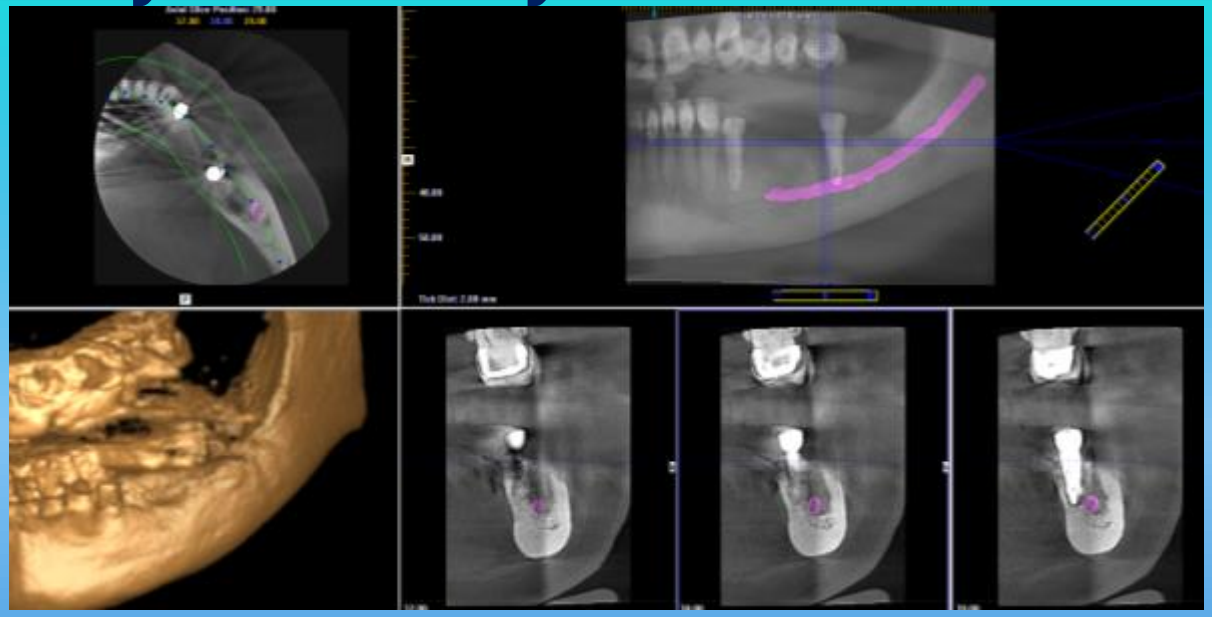
Meechan JG The use of the mandibular infiltration anesthetic technique in adults. J Am Dent Assoc. 2011 Sep;142 Suppl 3:19S-24S.

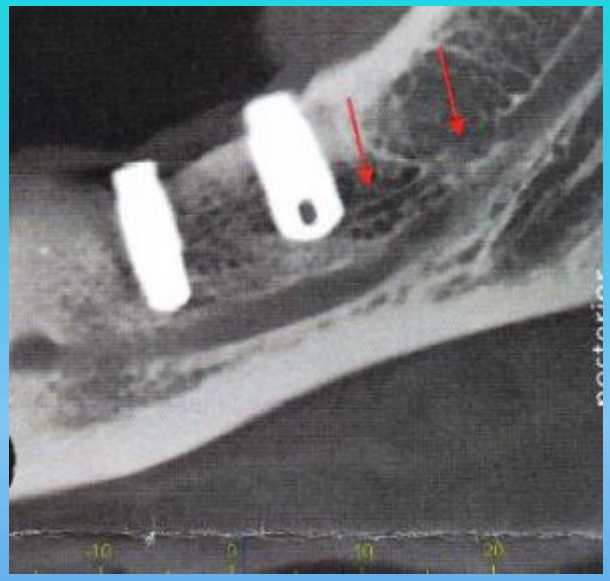
Renton T, Adey-Viscuso D, Meechan JG, Yilmaz Z. Trigeminal nerve injuries in relation to the local anaesthesia in mandibular injections. Br Dent J. 2010 Nov;209(9):E15.

Prevention of Implant nerve injury

TNI

Are you sure you know where the nerve is?



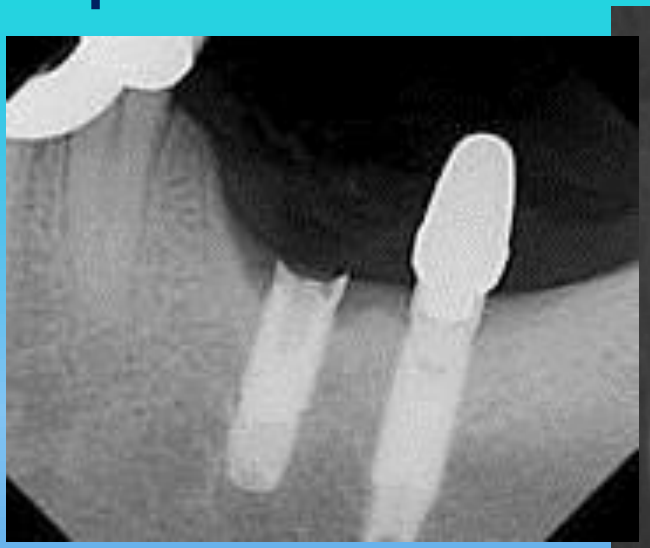


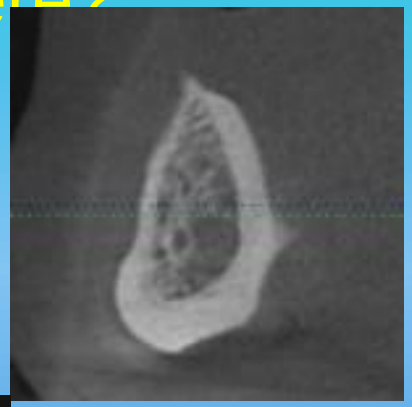
Prevention of Implant nerve injury

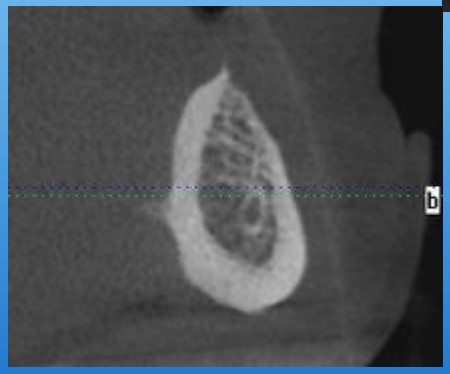
TNI

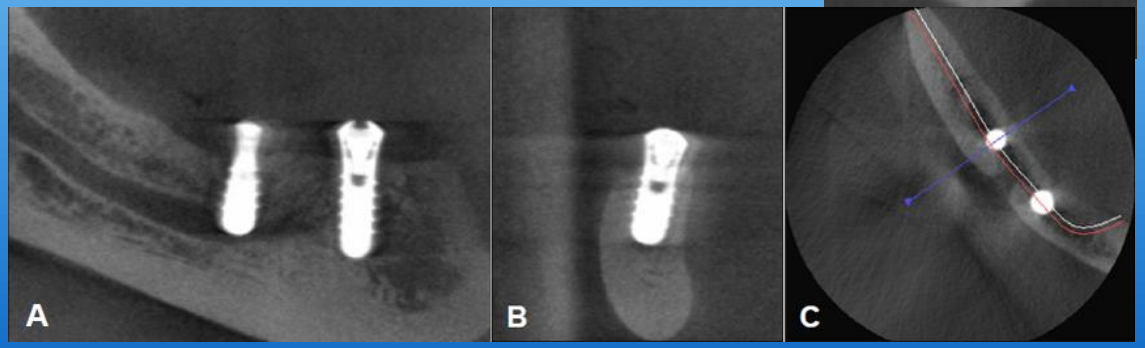
Beware the anterior loop /mental foramen!!!

- Adequate imaging?
- Here or there?
- Is it bifid?





