KING'S College LONDON

Treatment of Oral Pain through the ages

Tara Renton

BDA

Lilian Lindsay Memorial Lecture

Lilian Lindsey

Lilian Lindsay was a remarkable woman, born 1871, d.1960. Educated at Camden School for Girls and North London Collegiate School (Private schools). On scholarships, as her father died when she was only 14. Much to the amusement of her headmistress she decided to become a dentist – ladies were not permitted to enter dental school in those days, so she became apprenticed to a GDP for 3 years until 1892, whereupon she tried to enter dental school and
the Dean of the National Dental Hospital in Great Portland St. She was refu
then tried Edinburgh becoming the first, and at that time, the only female d
in the UK.. She qualified LDS with Honours in 1895, obviously becoming th
a formal dental qualification.

She practiced with her dentally qualified Husband Robert Lindsay in Edinburg
fellow undergrad, until he was appointed Secretary to the BDA in1920, whi
moving to live in a flat above the then HQ of the BDA at 23 Russell Square.

She started the BDA's library and Museum on a limited budget, taught herself
Latin to study and obtain Dental/Medical books from Europe, developing
history of both professions.

Following the death of husband in 1930, she became sub editor of the BDJ for ne
which time she championed the cause of women in dentistry.

Many honours came her way, including being the first woman President of the BDA in 1946, also in 1946 awarded CBE, and Dr of Laws at Edinburgh University, 1950 President of Section of History of Medicine at the RSM, 1953 Honorary Member of the American Acadamy of Dentistry, 1959 Honorary Fellow Dental Surgery RCS Ed. Etc etc.

Outline

The key **role of dentists** in developing local and general anaesthesia for modern surgery.

Exploring the **origins of commonly used drugs** in dentistry and how they assist with the challenge of managing acute post-operative pain.

Recent advancements for minimising side effects from historical remedies.

How **new developments** are leading the way for **improved pain management** in the future.

Anaesthesia is the absence of sensation.

Analgesia is the absence of pain.

Pain is any localisable noxious sensation

The word "anesthesia", coined by Oliver Wendell Holmes, Sr. (1809–1894) in 1846 from the Greek α ν -, *an-*, "without"; and αἴσθησις, *aisthēsis*,

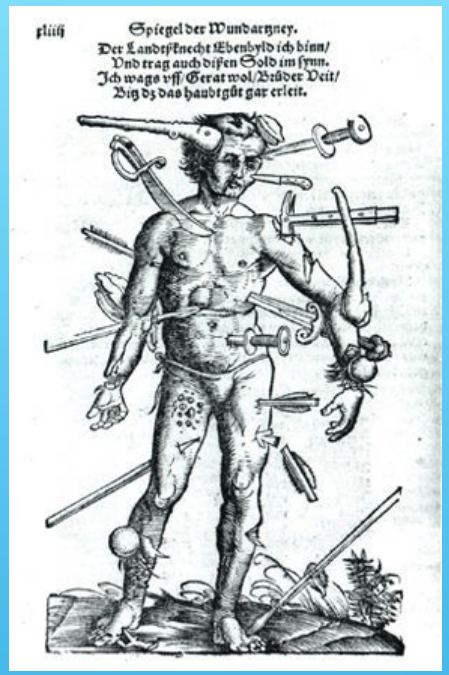
Celsus (25 BCE-50 CE) remarks that toothache "can be counted among the greatest of torments"

"*For there was never yet philosopher that could endure the toothache patiently.*"

-- Shakespeare, *Much Ado About Nothing*, Act V

Pain

The affliction



The goddess of poppies (c1300–c1250 bc)

In Rome there stood a shrine in one of the city's eat churches dedicated to St. Apollonia and people were said to travel great distances to ask for the assistance of the saint in a search for an end to their pain by reciting the following:

. 1 — Copy of a lithograph roducing an original paint- that is part of the Wesseler llection at the Royal School Dentistry in Stockholm.

"O Glorious Apollonia, patron saint of dentistry and refuge to all those suffering from diseases of the teeth, I consecrate myself to thee, beseeching thee to number me among thy clients. Assist me by your intercession with God in my daily work and intercede with Him to obtain for me a happy death. Pray that my heart like thine may be inflamed with the love of Jesus and Mary, through Christ our Lord. Amen.

O My God, bring me fe through temptation and strengthen me as thou dst our own patron Apollonia, through Christ our rd. Amen."

Patron Saint of Dentistry Apolonia

Health We may fear a trip to get our teeth checked out, but it was much worse all those centuries ago

THE PAIN HAS SUBSIDED FROM DENTIST'S CHAIR

SAY AHH: A dentist checks a toddler's teeth in 1964

"Today's procedures are much less damaging than ever before"

BITING: False teeth and the dentist's chair

THE EXCRUCIATING HISTORY OF DENTISTRY

Toothsome Tales & Oral Oddities from Babylon to Braces

JAMES WYNBRANDT

The key role of dentists in developing local and general anaesthesia for modern surgery.

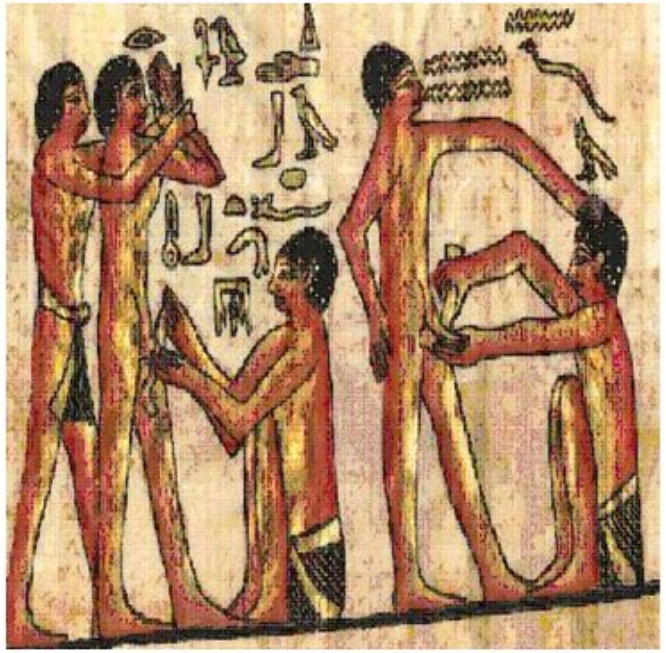
- Anaesthesia
  - Local Anaesthesia
  - General anaesthetic
- Anxiety management
  - Sedation
  - CBT
  - Desensitisation

Before anaesthesia

Surgery was a terrifying last resort, a final attempt to save life.

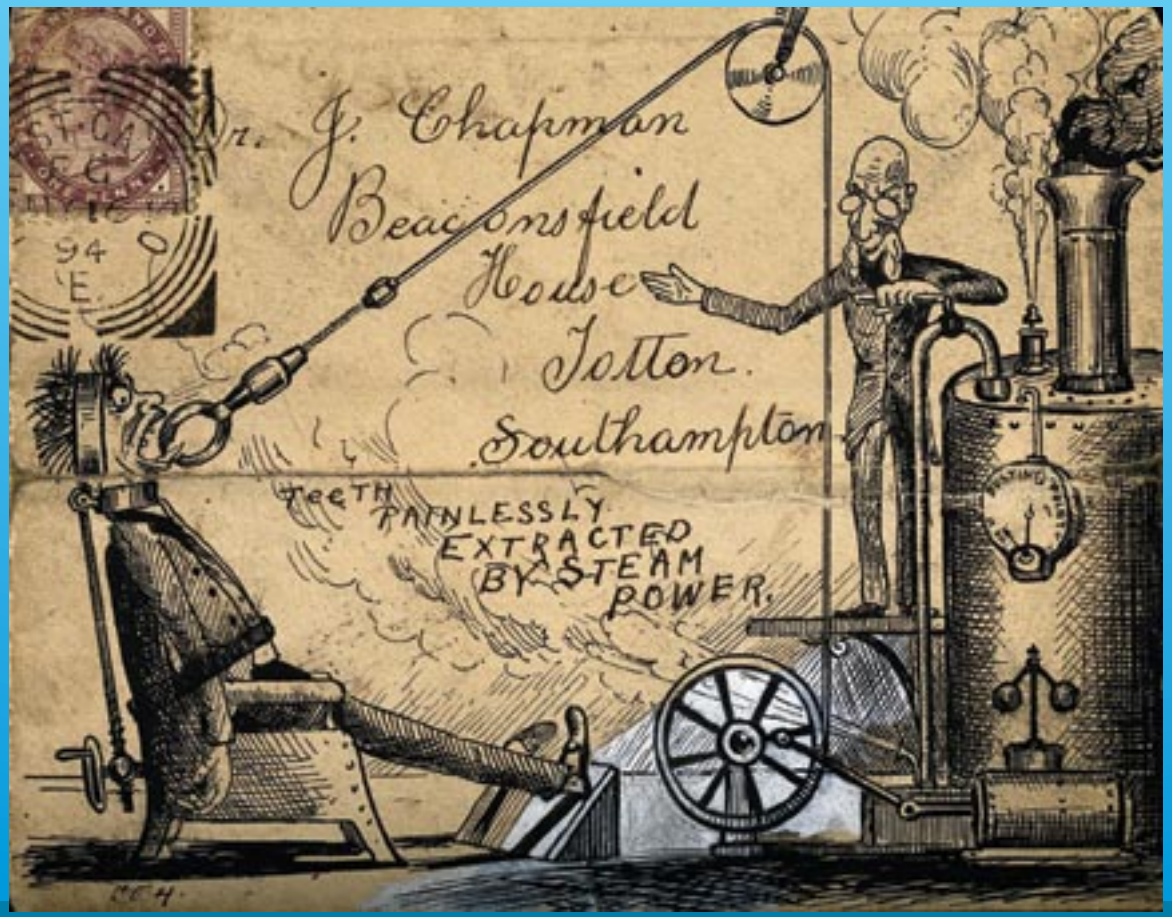
Few operations were possible and surgeons were judged by their speed

Some doctors had tried using alcohol, morphine and other sedatives to dull the pain of surgery but most patients were held or strapped down, some luckily fainted from the agony. Many died.



Before

Inventive and inquisitive nature of dentists



"The time for extracting a dental lesson from history is ever at hand for dentists who are wise" Demosthenes

Dental profession development

By 1800 there were still relatively few ‘dentists' practicing the profession. By the middle of the 19th century the number of practicing dentists had increased markedly, although there was no legal or professional control to prevent malpractice and incompetence. Pressure for reform of the profession increased.

The introduction of anaesthesia had a dramatic effect on dentistry. Alongside ether and chloroform, nitrous oxide became the most preferred option and most surgeries were equipped with general anaesthetic equipment by the end of the century.

History GA

BC opium based 'anaesthesia

Chinese medics 2-4AD

Joseph Priestley (1733–1804) was an English polymath who discovered nitrous oxide, nitric oxide, ammonia, hydrogen chloride and in 1775, Priestley published his research in *Experiments and Observations on Different Kinds of Air*, a six-volume work.

"As ni-trous oxide in its extensive operation appears capable of destroying physical pain, it may probably be used with advantage during surgical operations in which no great effusion of blood takes place."

On 13 October 1804, Hanaoka performed a partial mastectomy for breast cancer on a 60 year old woman named Kan Aiya, using tsūsensan as a general anesthetic. This is generally regarded today as the first reliable documentation of an operation to be performed under general anesthesia

Ether frolics

Henry Hill Hickman (1800–1830) experimented with the use of carbon dioxide

1830s, Humphry Davy's experiments had become widely publicized within academic circles in the northeastern United States. Wandering lecturers would hold public gatherings, referred to as "ether frolics", where members of the audience were encouraged to inhale diethyl ether or nitrous oxide to demonstrate the mind-altering properties of these agents while providing much entertainment to on-lookers.[57] Four notable men participated in these events and witnessed the use of ether in this manner. They were William Edward Clarke (1819–1898), Crawford Long (1815–1878), Horace Wells (1815

In January 1842, by now a medical student at Berkshire Medical College, Clarke administered ether to a Miss Hobbie, while Elijah Pope performed a dental extraction.[59] In so doing, he became the first to administer an inhaled anesthetic to facilitate the performance of a surgical procedure.–1848), and William T. G. Morton (1819–1868).

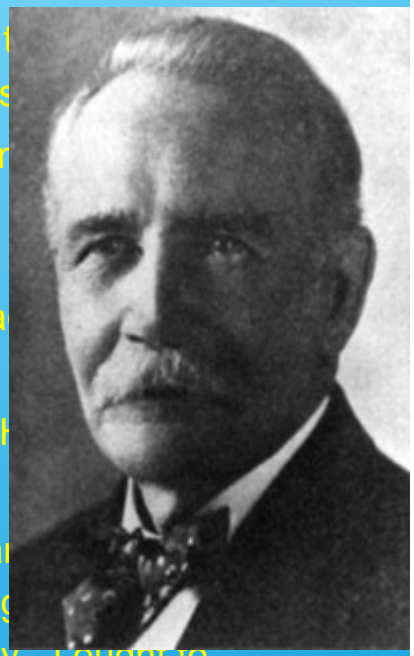
1844, Gardner Quincy Colton held a public demonstration of nitrous oxide in Hartford, Connecticut. One of the participants, Samuel A. Cooley, sustained a significant

William T. G. Morton, another New England dentist, was a former student and then-current business partner of Wells. He was also a former acquaintance and classmate of William Edward Clarke (the two had attended undergraduate school together in Rochester, New York). Morton arranged for Wells to demonstrate his technique for dental extraction under nitrous oxide general anesthesia at Massachusetts General Hospital, in conjunction with the prominent surgeon John Collins Warren. This demonstration, which took place on 20 January 1845, ended in failure when the patient cried out in pain in the middle of the operation.[64]

On 30 September 1846, Morton administered diethyl ether to Eben Frost, a music teacher from Boston, for a dental extraction. Two weeks later, Morton became the first to publicly demonstrate the use of diethyl ether as a general anesthetic at Massachusetts General Hospital, in what is known today as theEther Dome

Morton published his experience that year.[65] Harvard University professor Charles Thomas Jackson (1805–1880) later claimed that Morton stole his idea;[67] Morton disagreed and a lifelong dispute began.[66] For many years, Morton was credited as being the pioneer of general anesthesia in the Western hemisphere, despite the fact that his demonstration occurred four years after Long's

1910, Henry Isaiah Dorr



- Until 1913, oral and maxillofacial surgery was performed by mask inhalation anesthesia, t
  application of local anesthetics to the mucosa, rectal anesthesia, or intravenous anes
- After World War I, further advances were made in the field of intratracheal anesthesia. Ar
  were those made by Sir Ivan Whiteside Magill (1888–1986). Working at the
  Queen's Hospital for Facial and Jaw Injuries in Sidcup with plastic surgeon Sir
  Harold Gillies (1882–1960) and anesthetist E. Stanley Rowbotham (1890–1979), Ma
  the technique of awake blind nasotracheal
- The first hospital anesthesia department was established at the Massachusetts General H
  1936, under the leadership of Henry K. Beecher (1904–1976
- In 1910, Henry Isaiah Dorr, a retired physician and dentist, offered Harvard $2,000 a yea
  from a $63,000 gift—to establish an endowed chair devoted to research and teaching
  anesthesia at Harvard. President A. Lawrence Lowell was almost scornful in his reply. "I ought to say that $2,000 is not as much as we pay for most full professorships even in the clinical departments, where a man gives a part only of his time to the school," he wrote. "No doubt the word 'chair' would not necessarily mean a full professorship."
- Dorr's savings for his education grew so slowly that a prosperous dentist finally persuaded him to accept financial assistance, on the condition that Dorr abandon his plan to study medicine and take up dentistry instead. He enrolled as a dental student at Harvard and, following his graduation, practiced dentistry for several years. His ambition to become a physician was not realized until he was graduated from Jefferson Medical College at the age of 30

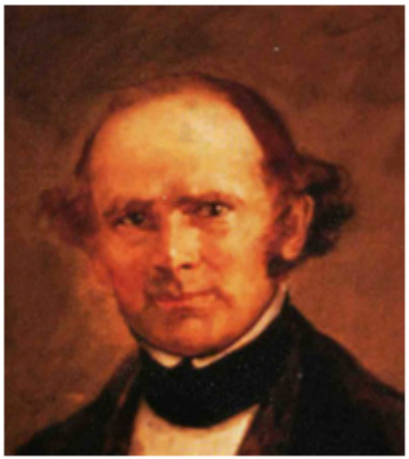
Dorr described his use of nitrous oxide and oxygen anesthesia, adding an excerpt from a local newspaper column: “Many experiments have been made in the use of anaesthetics, but none has been so successful as the one which took place at the Philadelphia Dental College last Friday afternoon. This is the first operation with nitrous oxide gas in combination with oxygen for an anaesthetic in short surgical operations.

