Are we making any progress on tinnitus?

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Overview

Mechanisms

Towards a solution

Models

Present treatment
# Tinnitus Progress Report

**Teacher's Name:** David Baguley  
**Student's Name:** The Audiology community  
**Date:** 15 May 2015

<table>
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<tr>
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**Comments:** (All comments are checked)

- Does Good Work
- Making Progress
- Working Hard
- Absences or Tardiness Affecting Work
- Works well with others
- Socializing is affecting their work
- Missing Assignments
- Turning his/her work in late
Audiologists Are...

A. Intelligent
B. Funny
C. Attractive
☑️ All of the Above
Hair cell damage: age
Central Auditory System

- Structured
- Two way
- A system
- Dynamic and changing
- Learning

- System noise
  - Heller and Bergman, 1952
Tinnitus Ignition sites

- Cochlea and auditory nerve
  - Noise induced
- Brainstem
  - Somatic
  - Dorsal Cochlear Nucleus
- Cortex
  - Reorganised CNS
- Baguley, Eggermont
  - 2007

Mechanisms

- Increased spontaneous activity
- Increased synchronous activity
- Network activity
Hair cell damage: age
• Male, 50 yrs old
• Bilateral tonal tinnitus,
• Intracranial monitoring of left hemisphere
• Intractable focal seizures
• Repeated suppression of tinnitus using residual inhibition
• Tinnitus driving network
  – Delta power and coherence
• Tinnitus memory network
  – Retrieval
  – Comparison with previous auditory memories
• Tinnitus perception network
  – Core network
Models
Living with tinnitus

- McKenna, Baguley, McFerran
- Sheldon Press, 2010

- British Tinnitus Association
- Amazon
Hearing anatomy

Ear and auditory nerve → Filtering and recognition → Conscious awareness

Filtering and recognition → Emotional brain

Emotional brain → Autonomic nervous system (fight or flight)
The central auditory system processing and enjoying music

Music

Sound converted to electrical nerve impulses → Music recognized and passed through filters → Conscious awareness

Pleasure

Relaxation or excitement
The filtering mechanism of the central auditory system prevents progression of random electrical activity

- Random electrical activity in ear or auditory nerve
- Filters block electrical activity
- No conscious awareness
- No emotional response
- No increase in autonomic activity
The filtering mechanism of the auditory system can fail

- Tinnitus related activity in ear or auditory nerve
- Filters fail to block electrical activity
- Conscious awareness and dislike
- Concern
- Increase in autonomic activity
The auditory system producing vicious circles

- Random electrical activity in ear or auditory nerve
- Filters fail to block electrical activity
- Awareness of persistent tinnitus
- Anxiety, fear, dismay
- Increase in autonomic activity
Habituation

Random electrical activity in ear or auditory nerve

Filters block electrical activity

No conscious awareness

No emotional response

No increase in autonomic activity
A cognitive model of tinnitus distress (McKenna, et al 2014)

- Distorted perception of tinnitus
- Selective attention and monitoring
- Arousal and distress
- Negative automatic thoughts (NATs)
- Tinnitus detection
- Tinnitus-related neuronal activity
- Beliefs
- Safety behaviours

Conscious process
Treatments
Sound therapy
Masking

• Itard (1821): environmental sound
• Wilson (1893): telephone
• Jones and Knudsen (1928): simple harmonic generator
• Vernon (1977): wearable device
The trouble with masking

• Poor take up: 50% (Henry et al., 2002)
• Very limited benefits
  – Hazell et al., 1985
  – Henry et al., 2002
• May hinder habituation
Hearing Aids

- Saltzman and Esner (1947)
- Uncontrolled studies: some benefit
  - Stacey, 1980
  - Surr et al., 1985
  - Surr et al., 1999
  - Trotter and Donaldson, 2008
- Controlled studies: low benefit
  - Melin et al., 1987
  - Moffat et al., 2009
- Systematic review (Hoare et al, 2014)
  - More research needed
McNeill et al., 2012

- N=70
- HL and tinnitus
- Retrospective design
- No blinding/placebo
- Benefit in 51% of patients
- No worsening
Why so little evidence?

• Little research
  • Noble, 2008

• Population biases
  • General hearing aid population
  • Population troubled with tinnitus

• Hearing aid prescription strategy
Searchfield (2014)

• Binaural and open fit
• Low compression knee point
• Expansion off
• Omnidirectional microphone
• Noise reduction off
Combination devices

• Sound therapy and hearing aids

• Minimal independent data

• Crucial data
  – Candidacy
  – Prescription
  – Benefits
Environmental sounds

• Handscomb (2006)
• Inexpensive bedside device
• Prospective observational trial, n=35
  • “sleep problems”
• Improvement on Sleep Quality Index
• Preferred sounds:
  • Brook
  • Birds
• White noise least liked
Tinnitus Retraining Therapy (TRT)

- Directive Counselling
- Sound enrichment
- Noise generators (>6hrs/day)

- Strictly defined
- Pure version available privately
TRT Evidence

• Cochrane Review
  – Searched 355 articles
  – 1 low quality trial (Henry, 2006)
  • TRT > masking
Cognitive Behavioural Therapy

- Beliefs affect perceptions and behaviour
Cognitive Behavioural Therapy ( CBT )

- Identifies and modifies maladaptive behaviours and cognitions

- Behaviour change and cognitive restructuring

- Effective in anxiety, chronic pain, phobia
CBT and tinnitus

- Information
- Functional analysis
- Manage hearing loss
- Sound enrichment
- Sleep hygiene
- Applied relaxation

- 10 weekly sessions
- Aspects available by Audiologists
- Internet?
Internet treatment

**Goal setting**

Before initiating treatment it is crucial that you identify the goals. Goal setting is a way to increase motivation and it is also useful for evaluation of the treatment.