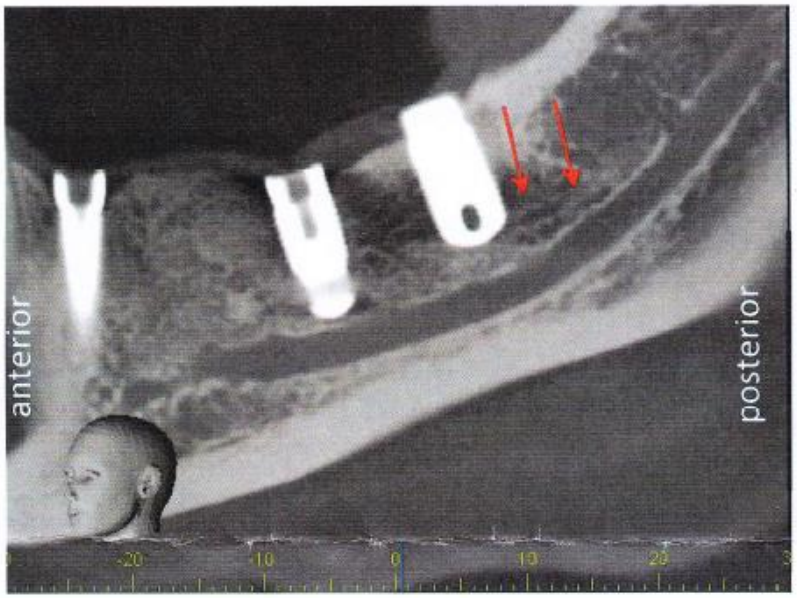


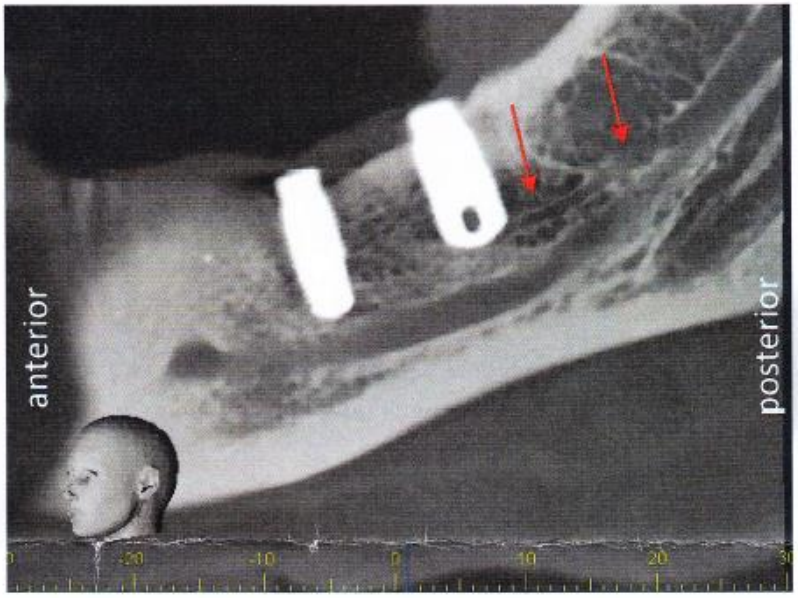


Prevention of Implant nerve injury

TNI

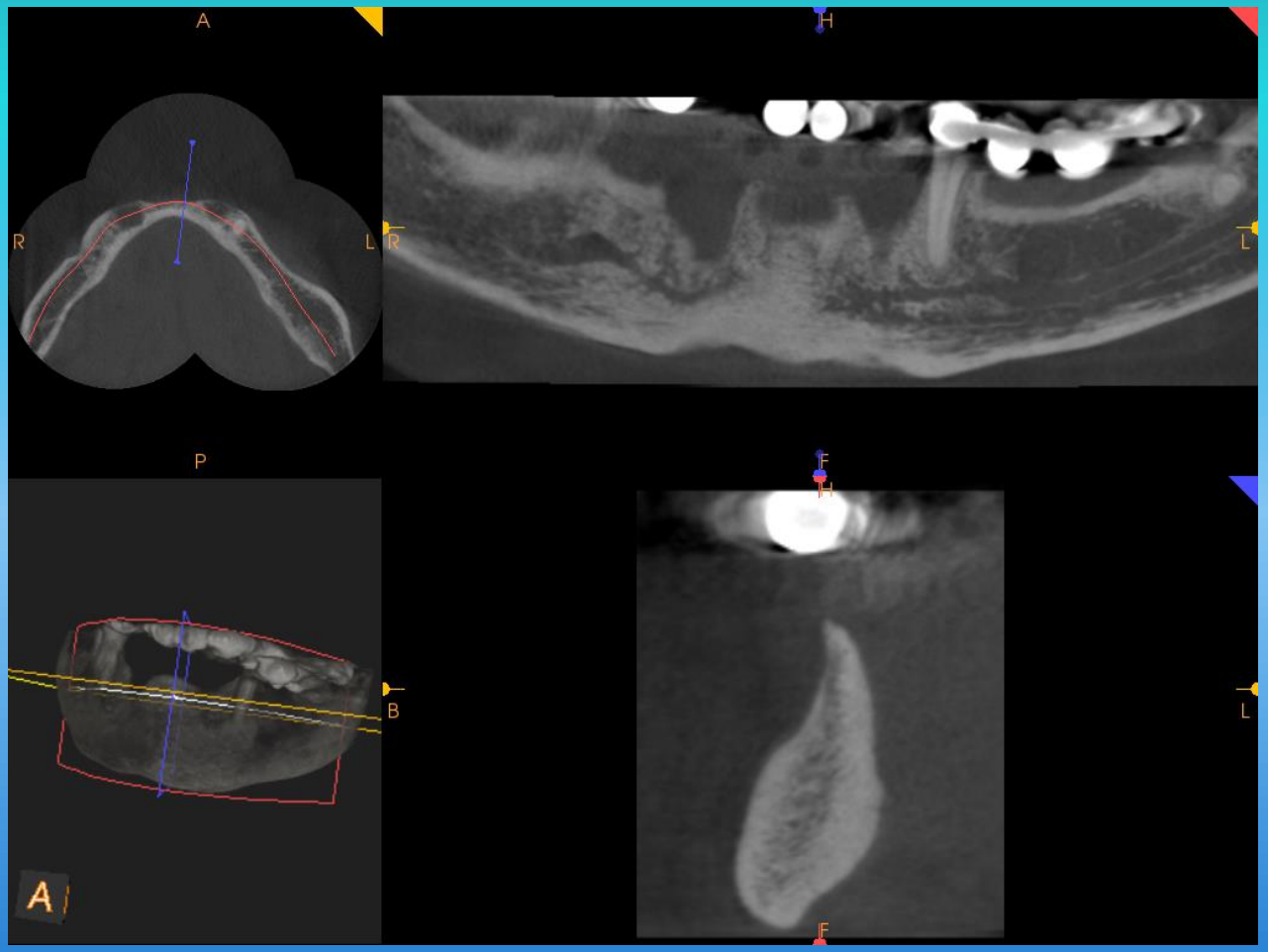
Are you REALLY sure??????





Prevention of Implant nerve injury

TNI



Courtesy of Dr. David R. Nelson BDS, MSc.(Imp.Dent), Clinical Director, Cranmore
Clinical Tutor, Institute of Postgraduate Dental Education, University of Central Lancashire
Tutor, School of Dentistry, Queen's University Belfast. Fellow, International Team for Implantology