“The patients under this combination of gases,” the newspaper column continued, “do not exhibit the excitement or groaning as when under the influence of nitrous oxide or other administrations. The lips retain their usual color and the patients experience but little acceleration of the pulse. The duration of the anaesthetic is longer and the operation for the administration is quite simple. It is a very recent importation from England and as this is the first use of it in the United States, Philadelphia scientists have displayed a great amount of interest.”

Dorr was apparently unaware that Edmund Andrews had administered oxygen with nitrous oxide in Chicago 15 or 20 years earlier, in 1868. Nevertheless, it was an interesting and noteworthy accomplishment. What other scientific, medical, or dental contributions Dorr may have made are undocumented. His obituary in the Winchester, Massachusetts newspaper stated that he had authored several books on anesthesia

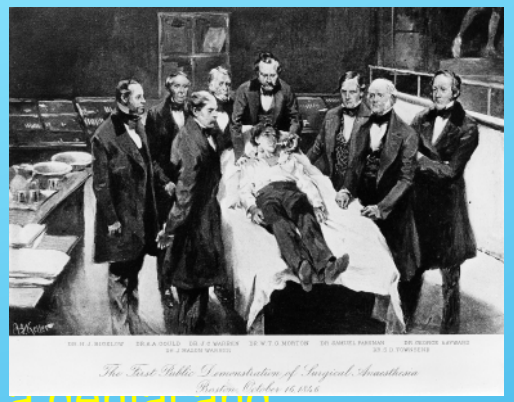
Anaesthesia

Horace Wells introduced the use of nitrous oxide for dental anesthesia in the 1842, and the first anesthesia machines appeared in 1902. Although its use fell in disfavour because of its weak anesthaetic properties, nitrous oxide continues to be used today for its "second gas effect.



Horace Wells

William Morton



William Morton is associated with the use of *ether* as a dental and surgical *anaesthetic*. He studied at the world's first dental school, Baltimore College of Dental Surgery, but left without finishing his degree. In 1844 he became a student at Harvard Medical School, but again did not finish his studies. However, at Harvard he attended the lectures of Professor Charles Jackson, who in 1844 demonstrated that inhaling ether caused unconsciousness

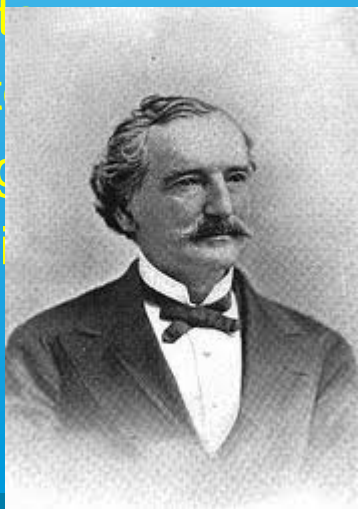
Having seen his former business partner Horace Wells fail to convince the medical establishment of the usefulness of nitrous oxide, Morton decided to investigate ether. In 1846 he extracted a tooth from a local Boston merchant, who felt no pain. The success of this operation led others to start experimenting with ether, and its use spread rapidly across the world. In 1852 Morton was granted an honorary doctorate by the Washington University in Baltimore

Anaesthesia

Anaesthetics were administered from the early 1840s, but the impact on general medical practice began after **William Morton** publically administered ether to Gilbert Abbott on 16 October 1846 at Massachusetts General Hospital, Boston

The American dentist **Horace Wells** was the first to administer nitrous oxide for pain relief during painful tooth extractions. Since, however, an official demonstration of the pain-relieving properties of the gas at Massachusetts General Hospital in Boston ended in failure, use of the drug was abandoned.

A few years later, **Gardner Quincy Colton**, a former coworker of Wells, took up Wells' idea to use nitrous oxide for pain relief and this was instrumental in its reintroduction into daily practice. Colton's publications on the advantageous use of nitrous oxide caused Stanislav Klikovitch from St. Petersburg, Russia, t
administer the drug for pain relief during labour. In order t
minimize the risk of asphyxia during the inhalation of the g
used an anaesthetic m ixture consisting of 80% nitrous oxi
20% oxygen



The first general anaesthetic administered for a dental extraction is credited to Connecticut dentist Horace Wells. Having observed at a travelling show that laughing gas induced anaesthesia, Wells began experimenting with the gas himself. On the 11th December, 1844, he underwent extraction of one of his own wisdom teeth by a colleague whilst under the influence of nitrous oxide. The following year he attempted to demonstrate this technique in Harvard. Unfortunately, his patient cried out during the operation and Wells was laughed out of the lecture theatre. However, on December 30, 1846, a pupil of Wells, William Morton, exploited the properties of ether to facilitate dental extraction, and this agent was subsequently demonstrated successfully to the public in Massachusetts the following month. The concept of general anaesthesia as a means of performing painless dental work was thus born

GA

On 19 December 1846, Francis Boott, an American botanist who had heard the news from Boston, watched dental surgeon James Robinson administer the first ether anaesthetic in England.

Two days later, Robert Liston operated on Frederick Churchill for a mid thigh amputation at UCH

Modern anaesthesia- chloroform Simpson's open drop me

Based on November 1847, James Simpson, Professor of Obstetrics in Edinburgh, introduced chloroform. It was more potent but could have severe side effects such as sudden death and late onset severe liver damage. It became popular because it worked well and was easier to use than ether. One of the early pioneers of anaesthesia was John Snow, renowned for removing the handle from the Broad Street pump and stopping the spread of cholera in London in 1854. He and J.T.Glover ascertained that anaesthesia remained in

Modernising of GA

The latter was partly overcome by Edmund Andrews of Chicago, who, in 1868, gave it with 20% oxygen. Paul Bert of Paris gave it under pressure 10 years later in 1878.

The first major war in which anaesthetics were used was the Crimean War of 1854-1855

Boyle machine appeared in 1917. In the 1930s the appearance of Bromethol (Avetin), Divinyl Ether, Cyclopropane and Trichloroethylene, and the induction of anaesthesia by intravenous barbiturates, were innovations

- There was a general agreement that sedation of the patient by opiates was desirable before inducing anesthesia with ether, and this was generally accomplished by administering the drug by mouth. In 1868, W.W. Green, a professor at the Maine Medical school, made a subcutaneous injection of from a half to one grain of morphine while the patient was under ether. He wrote that this injection would help in “preventing shock, shortening the anesthetic influence and in preventing delirium and nausea.”

A British physician in

1884 wrote that "in dental practice cocaine will probably prove itself of service, as there are many less severe tests of a patient's fortitude than the extraction of a tooth. The mode of application is either to employ a solution in alcohol of one in five or stronger, painting the gum, or to inject the submucous or subcutaneous tissue with a solution."

Dentists in other countries had their own suggestions. A Russian doctor

LA

first recorded appearance as a separate concept is due to Sir James Young Simpson (1848) in a review of alternatives to ether anaesthesia.[1]

Galen (129-216), who described a network of nerves leading to the brain

Descartes (1596-1650) who first stated that pain was experienced in the brain, rather than in the heart as was the accepted Aristotelian doctrine

The opium poppy was cultivated in Mesopotamia over

Later, in the American Civl War (1861-65), an estimated 400,000 soldiers became addicted to opiates after liberal use or morphine injections as well as opium pills: "The returning veteran could be...identified because he had a leather thong around his neck and a leather bag (with) Morphine Sulfate

Just six years after cocaine's introduction, dentists were warned of untoward eff ects of the drug. It was reported that a Philadelphia physician injected "a few drops" of a [illegible]0 percent solution to a woman, from whose face he proposed

Dentists then were warned to be
particularly on their guard since they
used cocaine so often in treating and
extracting the teeth, and were frequently
alone with their patients. Dentists
soon made it standard practice to have
a nurse or assistant present when
an anesthetic was administered.
26
Bizarre eff ects of the drug were apparently widely experienced. A dentist
in Shawnee, Oklahoma, in 899, gave
a woman an injection of cocaine, at
THE PATIENT BECAME
erotically excited

procaine,

a vasodilator, caused a profound drop in blood pressure, allowing the anesthetic to travel widely from the area of injection. A number of deaths occurred after infiltration anesthesia. This was

can divide practice into two approaches: mechanical and chemical. The mechanical involves physically interfering with the local nerve conduction process, by compression, cooling, warming, counter-irritant, venesection or nerve section. Such methods have been available to any practitioner, however basic.

Chemical methods I take to be the application of anodyne/ anaesthetic/counter-irritant substances to the specific area, by injection into the nerve or adjacent tissue, or topically via mucous membrane, transdermal, or eye surface absorption.

Ligature LA

Romans used ligatures

sixteenth and seventeenth centuries, among surgeons dealing with amputations

1564 the military surgeon Ambroise Paré (1510-91) noted that a tourniquet "much dulls the sense of the part by stupefying it: the animal spirits by the straite compression being hindred from passing in by the

Cold LA

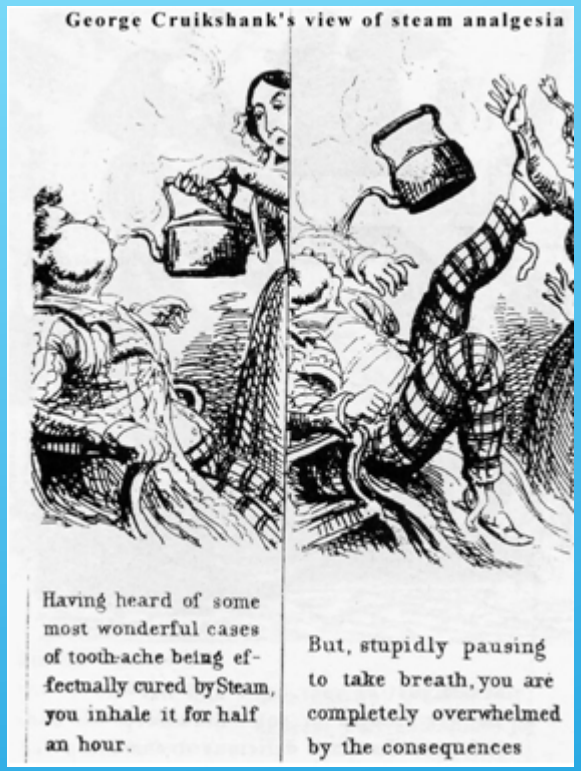
- Hippocrates (b. c.460 BCE) stated that “swellings and pains in the joints, without ulcerations, those of a gouty nature, and sprains are generally improved by a copious infusion of cold water....for a moderate degree of numbness removes pain.”[20]

Avicenna[21] used sips of ice-cold water to numb a tooth and gum before surgery.

In the Old English *Lacnunga* (c.1000) there is a recipe: to treat an abscess, let him sit in cold water till it be numb

British surgeon, James Arnott; he was concerned by the fatalities associated with the early days of ether and chloroform anaesthesia, admittedly then a very hit-and-miss procedure, and he repeatedly promoted refrigeration as much safer. “In all superficial operations, which constitute the immense majority, cold is superior to chloroform in the circumstances of safety, ease of application or the saving of time and trouble, certainly of producing anaesthesia

Steam LA


George Cruikshank's view of steam analgesia
Having heard of some most wonderful cases of tooth-ache being effectually cured by Steam, you inhale it for half an hour.
But, stupidly pausing to take breath, you are completely overwhelmed by the consequences

Electrical LA

eighteenth century saw great interest in the newly-discovered powers of electricity. The application of electric shocks in the cause of local analgesia became very popular

Electrical Treatment of Toothache, 1786

Charles Bew, surgeon-dentist to George IV of England, felt that tic douloureux (an extremely painful condition) was chiefly caused by dental problems. He recommended

London dentist, Joseph Snape, in 1858

reported in the London Times that he had used electricity as a local anesthetic. “In the course of the week I have extracted upwards of ⅌50 teeth from persons of all ranks, of both sexes, and of every age, and the testimony of each has been most satisfactory.” Almost all of the Attempts at using electricity to achieve freedom from pain were not unique to Europe. In Philadelphia, in ⅌856, a dentist, J. B. Francis, attached a wire to

his extraction forceps and the other end to the negative pole of a battery. A metal handle, attached to the positive pole was grasped by the patient, thus completing the circuit.

patients described their feelings as “delightful” upon experiencing no pain.

Counter irritant LA

The Arabs, during our Dark Ages, developed a large pharmacopoeia for pain relief both local and central. Opium, mandrake, and henbane were all used topically in dentistry, and also, with nightshade (*Solanum* spp) to treat ear and eye pain

The antiquary Camden (1551-1623) claims that "the [Roman] soldiers brought some of the nettle seed with them, and sowed it there for their use to rub and chafe their limbs

Capsaicin works by excitation of the sensory neurones, which initially produces the "burning" sensation, but with prolonged exposure, say by the application of an ointment, the neurones are depleted of their neurotransmitters and hence there is a reduction in the sensation of pain and eventually numbness; this is a reversible effect simply by removing the capsaicin, although prolonged exposure does lead to cell death.

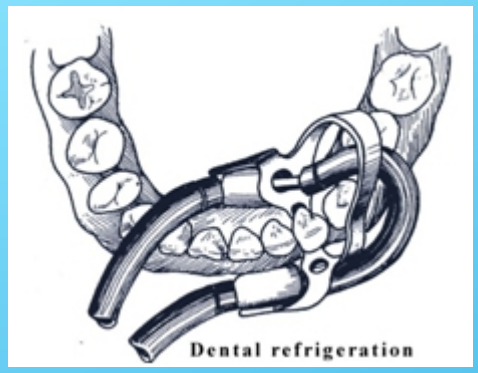
best-known topical anaesthetic probably is or are Cloves (*Syzygium aromaticum* syn. *Eugenia aromatica*) which are native to the Spice Islands

In the seventeenth century Woodall recommends *Oleum Garyophillorum* (Oyle of Cloues) as it "asswageth the paine of the teeth proceeding from a cold cause,"[47] and then as now it was used to relieve toothache by the time-honoured method of dabbing some on a small piece of absorbent substance which was then inserted into the cavity and left in situ. Its mode of action is not well understood but studies have shown that it is a powerful anti-inflammatory

For Toothache

Celsus recommends a decoction of the root held in the mouth but not, he cautions, swallowed, (*Liber* VI, ix) and for the same reason, from very early times the roots, dried, were made into anodyne necklaces/ rattles for babies for teething: "To Make Children's Necklaces for the Teeth. Take roots of hen bane, of orpin and vervain, and scrape them clean with a sharp knife, cut them in long beads and string them green.....till it is the bigness of the child's neck. Then take as much red wine as you think the necklace will take up and put thereto a dram of red coral, and as much single peony root, finely powdered. Soak the beads in this for 28 hours, and rub the powder on the beads, and when red and dry, let the child use them."[52] **Don't try this at home.**

Cold Dental LA



1946 an American dentist, harking back to Avicenna, described a quite horrendously uncomfortable-looking apparatus for delivering refrigeration anaesthesia to the jaws of naval personnel (who presumably were not in a position to say No, they'd rather have Novocaine, thank you)

Restarski, JS: Anesthesia induced by local refrigeration of the jaws, *Journal of the American Dental Association* 1946, 433-40

Local Anaesthesia

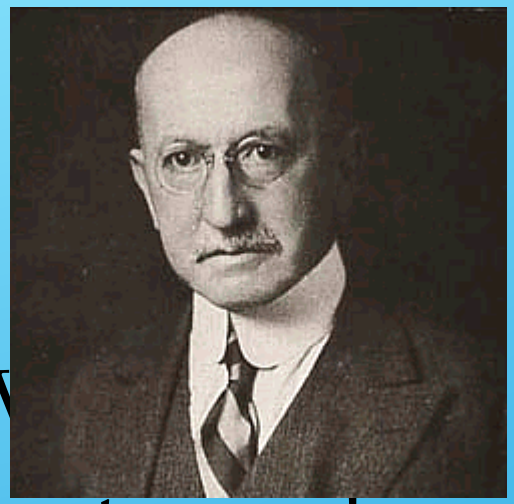
Two main discoveries paved the way for local anesthesia

-the development of the hypodermic syringe in 1851 by French physician Charles Pravaz 

Viennese physician Charles Koller's discovery of cocaine as an anaesthetic in 1884.