Please register below at least two and a maximum of six goals. Also register how important each goal is for you. If you need any assistance in finding goals please click here. If you have clicked finished.

Print this page but not until you have clicked finished.

<table>
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<tr>
<th>Description of treatment goals</th>
<th>How important is it for you to reach the goal</th>
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Kaldo et al. (2004)
Abbott et al. (2009)
CBT and tinnitus

• Cochrane review
  – (Martinez Devesa et al., 2007, 2010)
  – 8 trials comparing CBT to waiting list controls or other active intervention (n=468)
• No effect upon tinnitus loudness
• Small beneficial effects upon
  – Quality of life
  – Depression
CBT and tinnitus

- Hesser et al. (2011)
- Meta-analysis of 15 trials (n=1091)
- Beneficial effect upon “tinnitus distress”
- Smaller beneficial effect upon mood
- Some indication of sustained benefit

- Tautology in psychological trials
- Can CBT be done by Audiologists?
Combining tinnitus care

Specialised treatment based on cognitive behaviour therapy versus usual care for tinnitus: a randomised controlled trial


Summary
Background: Up to 21% of adults will develop tinnitus, which is one of the most distressing and debilitating audiological problems. The absence of medical cures and standardised practice can lead to costly and prolonged treatment. We aimed to assess effectiveness of a stepped-care approach, based on cognitive behaviour therapy, compared with usual care in patients with varying tinnitus severity.
Method

• Standard Care
  – Audiometry
  – Basic information
  – Hearing aid and / or sound generator
  – Social work support (when needed)
  – \( N=247 \)

• Specialised Care
  – Audiometry
  – Basic information
  – Hearing aid and / or sound generator
  – Tinnitus counselling
  – Cognitive Behavioural Therapy
  – \( N=245 \)
Results

• At 12 months Specialised Care improved
  – Health Related Quality of Life (p<0.01)
  – Tinnitus Severity (p<0.01)
  – Tinnitus Impairment (p<0.01)

• Manage distress and fear as well as hearing issues

• Demonstrable cost efficacy (Maes et al., 2014)
Pharmacology

• Tinnitus can be modulated by medication
  – Lidocaine
  – SSRI

• Congruent with patient desire

• Several compounds under evaluation
NMDA glutamate receptors, which are overexpressed after excitotoxic injury, especially after acoustic trauma or ischemia, may be the trigger of increased spontaneous firing in the auditory nerve: tinnitus.
AM 101

• NMDA/glutamate antagonist
• Intratympanic
• Within weeks of onset
• Acute inner ear tinnitus following sudden deafness, acute acoustic trauma or acute otitis media
• TACTT3 trial underway
Protocol AUT032063
QUIET-1: “The QUest In Eliminating Tinnitus”

A Balanced Randomised Placebo Controlled Double-blind Phase IIa Study to Investigate the Efficacy and Safety of AUT00063 Versus Placebo in Subjective Tinnitus
Repetitive Transcranial Magnetic Stimulation
Neuronavigated Coil localisation

Datafusion

MRI - Data
PET - Data

Segmentation

Fusion

Fused Dataset

Langguth et al., Neuroreport, 2003
rTMS benefits

• Temporary improvement in 50%
• Duration
• Side of tinnitus

• Meng et al., 2011 Cochrane Review

• Some worsening
• Need for repeat treatments
• Cost
Direct brain stimulation

Transcranial magnetic stimulation can only be performed for a limited amount of time

Longer (ongoing) stimulation might result in more effective treatment

Implantation of an electrode on the brain, which is connected to a generator (similar to a cardiac pacemaker)

40 patients being implanted worldwide

Dirk De Ridder (2007)
Towards a solution

• Careful selection of patients for studies
  – Time of problem
  – Trigger of problem
  – Extent of reaction
• Randomised controlled trials
• Good outcome measures

Methodological aspects of clinical trials in tinnitus: A proposal for an international standard

Michael Landgrebe a,b,*, Andréia Azevedo c, David Baguley d, Carol Bauer e, Anthony Cacace f, Claudia Coelho g, John Dornhoff er h, Ricardo Figueiredo c, Herta Flor i, Goeran Hajak j, Paul van de Heyning k, Wolfgang Hiller l, Eman Khedr m, Tobias Kleinjung n, Michael Koller o, Jose Miguel Lainez p, Alain Londero q, William H. Martin r, Mark Mennemeier s, Jay Piccirillo t, Dirk De Ridder u, Rainer Rupprecht a, Grant Searchfield v, Sven Vanneste u, Florian Zeman o, Berthold Langguth a,b
Tinnitus Functional Index

- Meikle et al., 2012
- 25 items, self report
- High validity
- Sensitive to treatment outcomes
Towards a solution ii)

- Summarise and share specialist knowledge
Towards a solution iii)
EU COST TINNET

Goal: Understand heterogeneity of tinnitus

Objectives

(1) Clinical and audiological assessment of tinnitus patients according to common standards

(2) Data management in a central database and identification of subtype candidates

(3) Developing standards for neuroimaging studies and probing the neurobiological entity of the defined subtypes by large-scale analyses of neuroimaging data

(4) Identifying the involvement of genetic factors in the pathogenesis of the different subtypes of tinnitus

(5) Development of standards for outcome measurements in clinical trials and central data
New perspectives in psychology

• Treatment via the internet
  – Eldre Beukes, ARU

• Acceptance and Commitment Based therapy
New technologies

- Mutebutton
- Pro Music Therapy
- Antitinnitus
- ANM
- Neuromonics
- SoundCure
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Questions and Answers