Prevention of Implant nerve injury

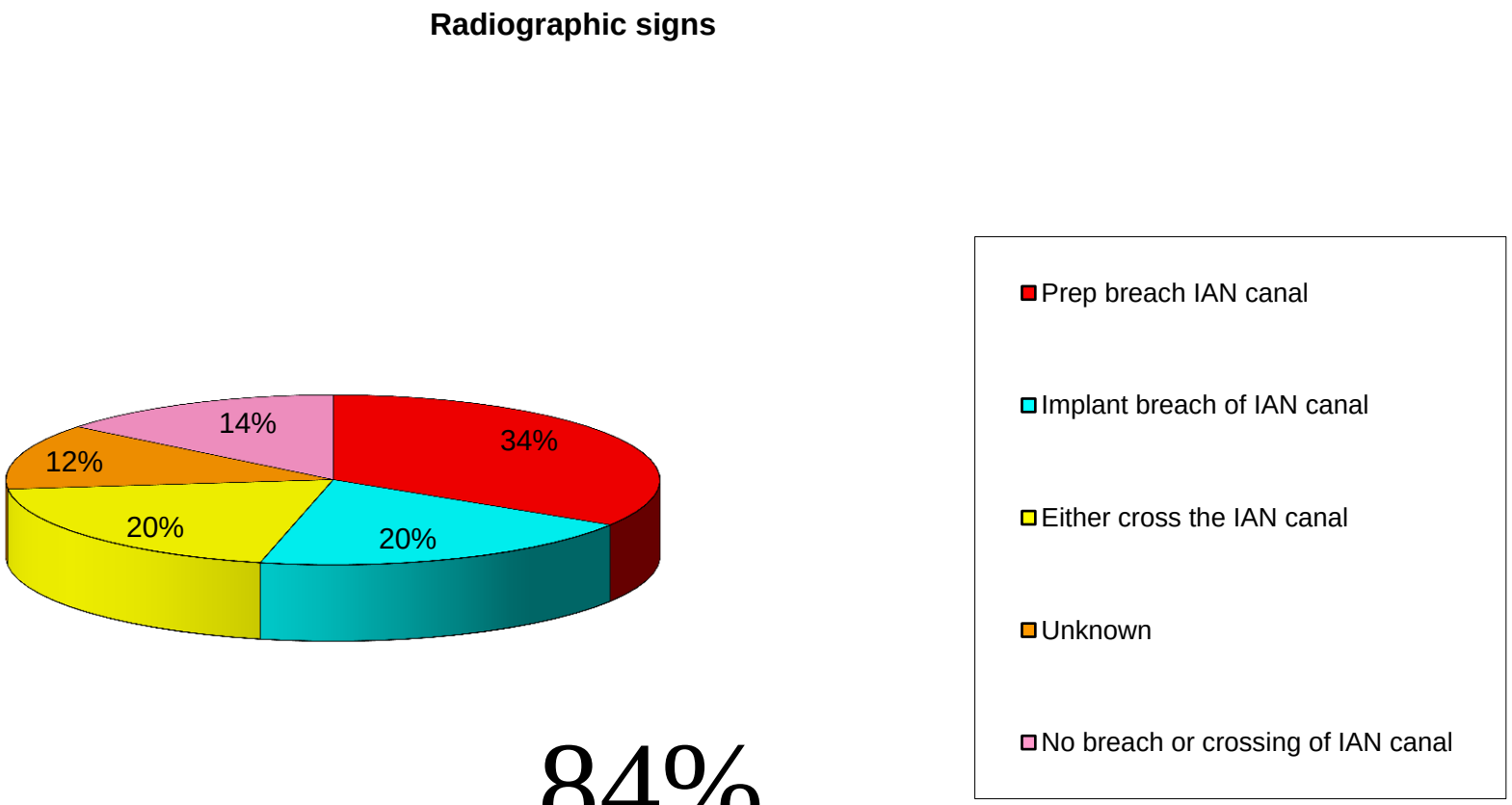
TNI

What's wrong with short implants?

Prevention of Implant nerve injury

TNI

Proximity of implants to IDC in injured cases



84%

Prevention of Implant nerve injury

TNI

Signs of intra-operative nerve injury

- **Pain on injection of LA**
- **Brisk persistent bleed**
- **Intense sudden pain during preparation or placement**

- Any protrusion into the IDC or breech, will result in acute and often severe neuralgic type pain intra-operatively

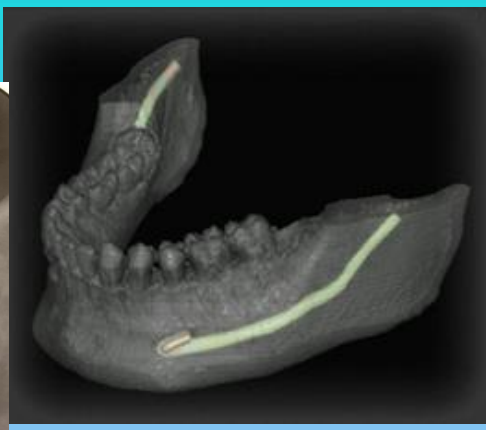
- Leckel M, Kress B, Schmitter M. Neuropathic pain resulting from implant placement: case report and diagnostic conclusions. J Oral Rehabil. 2009 Jul;36(7):543-6. Epub 2009

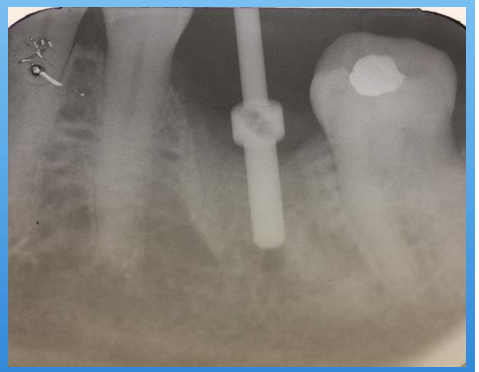
Prevention of Implant nerve injury

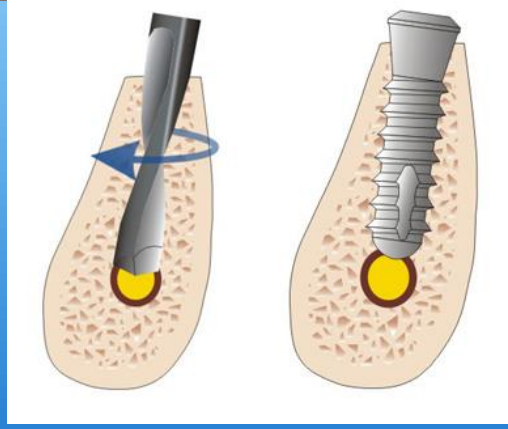
TNI

Intraoperative strategies to minimise nerve injury

- Good planning >4mm safety zone
- Infiltration anaesthesia
- Drill stops
- ITI recommend drill 6mm then take LCPA with measure to gauge position
- Use system with shorter prep drill than implant