In 1884, William S. Halsted used a 4% cocaine solution in a hypodermic syringe to deliver the first mandibular local anesthetic block. The deficiencies and dangers of cocaine, however, led to a search for a substitute. In 1905 Alfred Einhorn discovered procaine

Karl Koller (1857 - 1944)



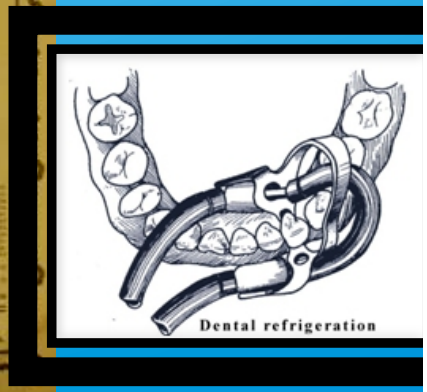
In 1884, Sigmund Freud asked V
ophthalmologist Dr Karl Koller to work with coca leaves. Dr Koller was looking for a procedure or agent to use during eye operations. Eye operations often needed a conscious, awake subject. Before the advent of local anaesthetia, such operations were fiendishly difficult

LA

Dental medicine was fundamentally changed unlike any other medical discipline. Local anaesthesia is the most frequently used form of pain relief in dental medicine.

Procaine, the first effective and tolerable local anaesthetic, was synthesised in 1905. One year earlier, adrenaline, which is added to local anaesthetics as a vasoconstrictor, was first successfully synthesised

Novocaine was introduced early in the 1900's as a local anaesthetic by a German chemist, Alfred Einhorn. The use of local anaesthetics during dental procedures did much to change the public's attitude towards dentistry.



Syringes

Hypodermic syringe was invented in 1841 by Illinois physician Zophar Jayne

An improvement came about in 1860 when an English surgeon, Alexander Wood, devised a glass-bodied syringe into which a tight plunger was fitted. The barrel's end had a screw onto which a hollow needle, of varying gauges and with a beveled point, could be attached.

first decade of the 20th century,Guido Fischer, director of the Dental University Institute at Greifswald, Germany, introduced a syringe which became the prototype of most modern syringes

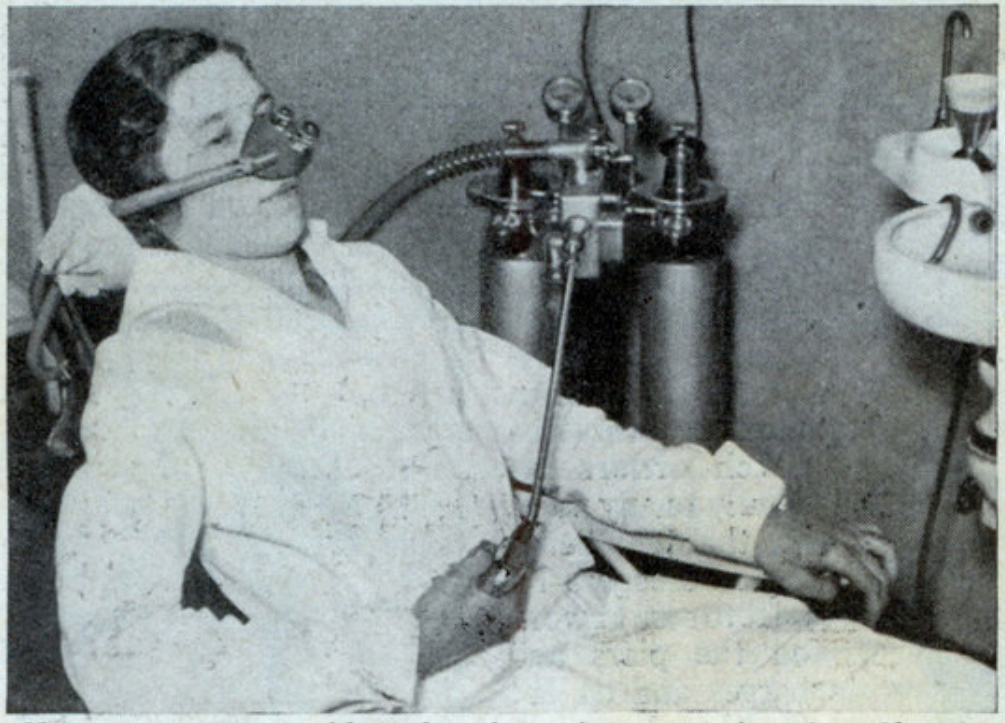
FIGURE 6. Guido Fischer, of Germany, in 1906 introduced this syringe, which became the prototype of most modern syringes.

Modern LA

Koller published his first paper on the use of cocaine as a local anesthetic in 1884. He described using a 2 percent aqueous solution instilled into the eyes of rabbits and dogs, causing insensitivity to painful stimuli in as short as 30 seconds. He then tried

Sedation RA

DENTAL PATIENT CAN GIVE HERSELF GAS



New apparatus enables dental patient to give herself gas

DENTAL patients can now administer their own anesthesia. The gas, the same as that now used by dentists, is a mixture of nitrous oxide and oxygen. A tube leading to the tanks containing the gases is equipped with a pistol-like control. While wearing a mask, a patient with this control can release as much gas as she needs to overcome the pain. The patient does not lose consciousness but suffers no pain.

Stanley L Drummond-Jackson. Pioneer of intravenous anaesthesia in dentistry.

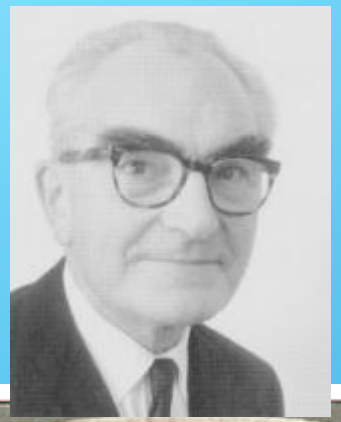
Gopakumar A, Gopakumar V.

Department of Restorative Dentistry, Liverpool University Dental Hospital, Pembroke Place, Liverpool L3 5PS. ashish_gopakumar@yahoo.co.uk

Abstract

Stanley Lithgow Drummond-Jackson was born in Northumberland and qualified from Edinburgh University Dental School in 1931. Even in the early stages of his practice he devoted his energies to the problem of pain control in dentistry, publishing his first paper in 1935. In the early 20th century most dental anaesthetics were inhalational with nitrous oxide, ether, ethyl chloride and chloroform. The introduction of intravenous hexobarbitone in 1931 led to bold and enthusiastic researchers like Drummond-Jackson to pioneer its use in dental practice. He published his major work on intravenous hexobarbitone in 1952. In 1957, Drummond-Jackson and a group of colleagues formed the now well-known organisation called 'Society for the Advancement of Anaesthesia in Dentistry' or SAAD. SAAD has grown from a group of 40 to over 4000 members worldwide. In 1969, the BMJ published an article condemning Drummond-Jackson's technique of intermittent intravenous methohexitone. At his personal expense, Drummond-Jackson brought a libel action against the BMJ and authors of this paper. There were no winners as the case was settled after 38 days and earned the reputation for being the longest and most expensive libel case in the history of the London Courts. Despite this setback the founder of SAAD devoted the last days of his life in research, teaching and abolishing fear and pain in dentistry. He gained international reputation as a teacher in dental anaesthesia and was honoured with fellowships and awards. He died in 1975 at the age of 66. In the early 1900s dental anaesthesia was only inhalational with mainly nitrous oxide on one hand and ether, ethyl chloride and chloroform on the other. Induction was at times stormy and prolonged and recovery was delayed. The

Sedation



1930's Stanley Drummond Jackso
Yorkshireexperimented with ne
introduced from Germany and
developed a method of intraver
providing fast onset

Dr Henry Mandiwall, a consultant
accomplished film maker. Toge
venepuncture techniques for general practice.

MacIntosh gave an anaesthetic in the Mayfair dental practice to Sir William Morris (of motor car fame). Oxford University established the first department of anaesthetics in Europe. Sir Robert MacIntosh became the first Professor of Anaesthesia in

The divisions between the professions came to a head when the British Medical Journal published a paper in 1969 on intravenous methohexitone in which the authors castigated Drummond Jackson and his technique. The technique the authors of the paper had used in their research (which was not that technique promulgated by SAAD) was condemned by their conclusions. DJ asked the British Medical Journal to publish a statement of withdrawal. This did not occur so he sued for libel. The legal case became the longest libel action in British legal history. The case was never completed as the judge recommended each party admonish the other for all blame and agree to disagree

In 1971 the government proposed a ban on the operator anaesthetist in dentistry.

Wylie Report in 1978 was subsequently adopted by the General Dental Council and today remains almost unchanged as the accepted definition of conscious sedation

the 1990s a Department of Health sponsored a guidance document on anaesthesia sedation and resuscitation and published "The Poswillo Report". Conscious Sedation and the Provision of Dental Care" (Department of Health) in

Origins of commonly used drugs in dentistry for managing acute post-operative pain.

dental drilling dates back 9,000 years. Primitive dentists drilled nearly perfect holes into teeth of live patients between 5500 and 7000 B.C. Researchers recently carbon-dated at least nine skulls with 11 drill holes found in a grave-yard in Pakistan. This means dentistry is at least 4,000 yrs older than first thought.

the twenty-first century, there are no new primary analgesics - those we use are still based on the willow and the poppy

Opium is the oldest painkiller. Originally it was used in a religious context.

As long ago as 900 B.C., Homer wrote of opium in the Iliad, describing it as the "bringer of sleep and forgetfulness". The Sumerians described it as the bringer of happiness and joy.

The Hippocratic Corpus, used between 800 and 400 B.C., was a multiherbal source of some 200 forms of pain relief.

In 1591, Alpino wrote a long paper on opium addiction. Later, in 1644, Descartes made a link between pain and brain. Sir Christopher Wren began using intravenous opium in 1665. Ladies in Victorian times often used laudanum for their "nerves". By 1917, morphine was produced.

In the meantime, the Reverend E. Stone began using willow bark in 1763. It was not until 1829, however, that Leroux developed salacin and in 1877, commercial salicylic acid was produced. Later, in 1899, Hoffman developed commercial aspirin, which has been produced by Bayer ever since.

Salicylic acid, the active ingredient in aspirin, is most known for its association with willow, but it is also found in other plants such as meadowsweet and wintergreen.

The other common analgesic, paracetamol, was developed in 1893, initially as acetaminopren (it only became paracetamol in 1953 and is known as acetaminophen in USA.)

Nowadays, there is a $20 billion market in analgesics and $4billion needed to treat side-effects (statistics from the Daily Telegraph suggest that 2000 deaths per annum are due to aspirin alone!)

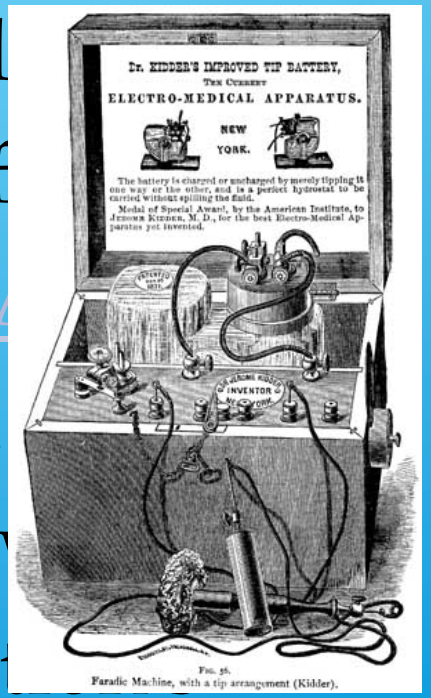
Returning to opiates: Henry Knowles Beecher (1904-1976) was the godfather of modern analgesia. In 1946, he wrote about pain in men wounded in battle. He recommended in a paper published in the prestigious journal JAMA, that the optimum dose of morphine should be 10mg, 6 hourly intramuscularly post-op. He set the scene for opiate use since then.

Since the mid-70s, scientists have uncovered information about endogenous (body's own) opiate receptors, and in the 90s, it became possible to clone some of these receptors and genetically engineer mice with or without these receptors in order to study the effects of pain.

Opium is a Middle English word (c1100–c1500 AD) of Greek origin that passed through Latin into English (3). *Opium* is a diminutive of the ancient Greek *opos*"milky juice of plants

other natural opium alkaloid, codeine, is also of Greek origin and is derived from the word *kodeia* (ion) "poppy head" + -

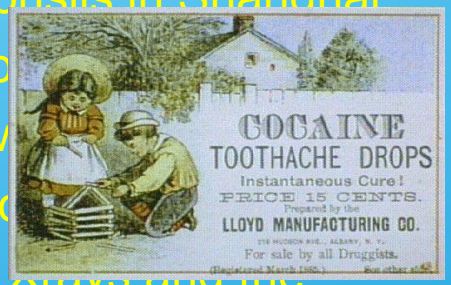
1930 - In **1930**, the company had
purchased the rights to manuf
little-known painkiller called
previously promoted through
to **dentists**. AHP's Anacin gre
popularity and became the na
leading over-the-counter **analgesic**. As
with



Faradic Machine, with a tip arrangement (Kidder).

Recent advancements for minimising side effects from historical remedies..

1958 - The team believes that acupuncture was first used in **dentistry** for pain relief during an operation to remove a patient's tonsils in Shanghai in **1958**. Mar 29, 1958 - Hypnosis makes it possible fo
per cent of all pregnant women to have their babies w
of **analgesia** or anesthesia including **...** In **dentistry** t
adjunct to anesthesia It also prevents gagging during X-rays and the



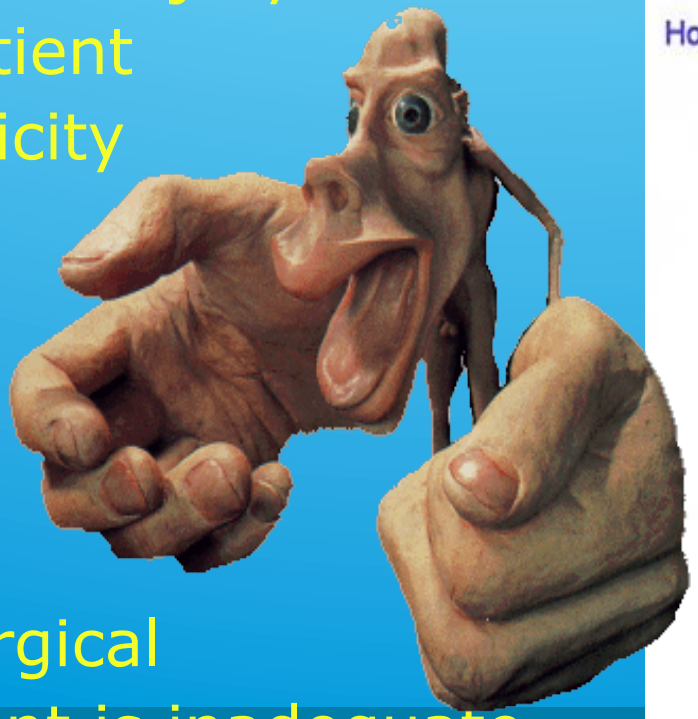
taking of impressions

Oct 19, 1960 - Of the three, hypnotism and auditory **analgesia** were met with the most - cism by some of the **dentists**. Auditory **analgesia** is a new technique

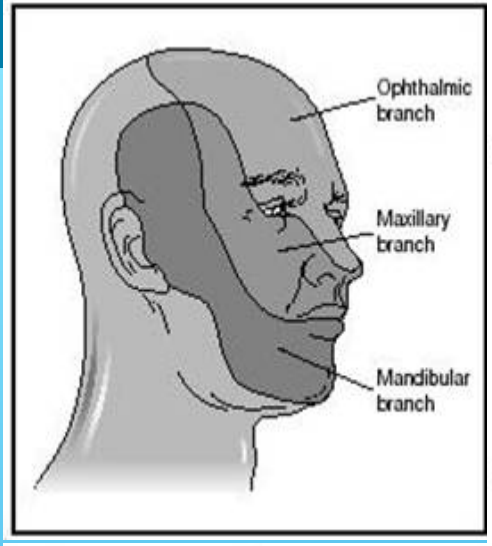
How new developments are leading the way for improved pain management in the future.

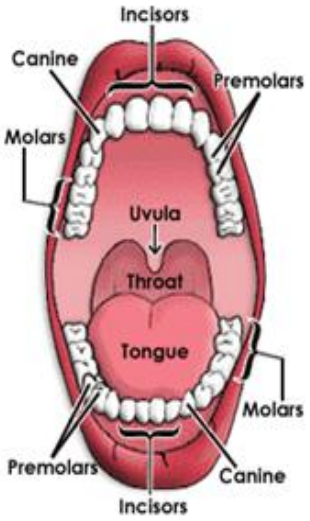
Issues specific to Trigeminal nerve

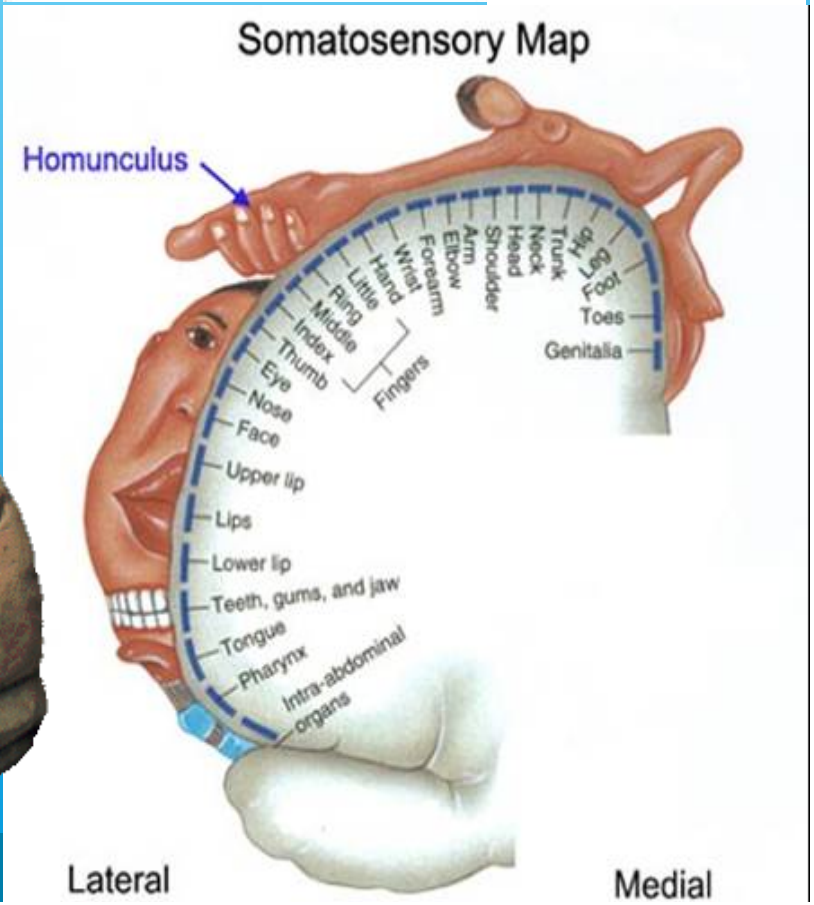
- Consent
- Closed injury
- Most resolve
- Type of nerve injury
- Type of patient
- Neuroplasticity



Current surgical management is inadequate







PAIN

Definition of pain

"An unpleasant sensory and emotional experience associated with actual or potential tissue damage or described in terms of such damage" (IASP, 1979).

Definition of emotion

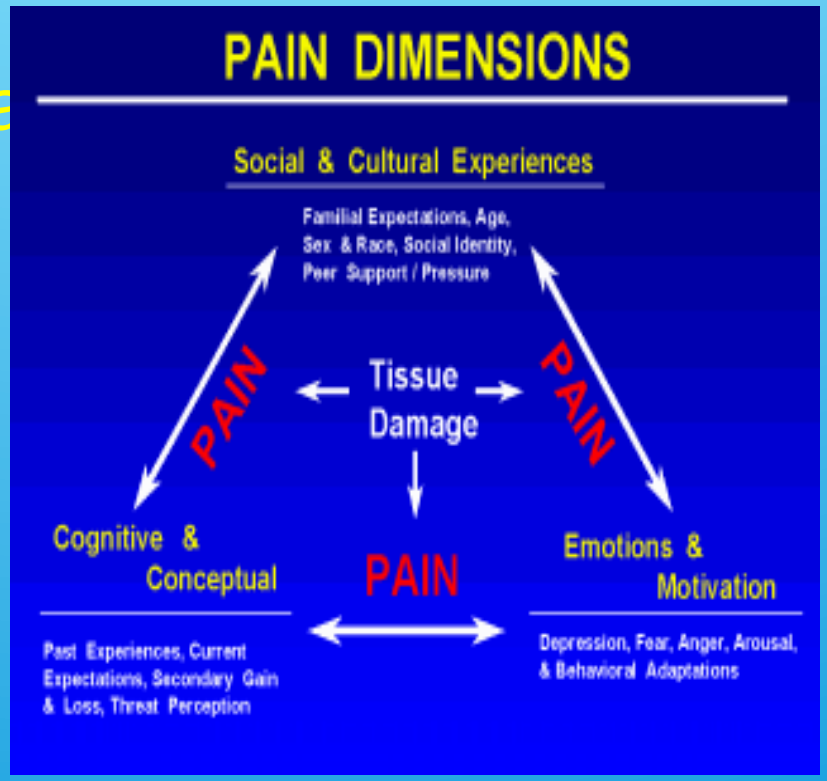
'any strong feeling

What is pain?

- Subjective sensation
  - with physical and psychological effects
- Individual response
  - dependant on
  - age / gender / experience / personality / anxiety
  - settings / trust in clinician / fatigue
- Organic and or psychological cause
- Measure
  - questionnaires to assess disability
  - physical / mental

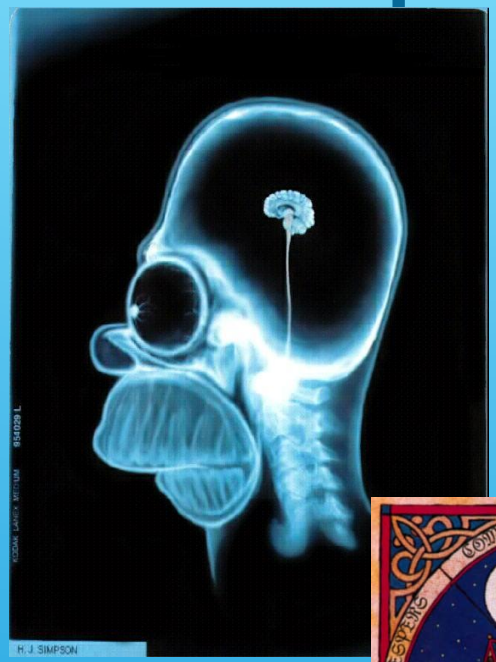
Influencing factors *Biopsychosocial model*

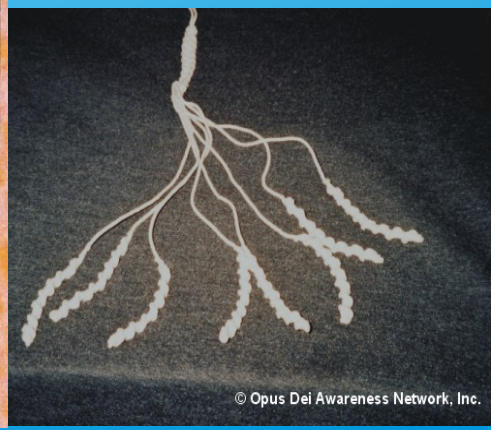
- Emotional and psychological state
- Memories of past pa experiences
- Upbringing
- Attitude
- Expectations
- Beliefs and values
- Age
- Sex
- Social and cultural influences



Perception of pain

Perception of pain





'I enjoy the pain'

David Beckham on tattoos

Opus Dei Priest 'Pain is

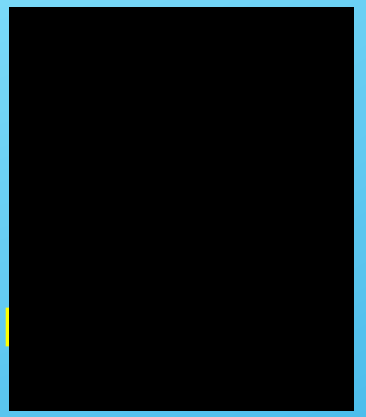
Pleasure and Pai

Brain images focused on areas experience of pain and on areas activated by cocaine, food and money.

The results showed that the painful 'hot' temperatures caused activation in the pain area and in some of the reward-associated structures, particularly in an area called the nucleus accumbens

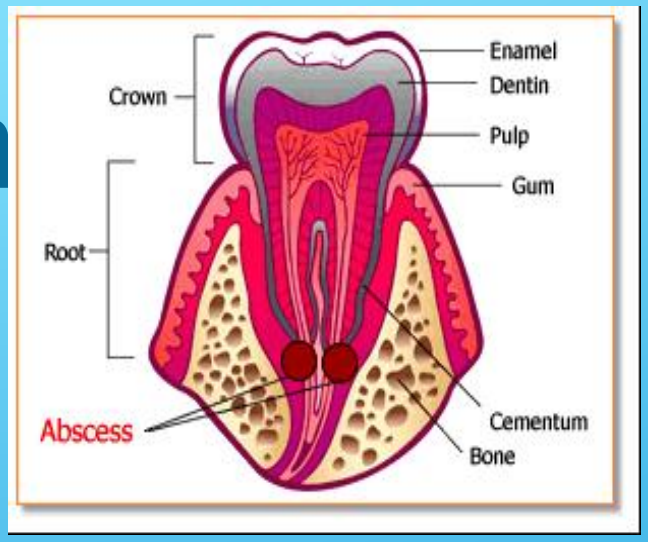
Classification

- Acute
  - Inflammatory due to tumour, infectio
    or trauma (surgical sieve)
  - Structure
    - non odontogenic
    - odontogenic
- Chronic
  - > 3months
  - Aetiology- IASP

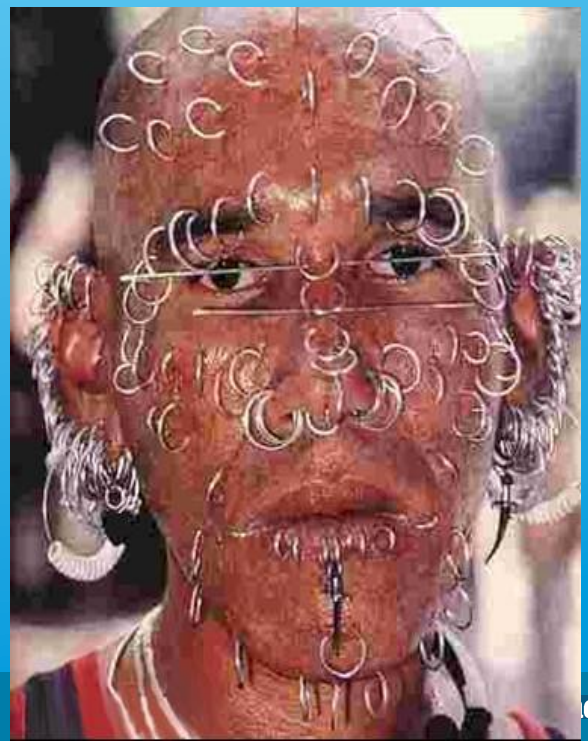


Trigeminal pain

Odontogenic



Non odontogenic



Pain of dental origin

Most common pain = toothache

- Caries

Supporting gum

- Periodontal disease
- Pericoronitis wisdom teeth

Non Odontogenic pain

Acute inflammatory due to

tumour, infection, trauma

Structure

- TMJ - TMD (including acute, often traumatic cases or strain, synovitis, capsulitis and TMD problems linked to more general diseases (Okeson, 1996).
- Sinuses
- Salivary glands
- Ears
- Eyes
- Throat
- Mandibular / maxillary bone

Idiopathic chronic pain

- No inflammation
- Unknown cause
- >3months duration

Pain - chronic

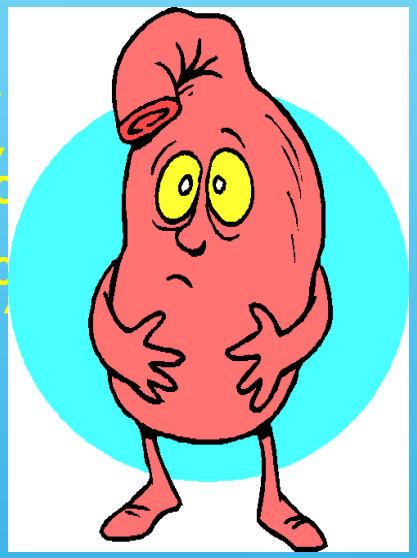
is a disease called

Neuropathic pa

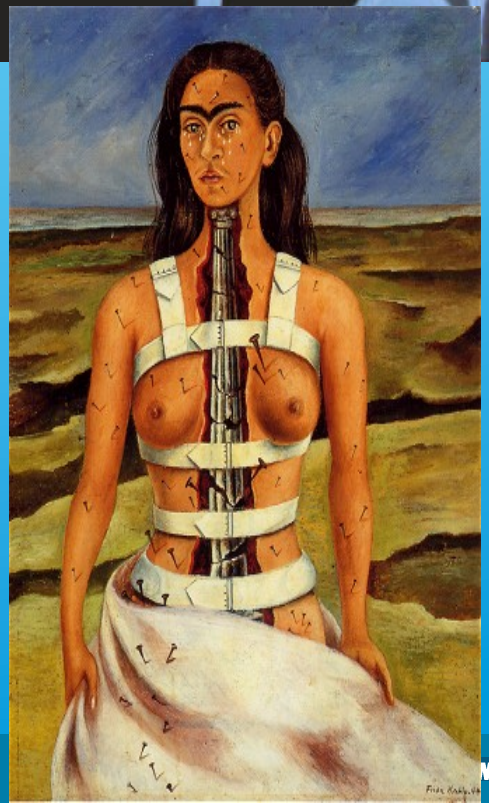
Back pain 47.5%

Head ache 45.2%

Joints 41.7%



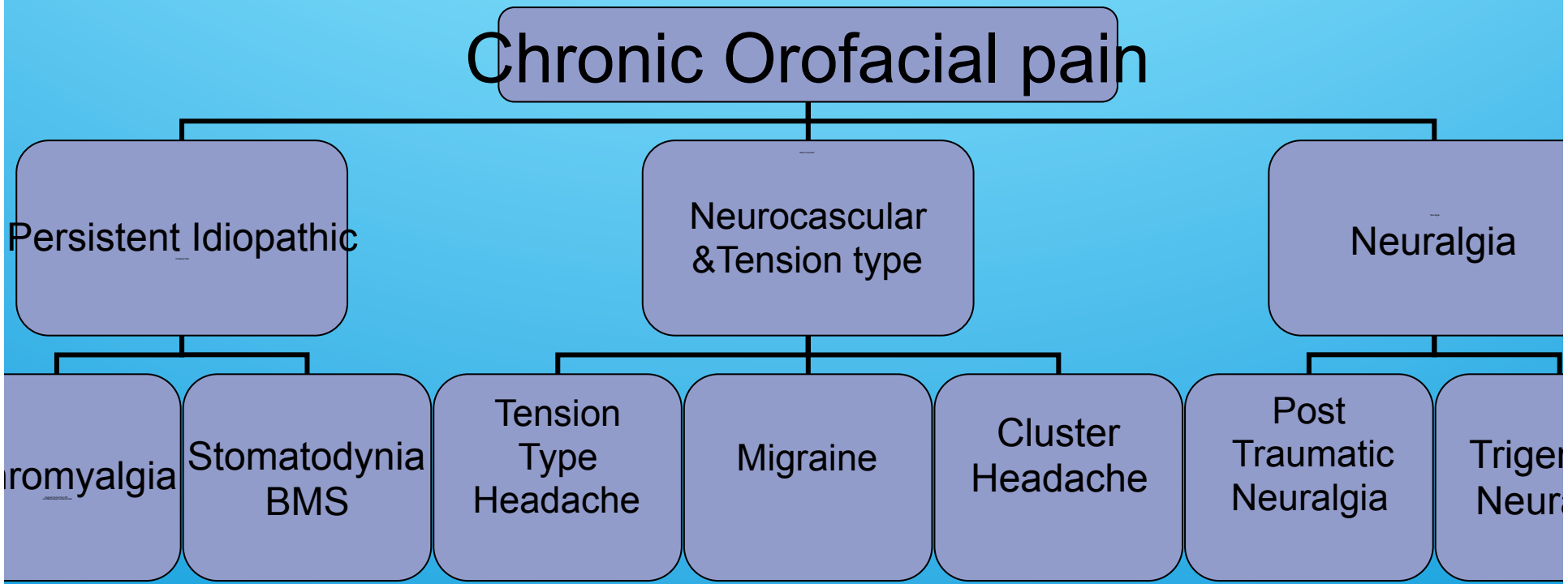
Disease of the neuromatrix



Chronic pain

- 33% of US population suffer from chronic pain
- 13% work force is compromised
- USA $61.4 billion dollars a year in lost production
- Diabetic and HIV neuropathy

  Accounts for £40 million GNP loss per year UK


Chronic Orofacial pain
Persistent Idiopathic
Neurocascular &Tension type
Neuralgia
romyalgia
Stomatodynia BMS
Tension Type Headache
Migraine
Cluster Headache
Post Traumatic Neuralgia
Trige
Neur

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.