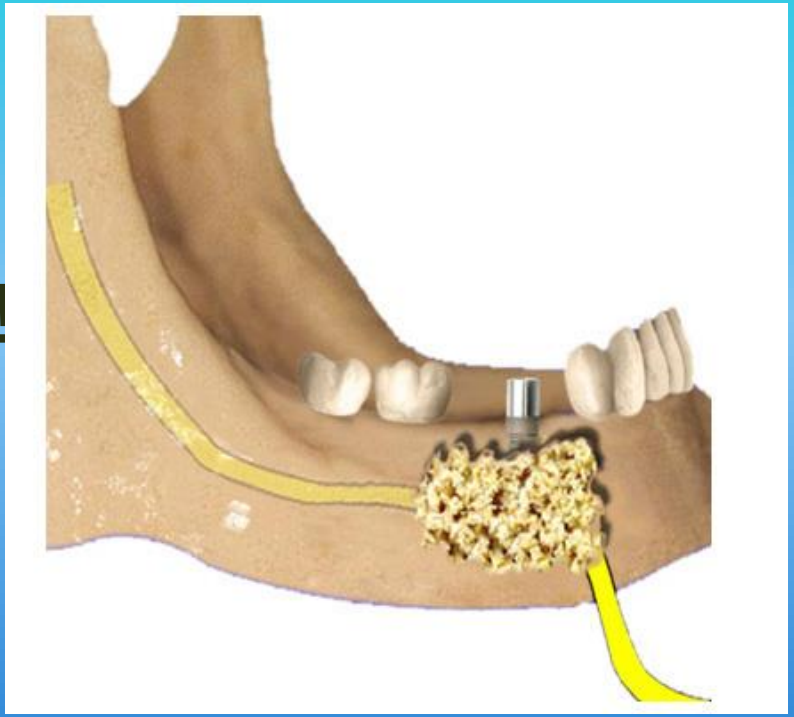


Prevention of Implant nerve injury

TNI

Ridge enhancement

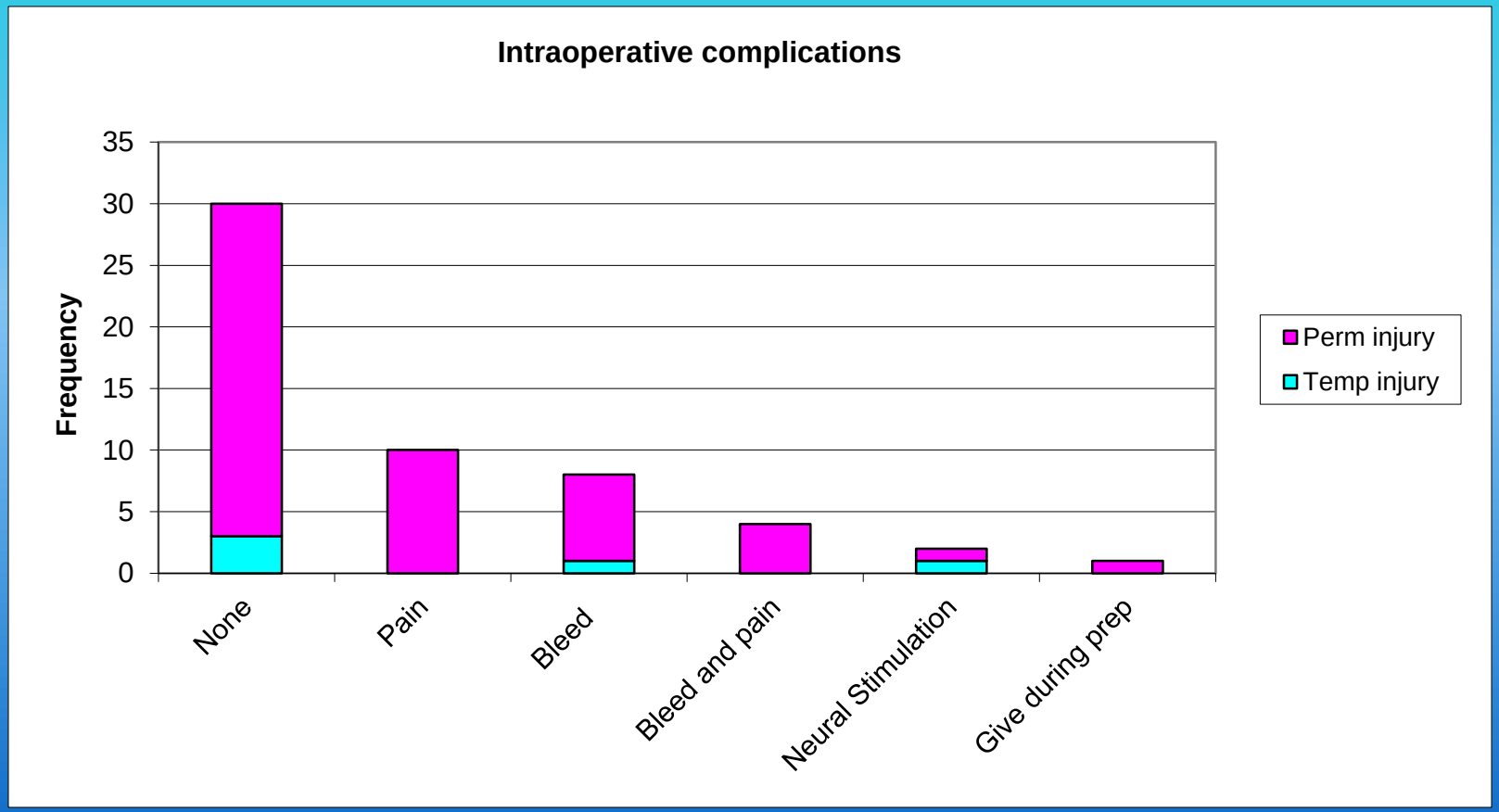
- pH >8.6 in vivo!



Prevention of Implant nerve injury

TNI

Intraoperative complications…
? Should you delay placement?



Prevention of Implant nerve injury

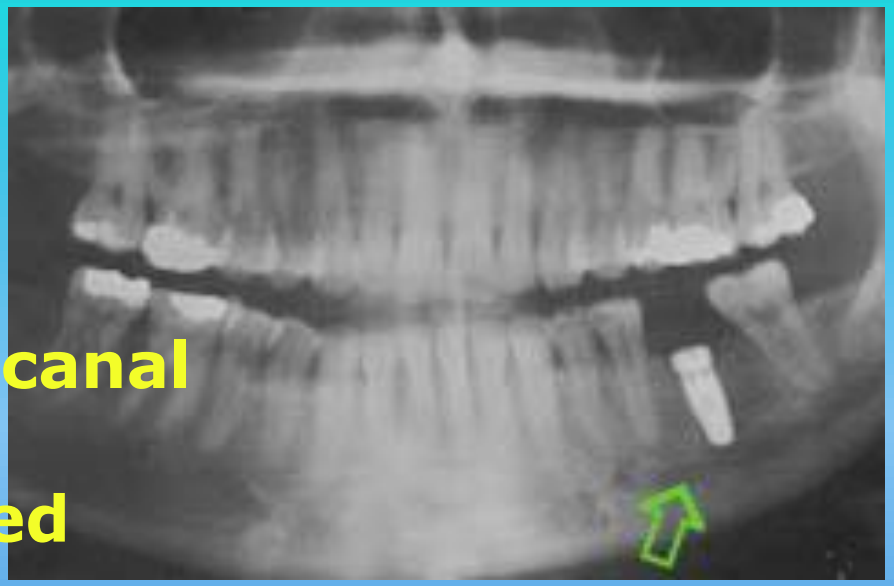
TNI

Intra-operative risk factors

Sudden 'give' during preparation

Extrusion of debris into canal

Intra-operative IAN bleed



Do not place implant immediately delay 2-3 days

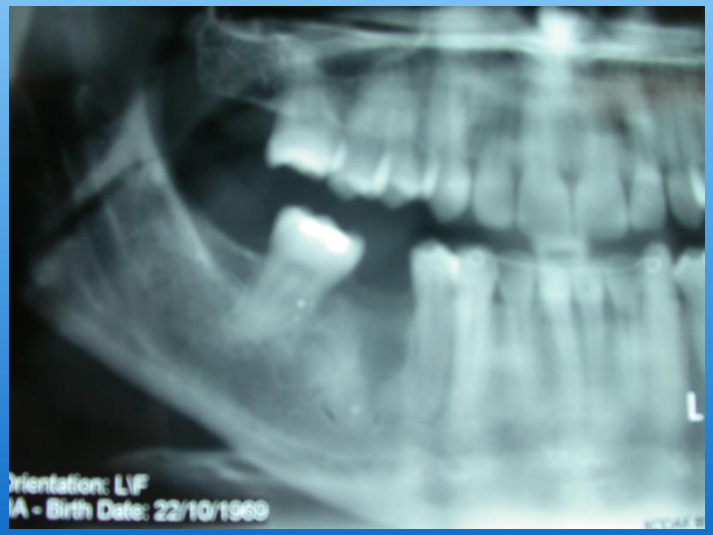
Prevention of Implant nerve injury

TNI

Post operative protocol

- **Routinely check on patient early post operatively at 6 -12 hours**

- **If patient has neuropathy immediately after local analgesia has worn off:**
  - **REMOVE the implant in less than 24 hours**
  - **Steroids and NSAIDS**
  - **Refer**