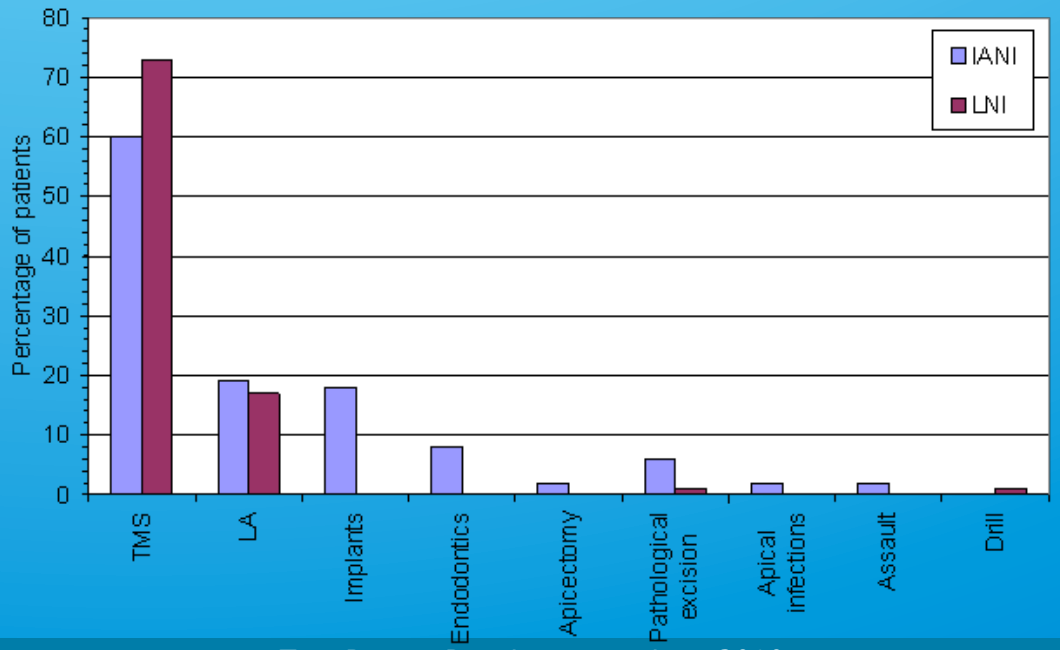
Table 1: **Estimated incidence of chronic postoperative pain and disability after selected surgical procedures***

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

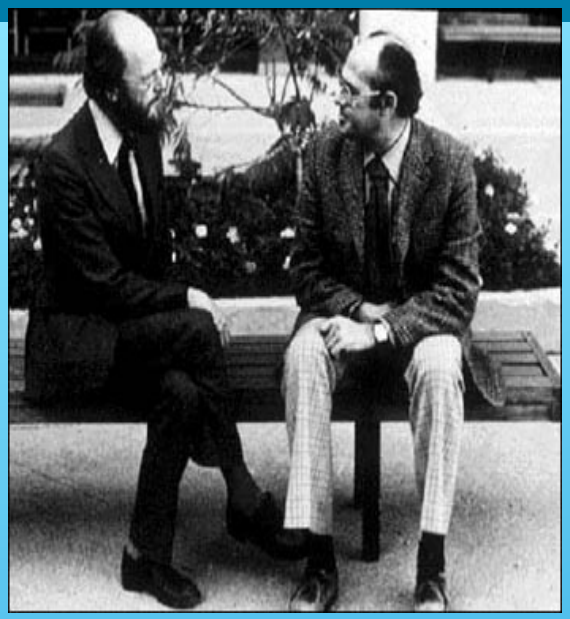
? 4-5% of trigeminal severely affected

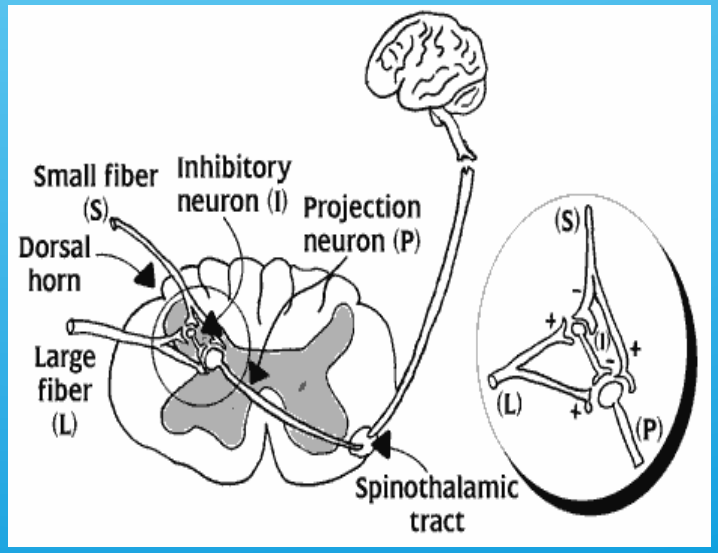
Post traumatic neuropathy of the trigeminal nerve

- Local anaesthesia
- Third molar surgery
- Implants
- Endodontics
- Orthodontics
- Orthognathic surgery
- Fractures
- Pathology



How do we feel the "ouch"



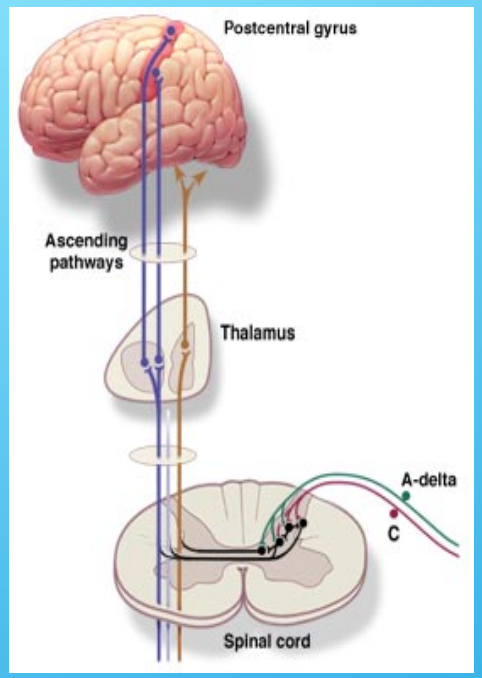


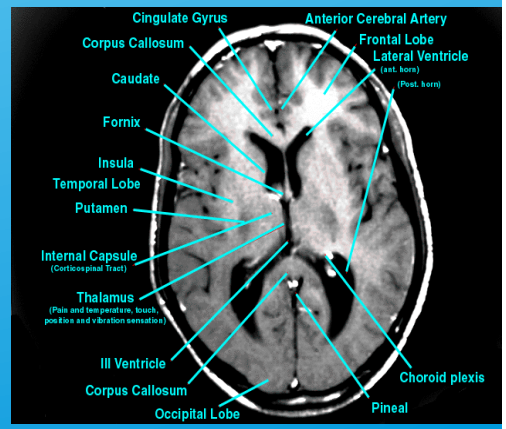
Descartes 1650 in Stockholm Canadian psychologist Ronald Melzak and British physiologist Patrick Wall 1965

Noxious stimulus
What events unfold **sensory** system?

- Neurophysiological
  - Peripheral nervous system
    - Inflammation
    - Receptors
    - Axons (primary / secondary / tertiary [cortex])
    - neurotransmission
  - Central nervous system
    - Pain pathways
- Patient
  - Clinical symptoms
  - Psychological factors
  - Environmental factors

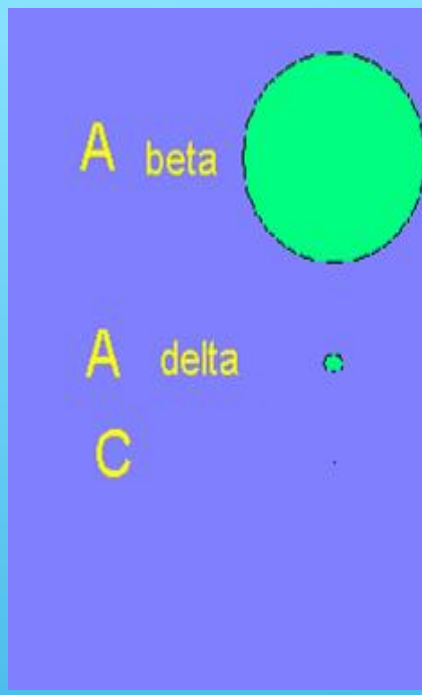
= reaction Emotional and Physical

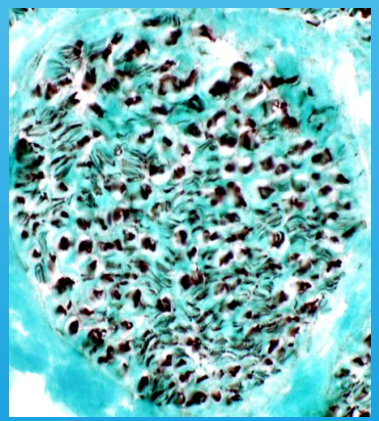


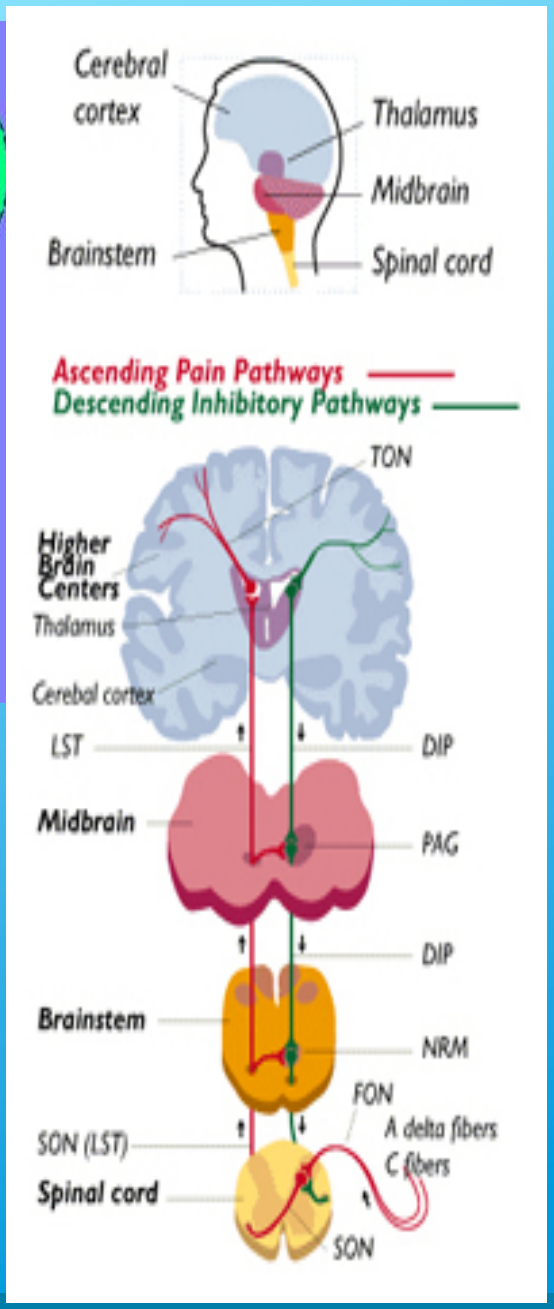


CNS and PNS

- Receptor
- Primary sensory nerve
  - A Delta and C fibres
- Secondary sensory nerve
  - Lamina I DRG
- Tertiary sensory nerve
  - Specific areas of the brain
    - Thalamus
    - Anterior cingulate cortex
    - S1 / S2
    - Insula
    - Brainstem







Peripheral

Acute inflammatory pain

Tissue injury

Cell damage

- Trauma mechanical, chemical . Radiation. heat

Cytokine release

- Attract immune cells
- Nerve activation via receptors via **NGF**

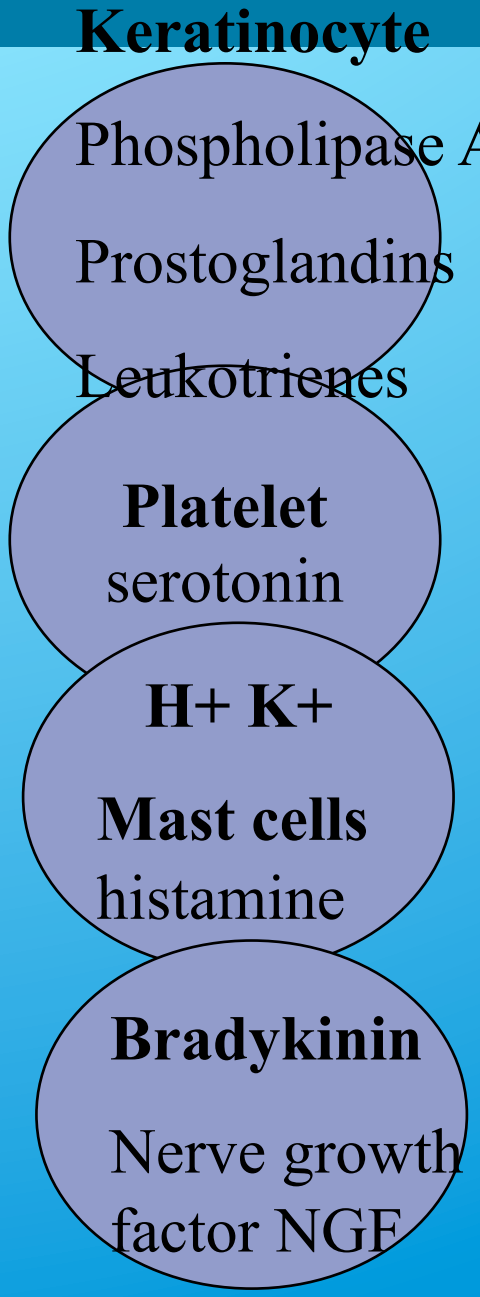
Neural depolarisation (PNS)

- Action potential
- Signals primary, secondary, tertiary (CNS)
- Cortical activation 'sensing
- Reaction (motor and sensory

More cytokine release
NEUROINFLAMMATION

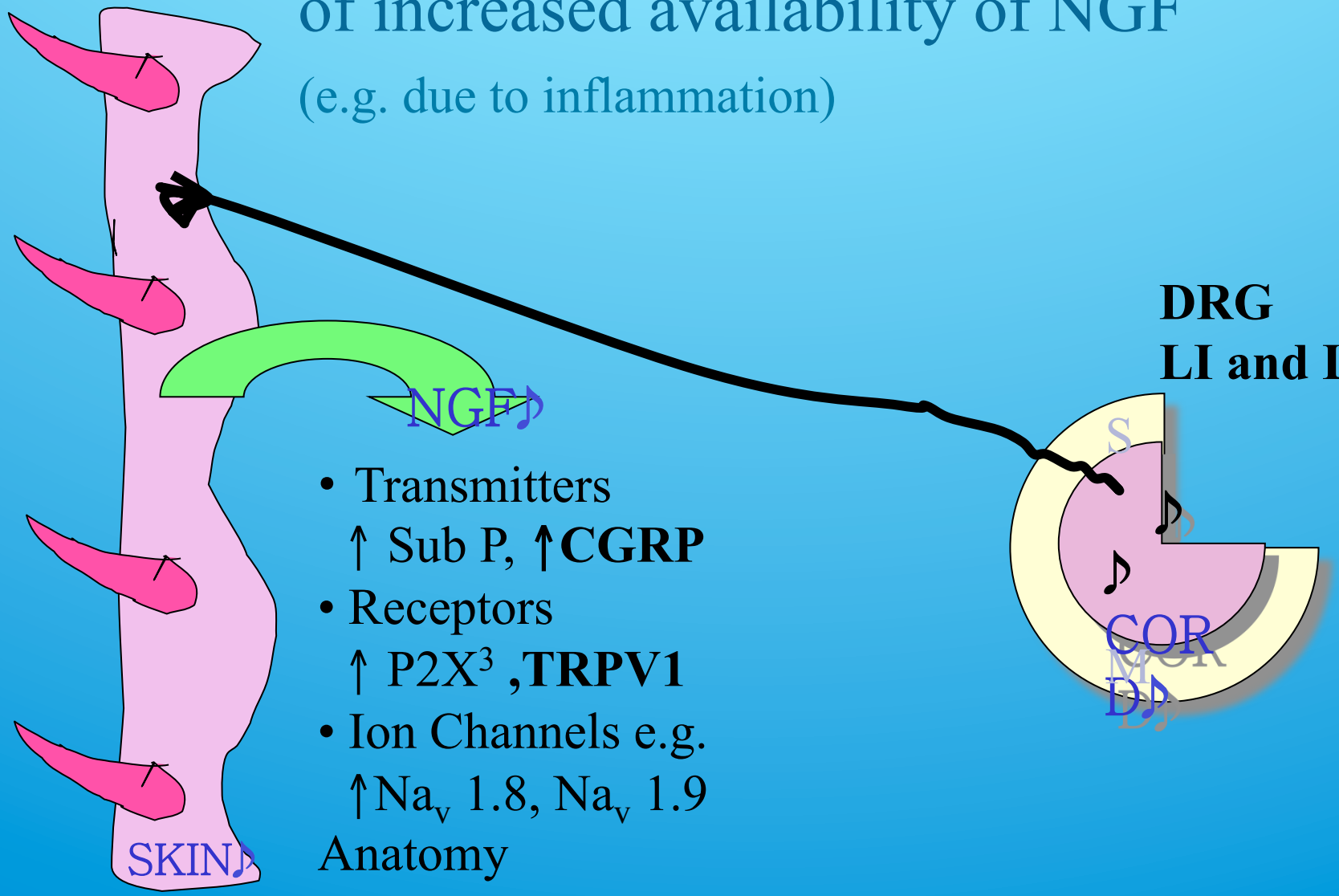
If process prolonged = changes in nervous system

Chronic non inflammatory pain



Peripheral changes in nociceptors as a consequence of increased availability of NGF

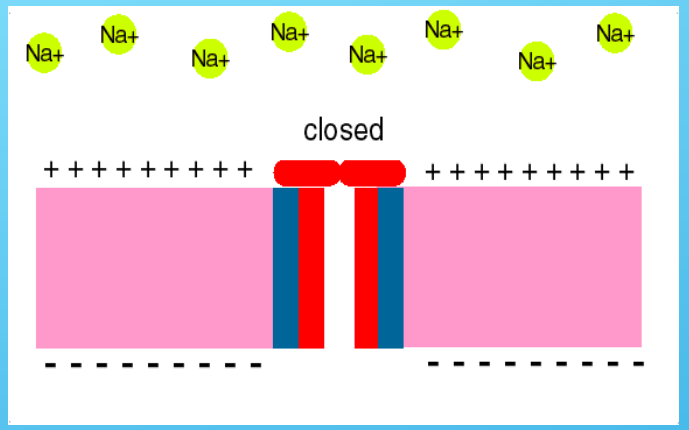
(e.g. due to inflammation)



- Transmitters
  ↑ Sub P, ↑**CGRP**
- Receptors
  ↑ $P2X^3$,**TRPV1**
- Ion Channels e.g.
  ↑Na_v 1.8, Na_v 1.9