Prevention of Implant nerve injury

TNI

Post operative protocol

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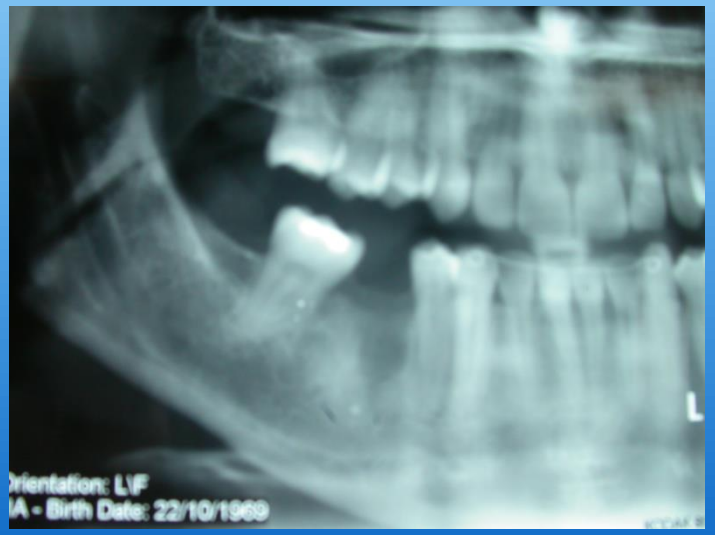
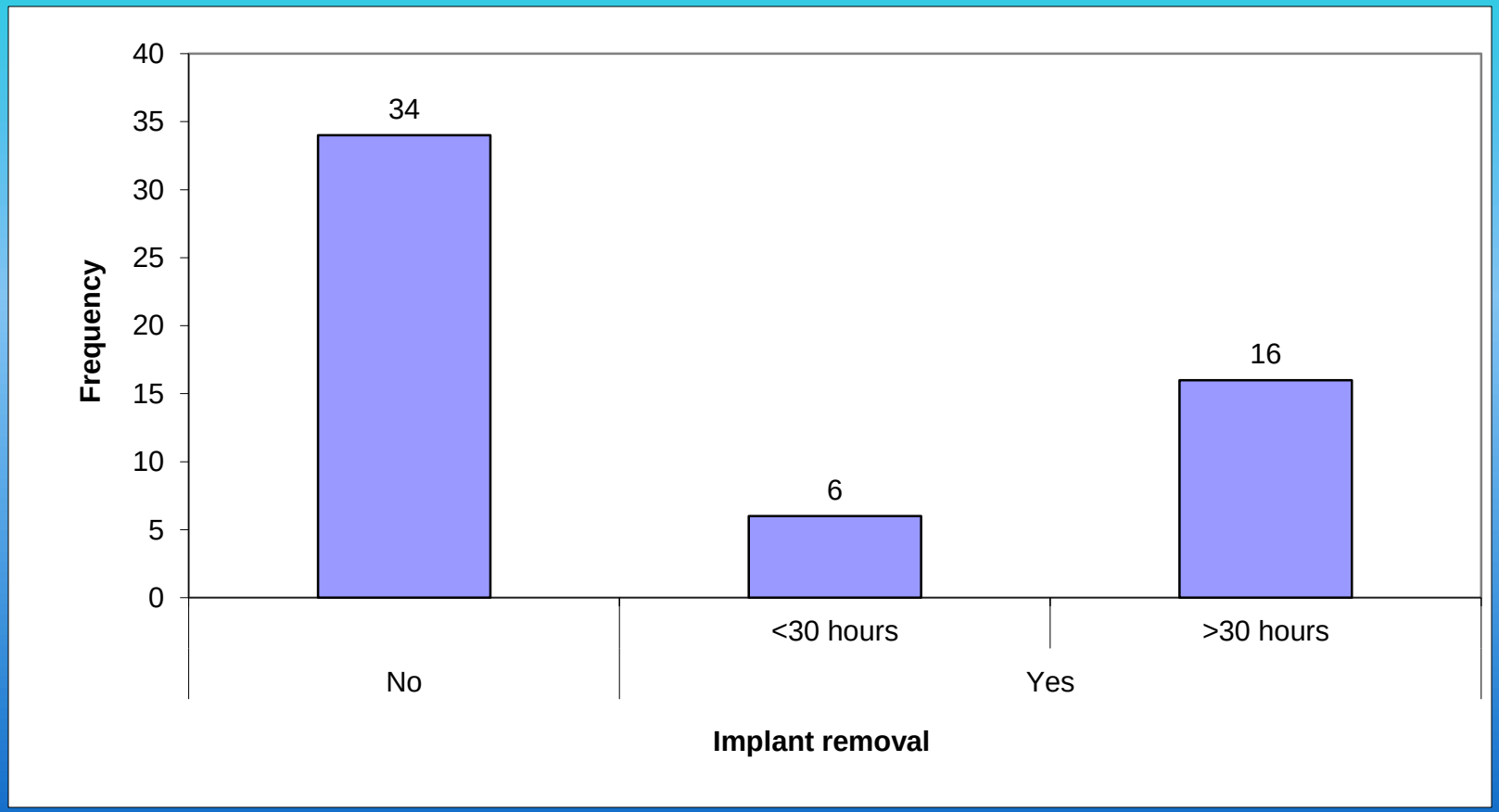


Prevention of Implant nerve injury

TNI

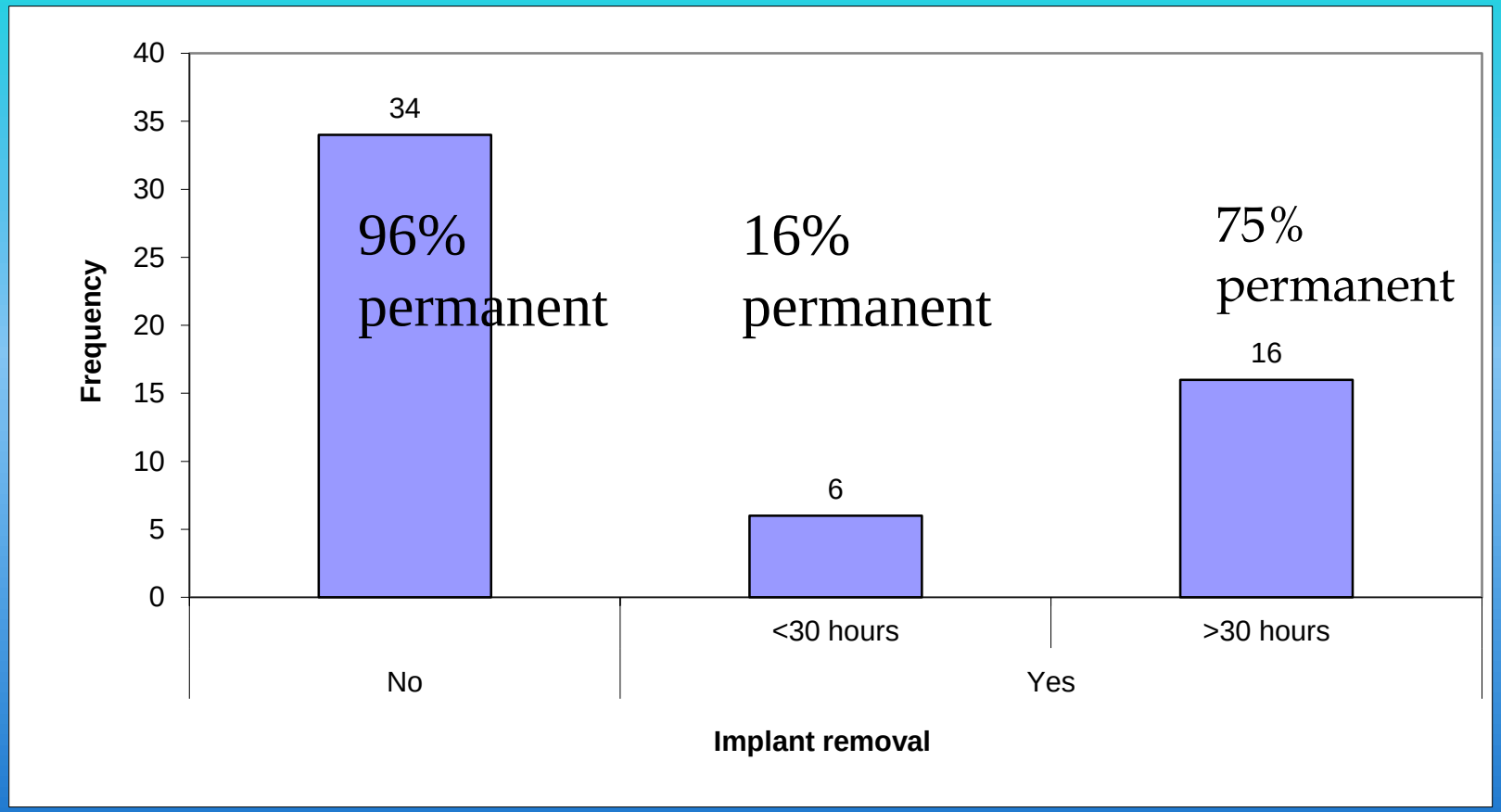
Does removal of implant work?



Prevention of Implant nerve injury

TNI

Does removal of implant work?



Prevention of Implant nerve injury

Management of IRTNIs (Acute)

- (LA IDB lasts 3 hours and 25minutes)
- Check on Patient after 6 hours (Home check)
- IAN NEUROPATHY? (extreme pain/ mixed symptoms large neuropathic area)
- **Yes**
- Consult patient, check for area of neuropathy and signs of nerve injury
- **Confirmed**
- Remove implant < 30 hours
- + High dose oral NSAIDs (600-800mgs Ibuprofen PO QDS)
- Prednisolone 5 day step down does 50-40-30-20-10mg PO
- (check medical history!)
- Vitamin B complex/ Tricyclic anti depressants/ pregabalin
- **Review**

Prevention of Implant nerve injury

TNI

IRNI 3 days old or more

Manage therapeutically

- Surgery - removal of implant **doesn't work**
- Many patients destined to a life of neuropathic orofacial pain
- Post implant pain
- Detectable subclinical IAN neuropathy in patients subsequent to implant placement using electrophysiological methods (Eliav E et al IASP 2010)

Queral-Godoy E, Vazquez-Delgado E, Okeson JP, Gay-Escoda C. Persistent idiopathic facial pain following dental implant placement: a case report. Int J Oral Maxillofac Implants 2006; **21:** 136-40.

Rodriquez-Lozano F, Sanchez-Perez A, Moya-Villaescusa MJ, Rodriguez-Lozano A, Saez-Yuguero MR. Neuropathic orofacial pain after dental implant placement: review of the literature and case report. OOOE 2010; **109:** e8-e12.

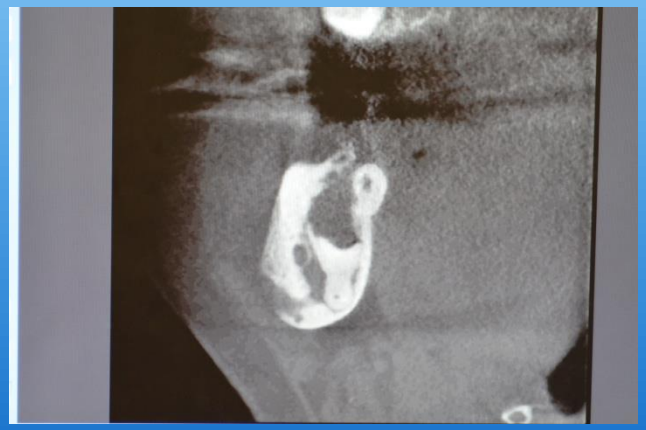
Renton T, Yilmaz Z. Profiling of patients presenting with posttraumatic neuropathy of the trigeminal nerve. J Orofac Pain. 2011 Fall;25(4):333-44

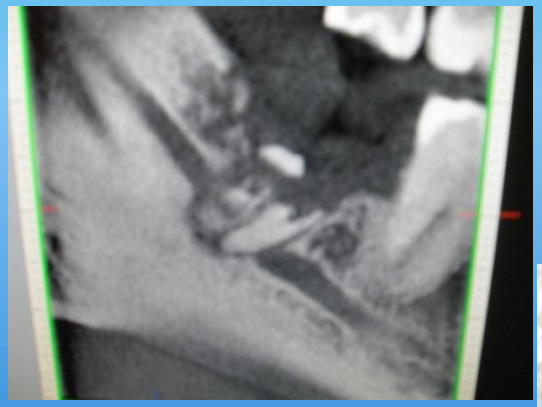
Renton T, Dawood A, Shah A, Searson L, Yilmaz Z. Post-implant neuropathy of the trigeminal nerve. A case series. Br Dent J. 2012 Jun 8;212(11):E1 doi: 10.1038/sj.bdj.2012.497

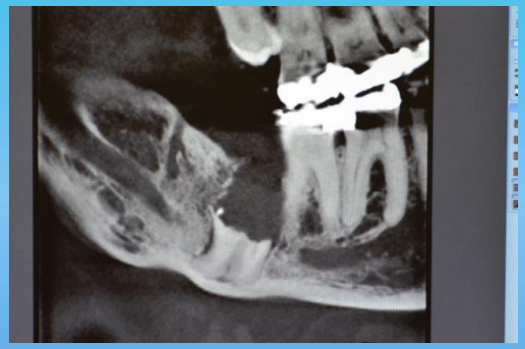
Management of V nerve injury

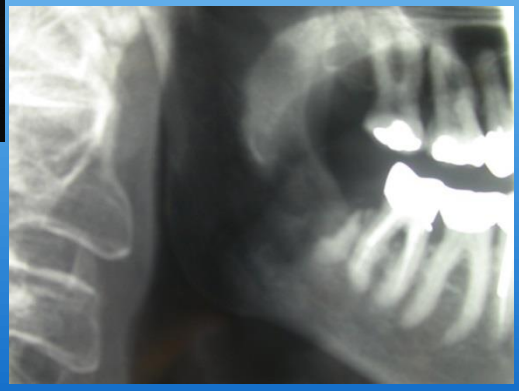
TNI

When it goes wrong…….
If nerve injury does happen
What next?









Management of V nerve injury

TNI

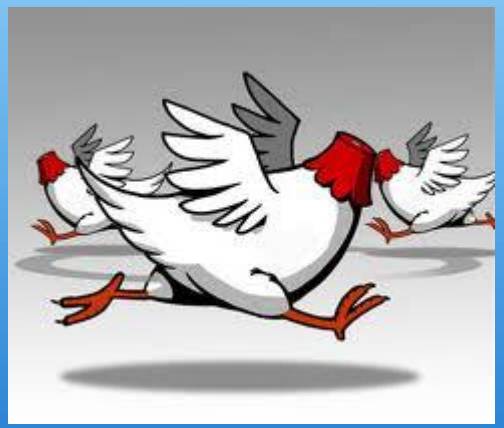
- If the patient has a good experience they are less likely to complain

Management of V nerve injury

TNI

Optimum

- Dentist
  - Patients expectations previously managed (good informed consent)
  - Don’t wait for the patient to let you know things have gone wrong!.....**Home check**
  - Maintain communication
  - Advice / refer



Management of V nerve injury

TNI

Home Check on your patient

- Be honest
- Contact them after surgery
- Appropriately advise and manage problems

- If you're not sure ask for help /advice

Management of V nerve injury

TNI

Don’t panic……Say sorry!

- Not an admission of guilt just shows empathy!
- You should already have had a conversation about the risks!

Int. J. Oral Maxillofac. Surg. 2012; 41: 629–637
doi:10.1016/j.ijom.2011.11.002, available online at http://www.sciencedirect.com

International Journal of
Oral & Maxillofacial Surgery

Review Paper
Oral Surgery

Managing iatrogenic trigeminal nerve injury: a case series and review of the literature

T. Renton, Z. Yilmaz
King's College London Dental Institute, Denmark Hill Campus, London, UK

T. Renton, Z. Yilmaz: Managing iatrogenic trigeminal nerve injury: a case series and review of the literature. Int. J. Oral Maxillofac. Surg. 2012; 41: 629–637.

Abstract. This study describes the management of 216 patients with post-traumatic iatrogenic lingual nerve injuries (LNIs; $n = 93$) and inferior alveolar nerve injuries (IANI; $n = 123$). At initial consultation, 6% IANI and 2% LNI patients had undergone significant resolution requiring no further reviews. Reassurance and counselling was adequate management for 51% IANI and 55% LNI patients. Systemic or topical medication was offered as pain relief to 5% of patients. Additional cognitive behaviour therapy (CBT) was offered to 8% of patients. Topical 5% lidocaine patches reduced pain and allodynia in 7% of IANI patients, most often used without any other form of management. A small percentage of IANI

Management of V nerve injury

TNI

Early Postoperative Management

- Routinely check on patient early post operatively at 6 hours
- Check for relevant neuropathy
- Radiographs?
- ? Steroids and NSAIDS

  Step down dose 50/40/30/20/10 mg over 5 days

  Oral ibuprofen 800mgs 6 hourly

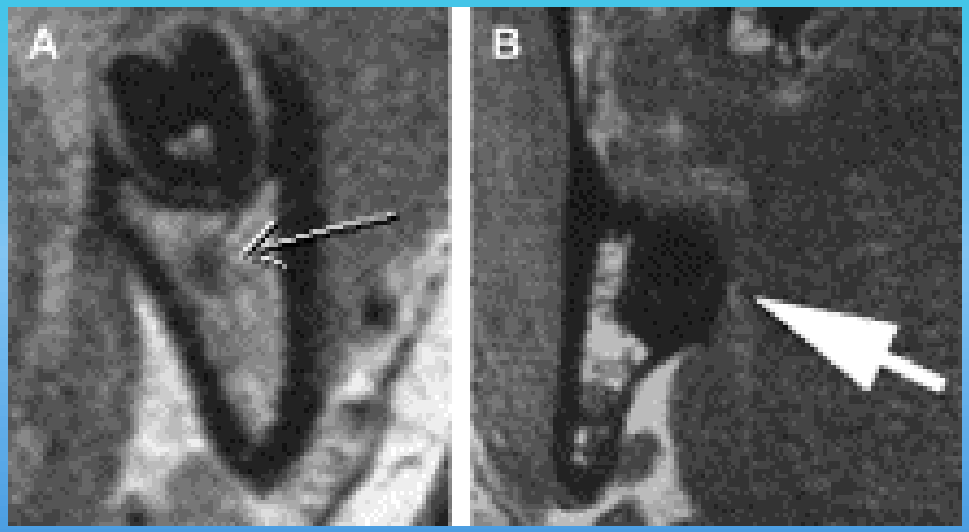
  CHECK MH
- Refer or get advice
- Use **Trigeminalnerve.org.uk website**

Ultrasound?
MRI?

- Better to modify technique and prevent injury!

- Miloro M, Kolokythas A. **Inferior alveolar and lingual nerve imaging.**Atlas Oral Maxillofac Surg Clin North Am. 2011 Mar;19(1):35-46.

High-Resolution Magnetic Resonance Imaging lingual nerve



We cant fix nerve injuries!
We can only reverse them early on!