Anatomy
↑GAP 43, ↑ innervation density

Specific pain receptors



Transmitters

↓NGF, ↓ SP, ↓ CGRP

Receptors

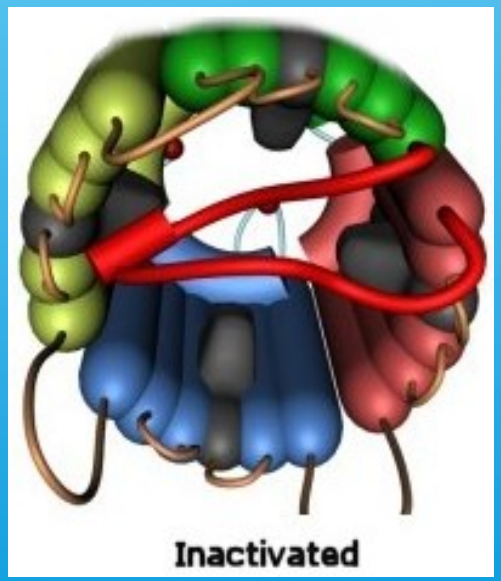
↓ TRPV1, ↓ P2X3

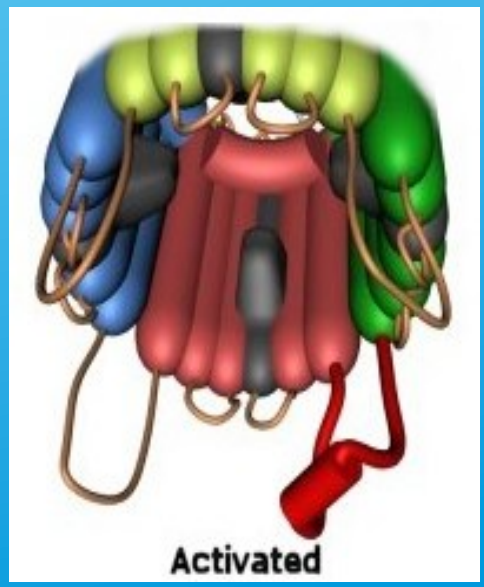
Ion Channels

- Na, Ca, K

Anatomy

- degeneration

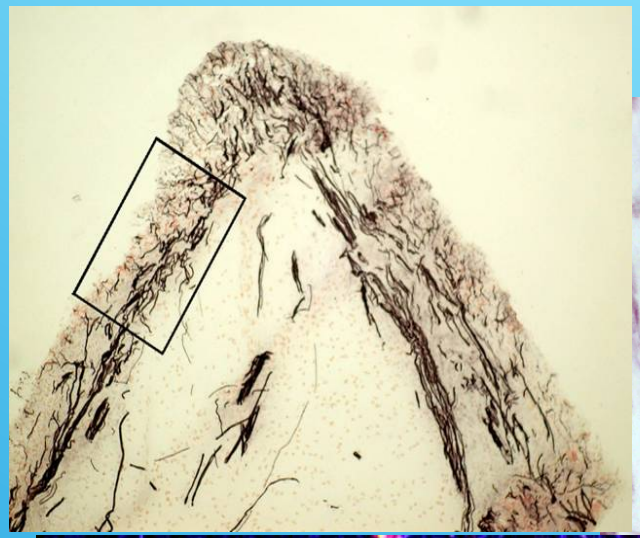


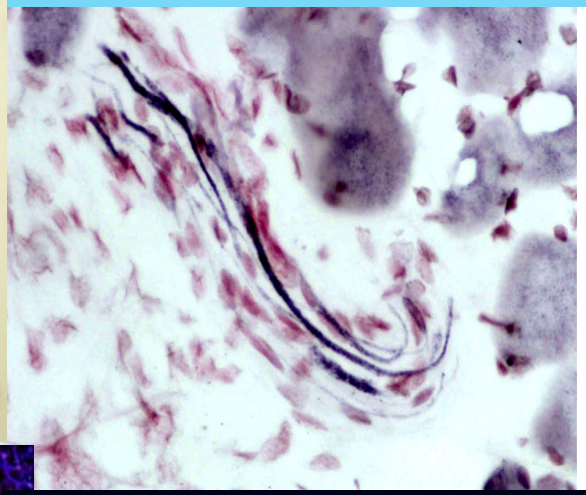


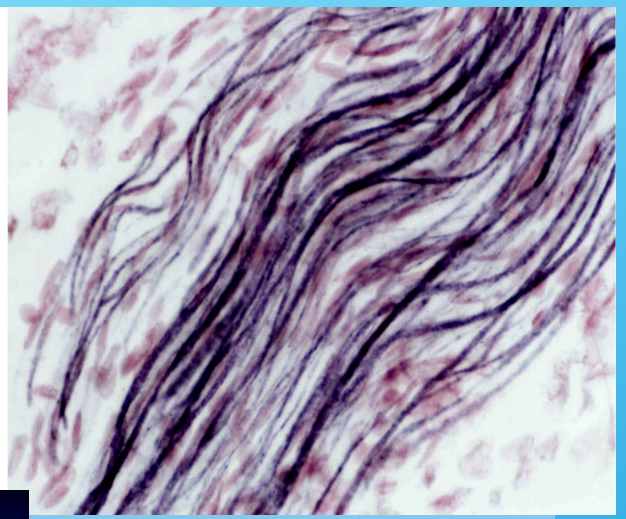
↑ spontaneous activity

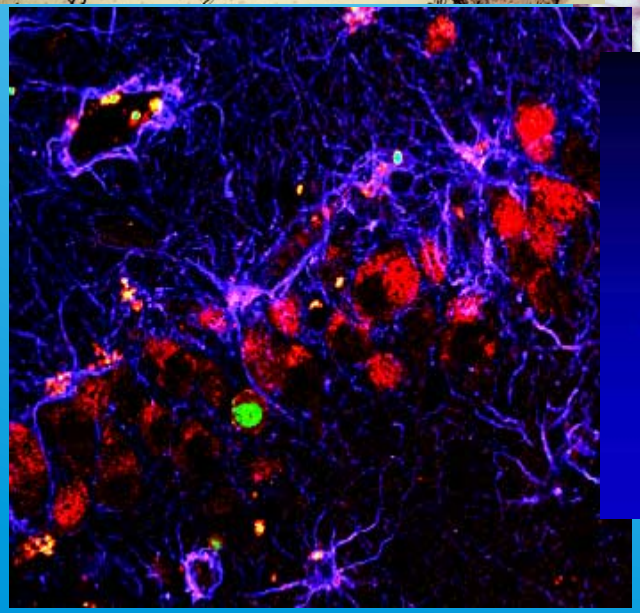
Control

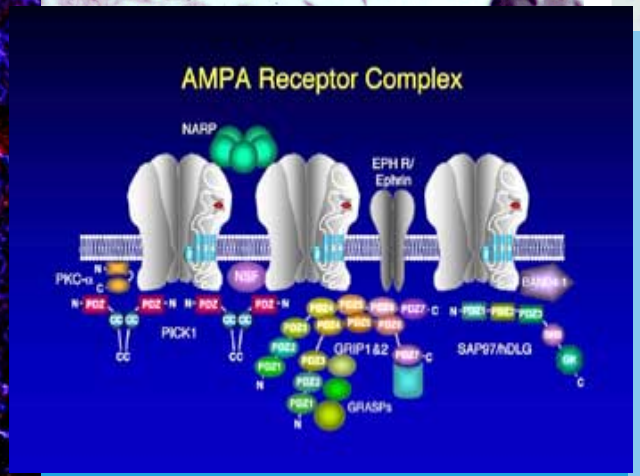
Pain

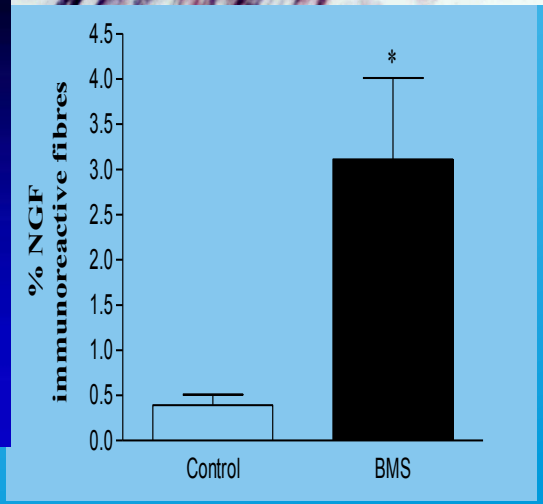










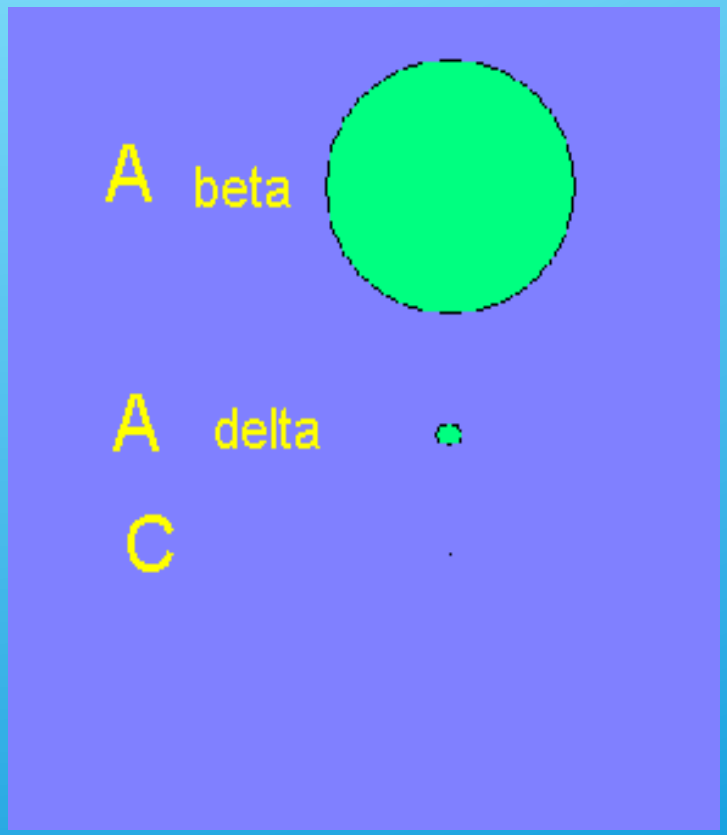


Neurons involved in pain

There are several types of nociceptor fibres

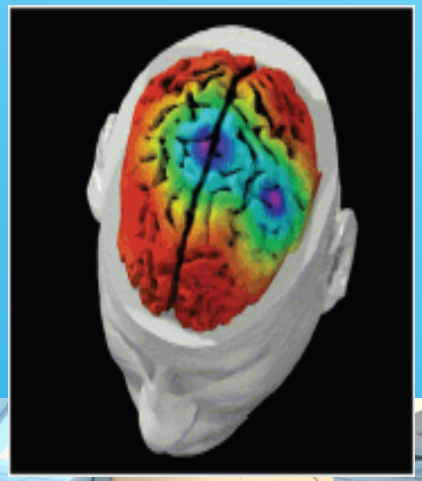
Aβ nerve fibres
Mechano

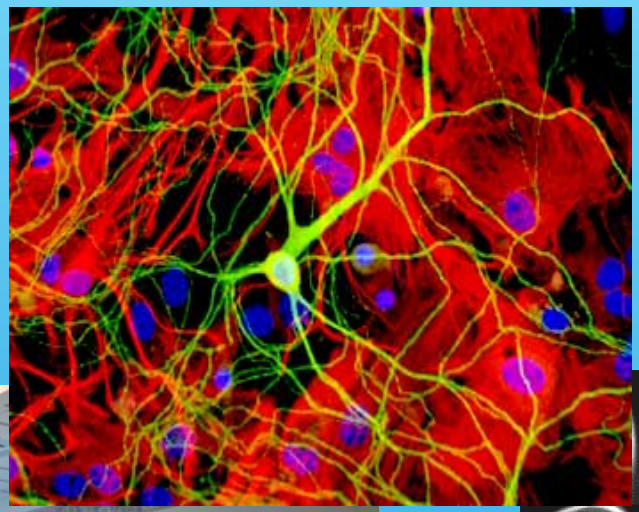
Aδ	Cold Pain
C	Warm Pain

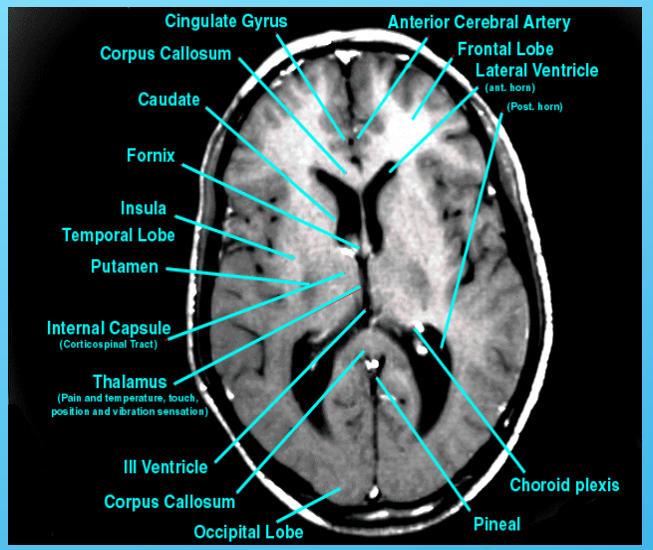


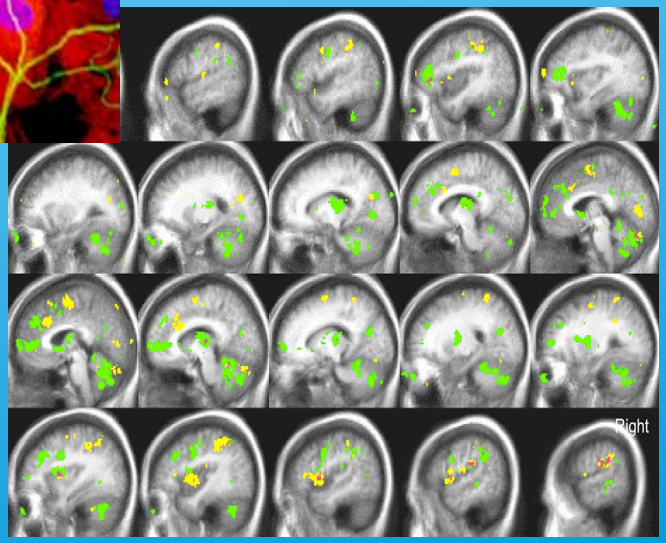
Central pain Human assessment

fMRI functional magnetic resonance imaging









Assessment- Measurement Tools

Pain history

Examination

- Psychometric
  - Subjective pain scores
    - VAS, pain descriptors
  - Affective
    - Anxiety depression functionality disability
- Psychophysical
  - Neurophysical tests - neuropathic area
    - Cold warm / Mechanosensory / Vibration
    - Special sensory =Taste

Pain

Diagnosis of pain

Pain History

Pain thresholds

Subjective measurement of pain

Indirect measurement of pain

Objective assessment of pain

Pain history

- Site
- Duration
- Frequency
  - Spontaneous / evoked (cause / relief)
- Character
  - Type
    - burning, stabbing
  - Intensity
- Persistent / intermittent
- Localisation
- Radiation

Pain history

P the pattern of the pain

- how it started
- how the pain affects your life, work and leisure time
- what activities make the pain better and what make it worse
- what medications relieve the pain, or don't work
- whether the pain is constant or comes and goes
- how long the pain lasts

A the area affected by the pain

- location of the pain and/or if it moves or "radiates" (spreads out from a core spot) or stays in the same place

I the intensity of the pain

- the severity or intensity of the pain (on a scale of 0 to 10, 0 being no pain, 10 being the worst it can be)
- what the pain is like now (what it is like at its worst and at its least)

N the nature of the pain

- the physical sensation of the pain: stabbing, burning or aching, for example
- how it feels to you and makes you feel: tiring, exhausting, sickening, fearful, vicious

(Source: PAINUCope, a multimedia educational program for people living with pain. ?1998 D. J. Wilkie.)

Pain history-important terms

spontaneous OR evoked constant OR intermittent

Character of pain	neuralgic shock like or burning pain
Dysesthesia	abnormal unpleasant sensations (eg shooting, lancinating, burning)
Paresthesias	abnormal not unpleasant sensation (tingling)
Allodynia	painful response to non painful stimulus
Hyperalgesia	heightened response to normally painful stimulus
Hyperpathia	explosive response to normally painful stimulus

Visual Analogue Scales

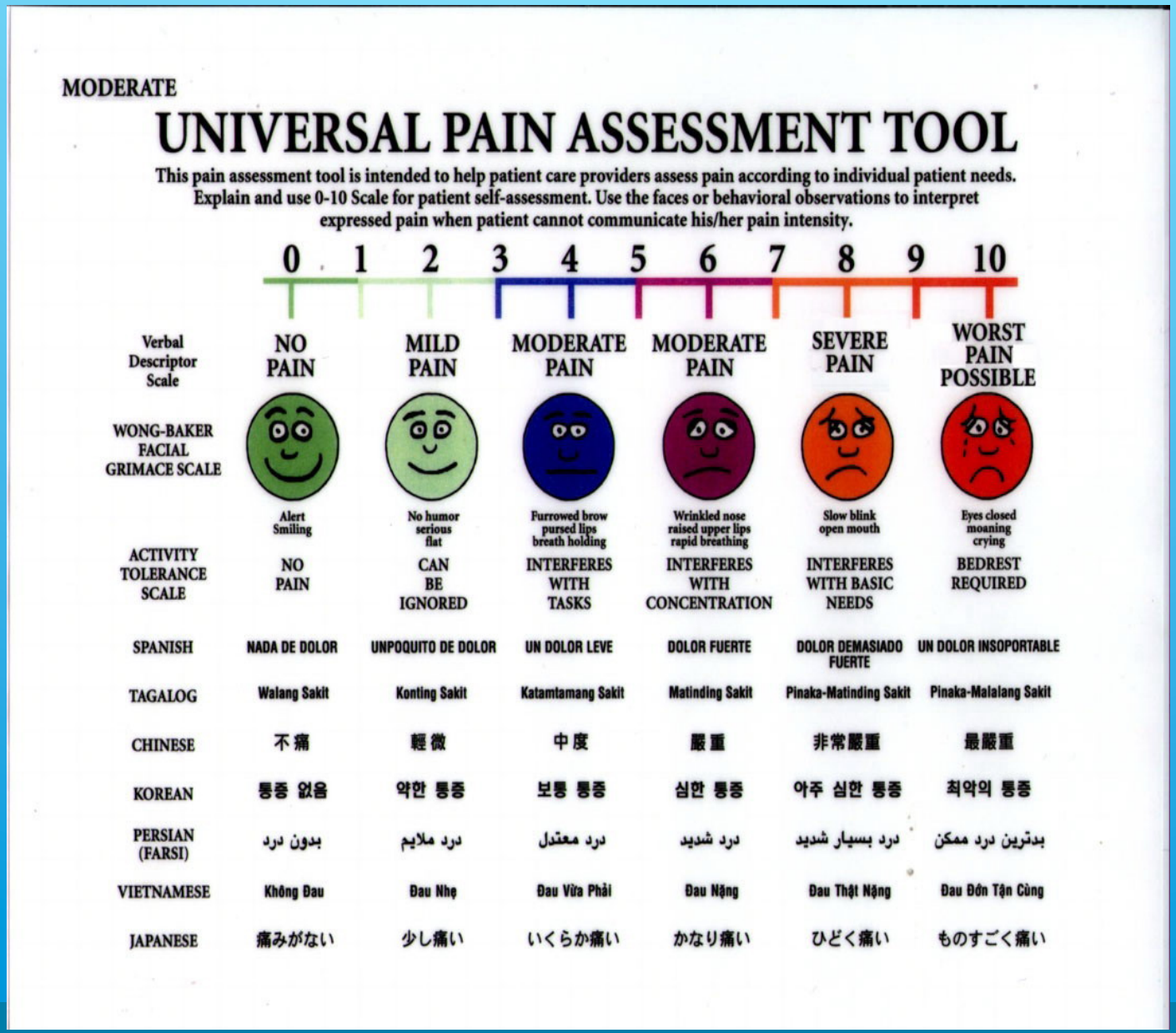
anchors : no pain max pain

no relief max relief

no distress max distress

10 cm line

Assessment of pain



MODERATE

UNIVERSAL PAIN ASSESSMENT TOOL

This pain assessment tool is intended to help patient care providers assess pain according to individual patient needs. Explain and use 0-10 Scale for patient self-assessment. Use the faces or behavioral observations to interpret expressed pain when patient cannot communicate his/her pain intensity.

0 1 2 3 4 5 6 7 8 9 10

Verbal Descriptor Scale	NO PAIN	MILD PAIN	MODERATE PAIN	MODERATE PAIN	SEVERE PAIN	WORST PAIN POSSIBLE
WONG-BAKER FACIAL GRIMACE SCALE						
	Alert Smiling	No humor serious flat	Furrowed brow pursed lips breath holding	Wrinkled nose raised upper lips rapid breathing	Slow blink open mouth	Eyes closed moaning crying
ACTIVITY TOLERANCE SCALE	NO PAIN	CAN BE IGNORED	INTERFERES WITH TASKS	INTERFERES WITH CONCENTRATION	INTERFERES WITH BASIC NEEDS	BEDREST REQUIRED
SPANISH	NADA DE DOLOR	UNPOQUITO DE DOLOR	UN DOLOR LEVE	DOLOR FUERTE	DOLOR DEMASIADO FUERTE	UN DOLOR INSOPORTABLE
TAGALOG	Walang Sakit	Konting Sakit	Katamtamang Sakit	Matinding Sakit	Pinaka-Matinding Sakit	Pinaka-Malalang Sakit
CHINESE	不痛	輕微	中度	嚴重	非常嚴重	最嚴重
KOREAN	통증 없음	약한 통증	보통 통증	심한 통증	아주 심한 통증	최악의 통증
PERSIAN (FARSI)	بدون درد	درد ملایم	درد معتدل	درد شدید	درد بسیار شدید	بدترین درد ممکن
VIETNAMESE	Không Đau	Đau Nhẹ	Đau Vừa Phải	Đau Nặng	Đau Thật Nặng	Đau Đớn Tận Cùng
JAPANESE	痛みがない	少し痛い	いくらか痛い	かなり痛い	ひどく痛い	ものすごく痛い

Circle the words below that best described your pain
Use only one word in each group.
Lease out any group if the words are unsuitable.

	2	3	4
1 Flickering	1 Jumping	1 Pricking	1 Sharp
2 Quivering	2 Flashing	2 Boring	2 Cutting
3 Pulsing	3 Shooting	3 Drilling	3 Lacerating
4 Throbbing		4 Stabbing	
5 Beating		5 Lancinating	
6 Pounding			

5	6	7	8
1 Pinching	1 Tugging	1 Hot	1 Tingling
2 Pressing	2 Pulling	2 Burning	2 Itchy
3 Gnawing	3 Wrenching	3 Scalding	3 Smarting
4 Cramping		4 Searing	4 Stinging
5 Crushing			

9	10	11	12
1 Dull	1 Tender	1 Tiring	1 Sickening
2 Sore	2 Taut	2 Exhausting	2 Suffocating
3 Hurting	3 Rasping		
4 Aching	4 Splitting		
5 Heavy			

13	14	15	16
1 Fearful	1 Punishing	1 Wretched	1 Annoying
2 Frightful	2 Gruelling	2 Blinding	2 Troublesome
3 Terrifying	3 Cruel		3 Miserable
	4 Vicious		4 Intense
	5 Killing		5 Unbearable

17	18	19	20
1 Spreading	1 Tight	1 Cool	1 Nagging
2 Radiating	2 Numb	2 Cold	2 Nauseating
3 Penetrating	3 Drawing	3 Freezing	3 Agonizing
4 Piercing	4 Squeezing		4 Dreadful
	5 Tearing		5 Torturing

McGill Pain Questionnaire

Descriptive WORDS

www.kcl.ac.uk

Depression and Anxiety

- **In the last month have you**
  - **felt a lack of pleasure in life?**
  - **felt depressed ?**

- **Hospital Anxiety and Depression Scale**
- **Beck Depression Inventory**

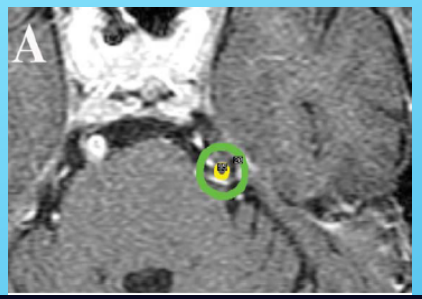
Central / peripheral pathology
central brain SOL / tumours

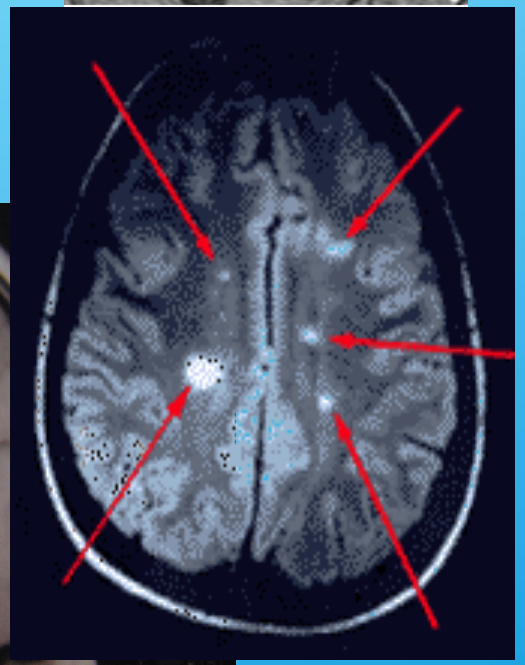
Comparison of upper and lower neurone lesions

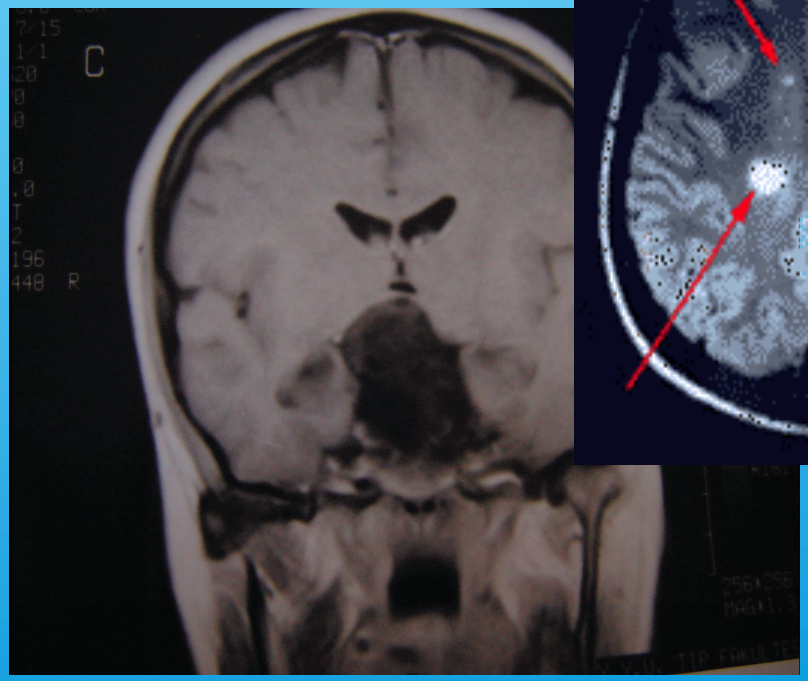
	Upper	Lower
Fasciculations	No	Yes
Wasting	Only if lack of use is prolonged	Yes
Tone	Increased, spastic	Decreased, flaccid
Weakness	Yes	Yes
Reflexes	Exaggerated	Depressed or absent
Clonus	Yes	No
Plantar response	Extensor	Flexor