Wait for resolution

- Lingual nerve injuries related to LINGUAL ACCESS third molar surgery
- LA
- Trauma
- Orthognathic

URGENT treatment < 30 hours

- Suspected nerve trauma
- Inferior alveolar nerve injuries related to third molar surgery
- Implants
- Endodontics

Acknowledge problem (home check)
Seek advice
You MUST reassure your patient but don't give them false expectations!
Medication and REFERRAL

Novel Management of nerve injuries

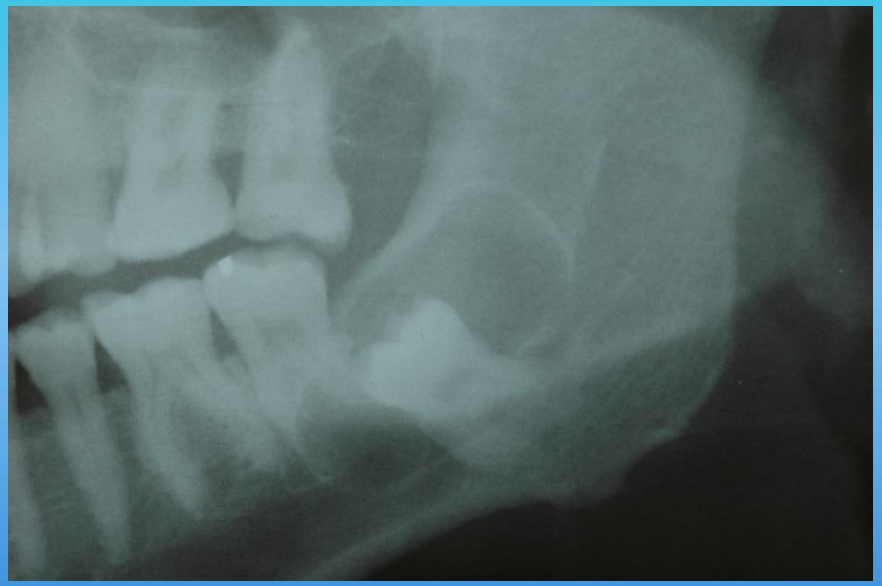
Mechanism	Duration	Treatment
Known/suspected nerve section		**Immediate exploration**
TMS IANI –retained roots	**<30 hours**	**Immediate exploration**
Implant	**<30 hours**	**Remove implant**
Endodontic	**<30 hours**	**Remove tooth / overfill**
Implant / Endodontic	>30 hours	Treat therapeutically
TMS IANI large neuropathic area, pain and disability	**<3 months**	**Consider exploration**
TMS LNI – large neuropathic area, pain and disability	**<3 months**	**Consider exploration**
TMS IANI –	>6 month	Treat therapeutically
TMS LNI–	>6 month	Treat therapeutically
LA, fracture, orthognathic		Treat t therapeutically

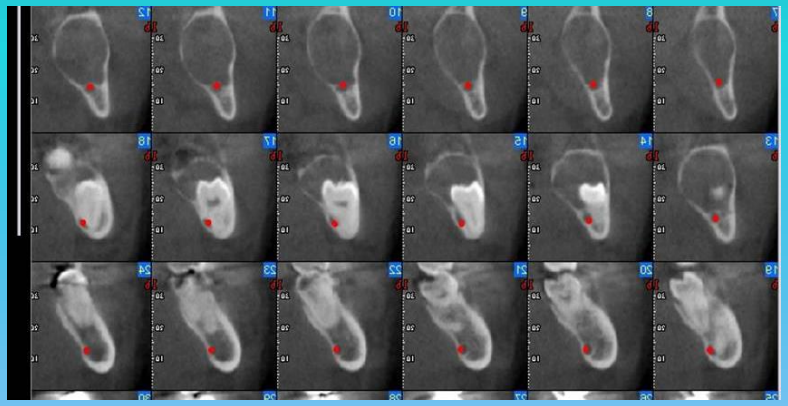
Nerve injuries best prevented!

Prevention of nerve injury

TNI

Risk assessment

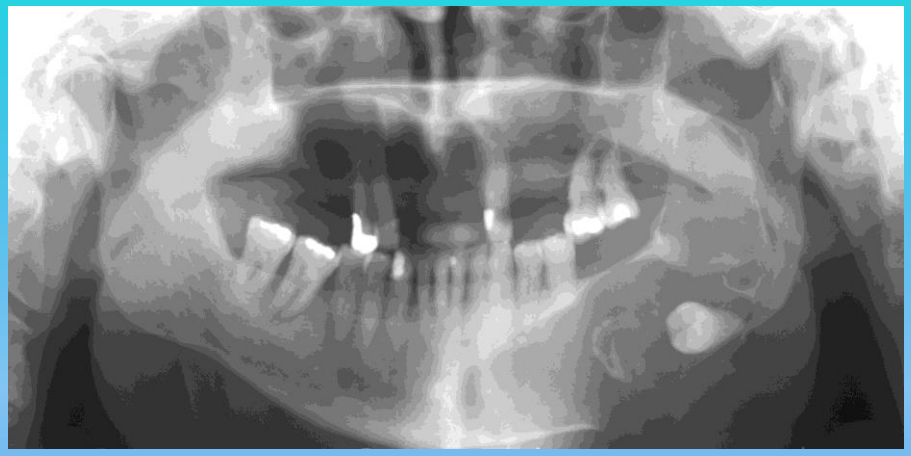


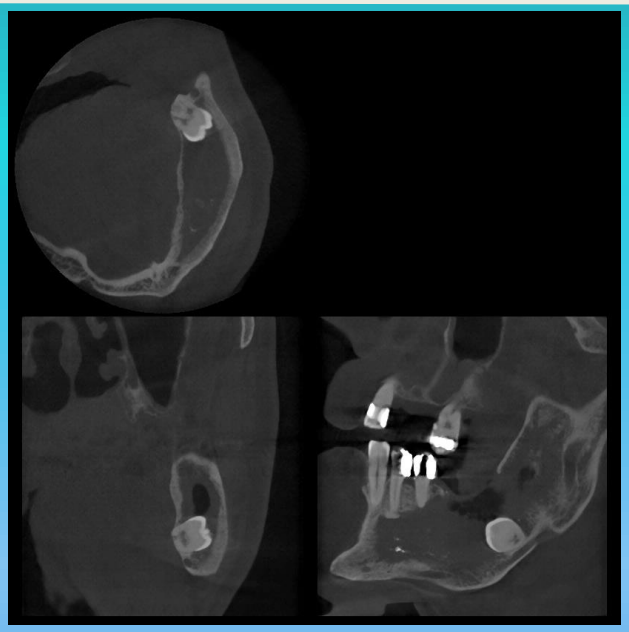


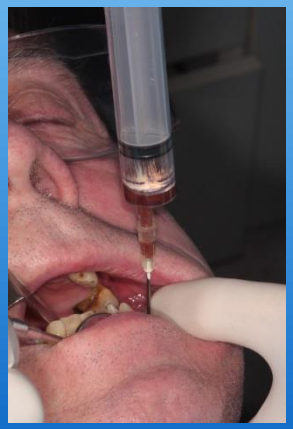
Prevention of nerve injury

TNI

Risk assessment

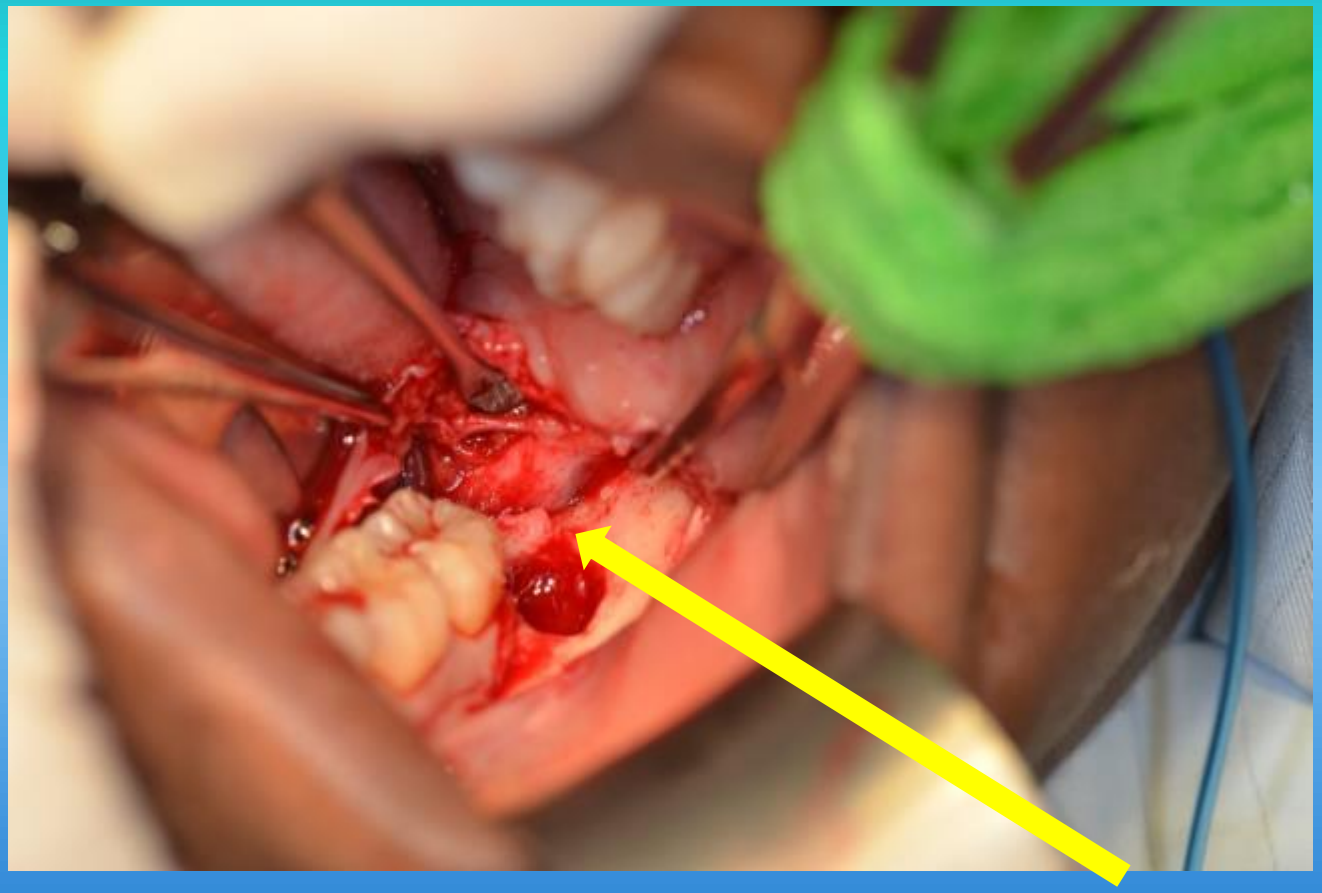






Lingual nerve exploration

Lingual nerve exploration



Key messages…

changing practice

- We can prevent most of these nerve injuries
- We cannot ‘fix’ patients with these nerve injuries
- We can improve informed consent –

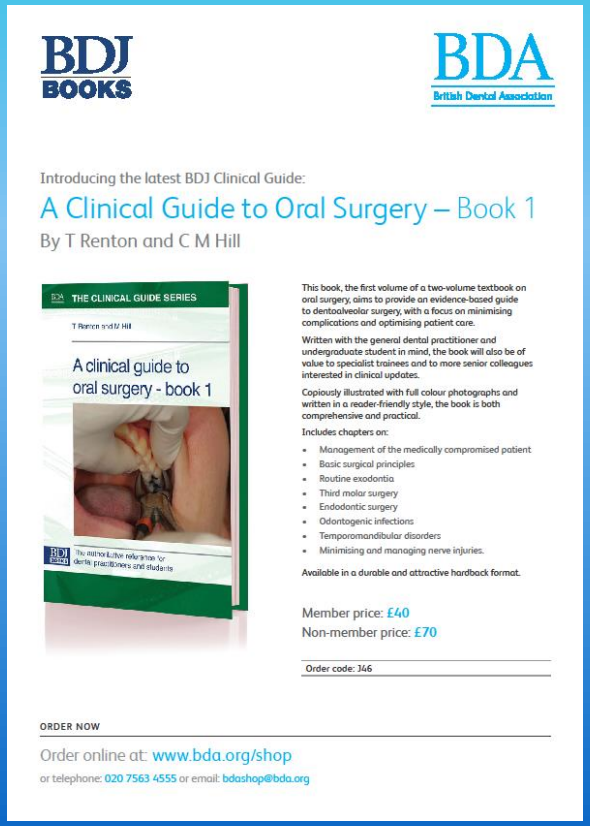
Hyperaesthesia and pain are more likely than numbness

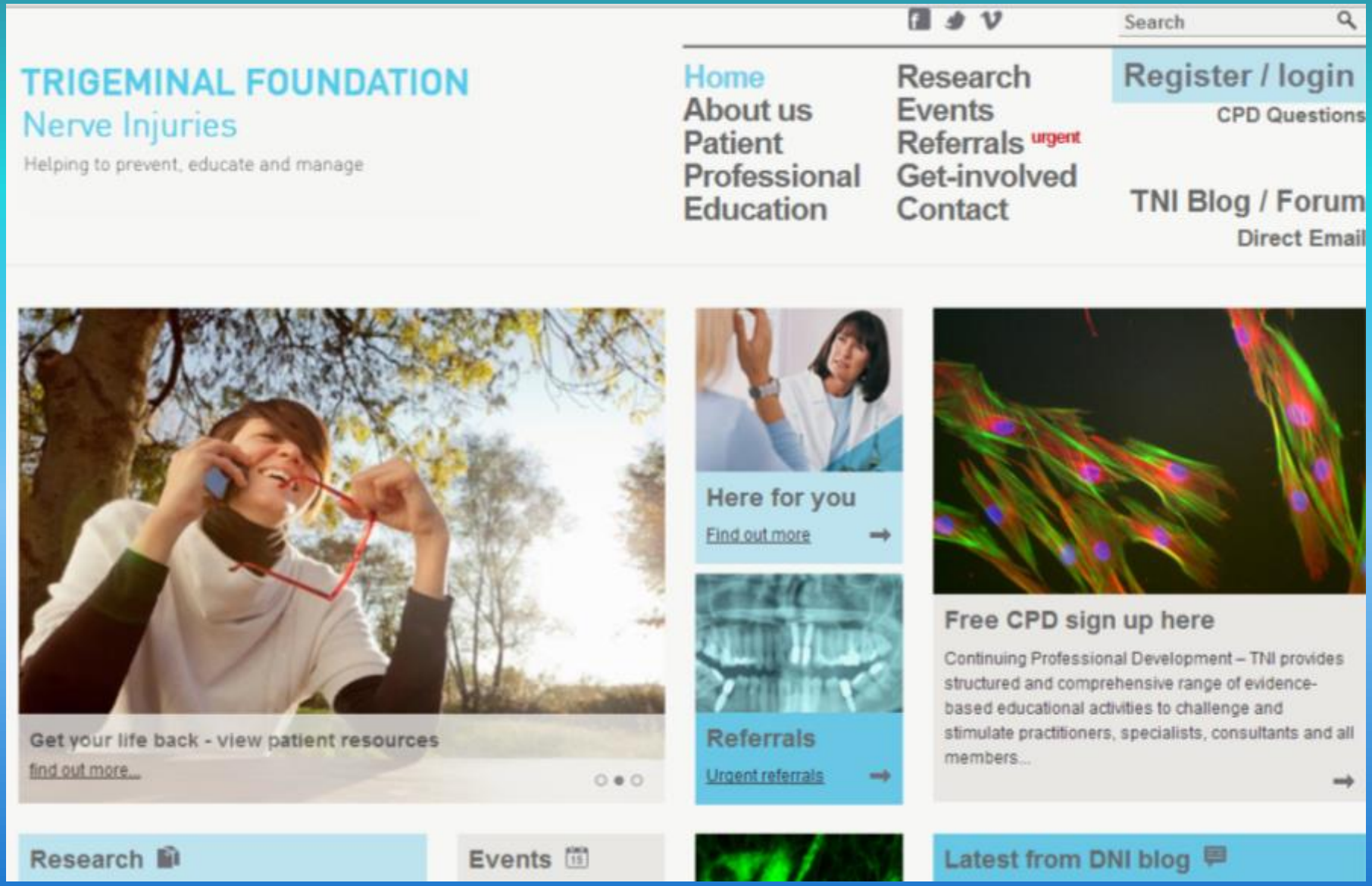
- Lingual nerve / inferior alveolar nerve injuries are NOT mainly temporary? **DO NOT SIT AND WAIT** for resolution
- Home check will facilitate timely urgent intervention

Thank you

http://trigeminalnerve.org.uk

Zehra Yilmaz

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Nerve Injuries
Helping to prevent, educate and manage
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Direct Email
Get your life back - view patient resources
find out more...
Here for you
Find out more
Referrals
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