Central pathology

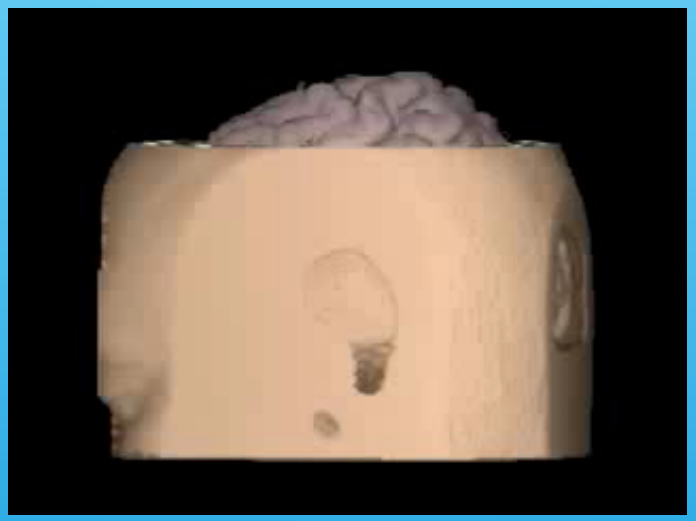
- Classical
  - vascular compression
- Multiple sclerosis
  - MRI plaques
- Stroke
- Post herpetic neuralgia
- Tumours
  - Meningioma







fMRI video



Thank you

Management tools

Counselling

- LA, Orthognathic, Fracture
- Endo or implant injuries>30 hours
- TMS injuries older 6 months

- Reaffirm nerve injury is permanent
- Reassurance and explanation

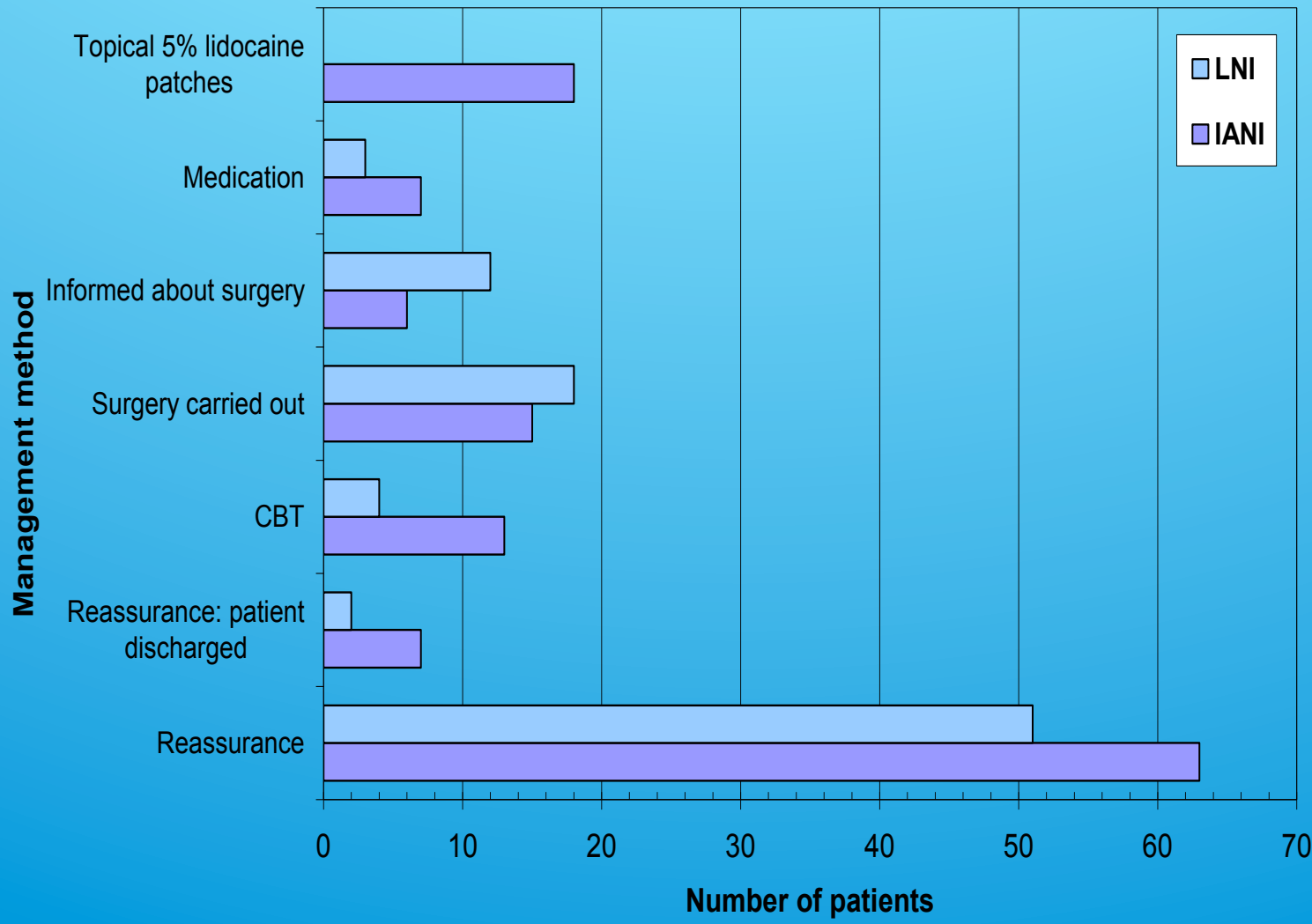
Medical symptomatic therapy (pain or discomfort)

- Topical agents for pain
- Systemic agents for pain

Surgical exploration

- remove implant or endo material within 24 hours
- Explore IAN injuries thro socket less than 4 weeks
- Explore LN injuries before 12 weeks

Mx Methods



A small percentage of IANI patients (4%) received a combination of therapies involving CBT, surgery, medication and 5% lidocaine patches

Management of affective or behavioural problems

Liaison psychiatry

Cognitive behavioural therapy

50% Chronic pain sufferers are depressed

Wesseley S 2010

All pts were ‘counselled’

CBT was offered to 8% of patients

Medications

Neuralgic pain

- Oxcarbazepine
- Neurontin pregabalin
- Gabapentin

Burning chronic pain

- Nortriptyline > Amitriptyline

5% pts persisted with systemic meds

18% IANI used topical medication

Topical Lidocaine 5% patches

Botox injections

Peripheral local anaesthetic block

Check effect on local musculature- Facial nerve

Experience so far

TN	2
PTN	4
AO	2
Headache	21

Ngeow WC, Nair R Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2010 Mar;109(3):e47-50.
Injection of botulinum toxin type A (BOTOX) into trigger zone of trigeminal neuralgia as a means to control pain.

Surgical intervention

Why do we operate?

When do we operate?

What technique should be used?

How do we assess the outcome?

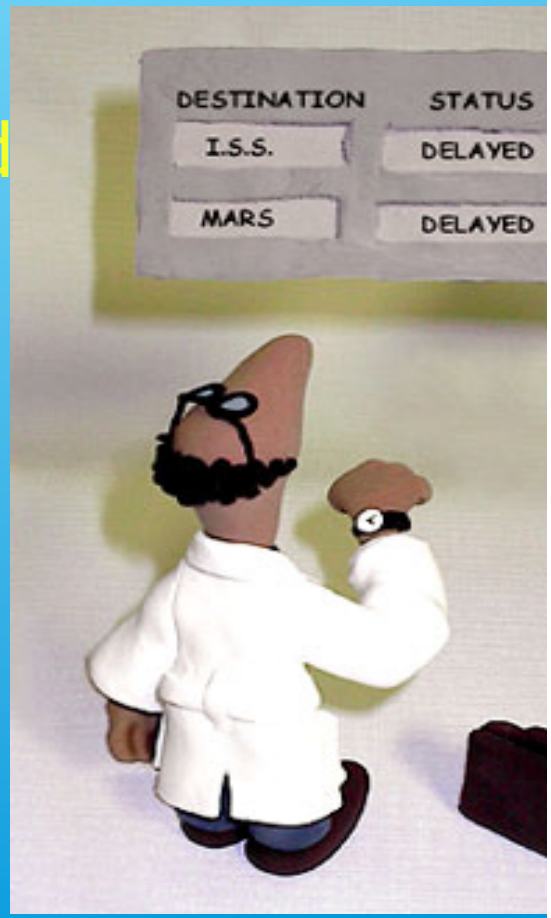
Why only surgery?

When do we operate?
Delay of referral for repair

Seddon's dictum (1943) 'if a purely expectant policy is pursued the most favourable time for operative intervention will always be missed'

Mean delay before repair for 21 studies is **16 months**

Why does this delay happen?



Why is the timing of nerve repair so paramount?

Peripheral consequences of nerve injury

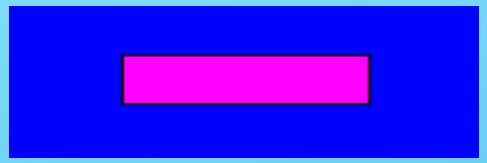
Central consequences of nerve injury

Improved outcomes

- Susarla et al 2007
- Ziccardi 2007

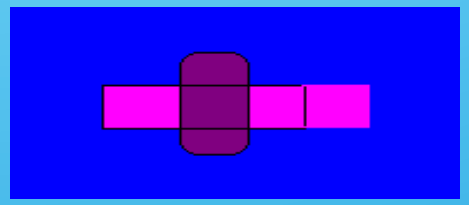
Nerve surgery

Exploration

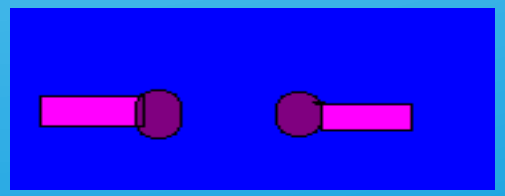


Decompression

Neuroma in continuity (NIC) excision and re-approximation

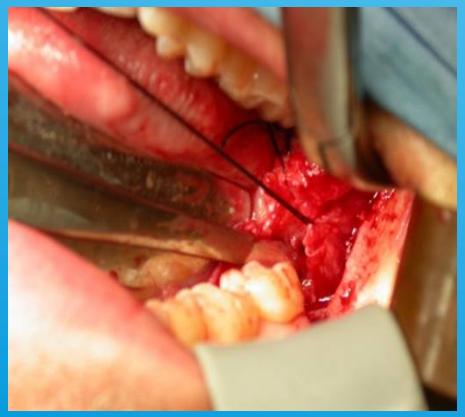


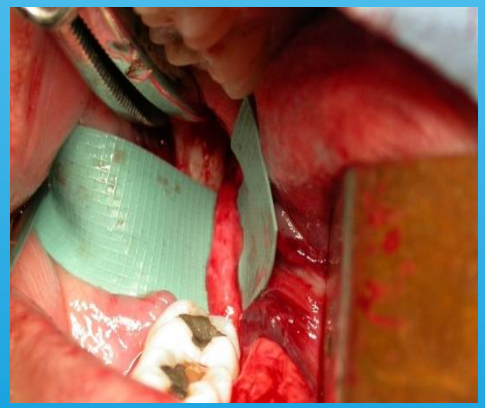
End neuromata EN) excision and re-approximation with minimal tension



Key surgical procedures carried out for LNI patients

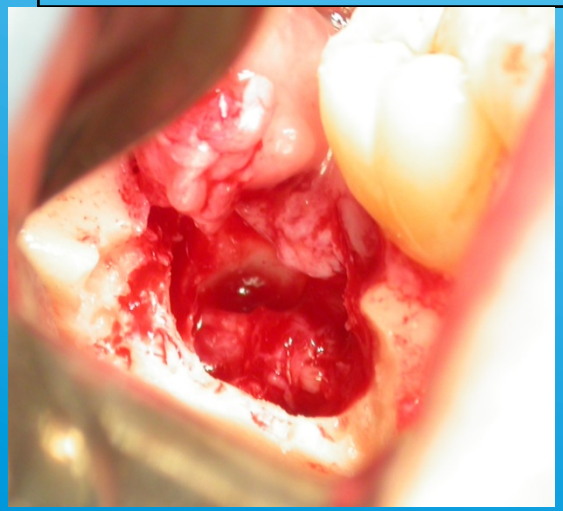
Procedure	Number of patients
Exploration and decompression	11
Release of scar tissue, excision of neuroma and re-anastomosis of the nerve	7
Nerve appears normal	1

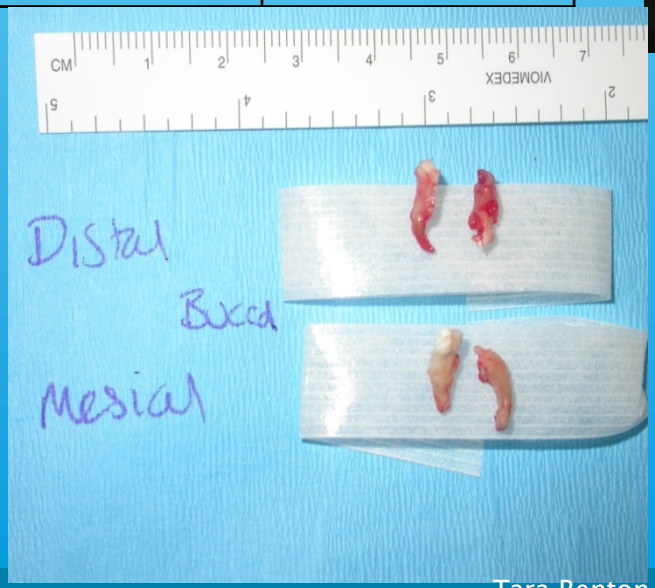


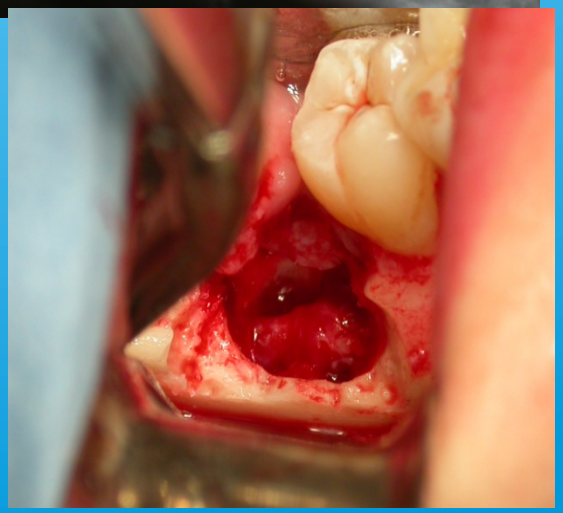


Key surgical procedures carried out for IANI patients

Procedure	Number of patients
Exploration and debridement	1
Exploration and decompression	2
Exploration and removal of roots and decompression	6
Excision of neuroma and reanastamosis of the nerve	3
Extraction of infected retained root and re-anastomosis of the nerve,	1







In Summary

Prevention

Let's not cause nerve injuries in our patients

Informed consent

Modified management

When we do we must use a holistic approach to managing the patient

Thank you

Zehra Yilmaz Post Doc Oral Surgery KCL

All the patients

Refs

Gan TJ; Risk factors for postoperative nausea and vomiting.; *Anesth Analg*. 2006 Jun;102(6):1884-98. [abstract]

Recommendations for standards of monitoring during anaesthesia and recovery. Association of Anaesthetists of Great Britain and Ireland; Guideline 4th Edition March 2007.

Pedersen T; Complications and death following anaesthesia. A prospective study with special reference to the influence of patient-, anaesthesia-, and surgery-related risk factors. Dan Med Bull. 1994 Jun;41(3):319-31. [abstract]

Young D, Griffiths J; Clinical trials of monitoring in anaesthesia, critical care and acute ward care: a review. Br J Anaesth. 2006 Jul;97(1):39-45. Epub 2006 May 12. [abstract]

Immediate postanaesthetic recovery, Association of Anaesthetists (2002)

Internet and further reading

AAGBI; Association of Anaesthetists of Great Britain and Ireland Website

Dr John Powell; a personal history of anaesthesia

Royal College of Anaesthetists; College website

The history of local anesthesia

REFERENCES

1. Scribonius Largus Compositiones Medicae, Helmreich G, ed., Leipzig, Teubner publ., 1887.
2. The Home Journal, New York, Nov. 28, 1858, p 4.
3. Archer WH, A Manual of Dental Anesthesia, second ed., Philadelphia, 1958, p 22.
4. Davison MH, The Evolution of Anaesthesia.