

Abstracts

The following papers were presented at the Annual Spring Meeting of the Ulster Biomedical Engineering Society in collaboration with the Association of Physical Scientists in Medicine, held in Newry, Northern Ireland on 19-21 May 1989*

A PORTABLE MULTI-ECG DATA RECORDER

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The system developed consists of a memory card and a portable digital recorder unit. A canvas harness which encloses a matrix of 36 electrode sites detects the unipolar electrocardiograms (ECGs) when attached to the patient's chest. Two pre-amplifying boxes are used to amplify signals from the 36 electrode harness or a standard 12 lead system. These signals are then digitized and stored by the recorder unit on to the memory card, which can be unplugged freeing the unit for future use. These temporary patient records are downloaded into an IBM personal computer. System software developed allows the doctor to create a database of patient maps and will perform both ST and QRS complex analyses. Each patient record can easily be reviewed in ECG strip form on the computer screen.

The technique of recording ECGs at 36 points is used to assess anterior infarcts, whilst using five of the 12 standard leads for inferior infarcts. Initial ST segment elevations measure ischaemic injury, while QRS complex parameters on later maps indicate final necrosis. Alterations of the relationship between initial injury and final necrosis are used to compare the efficacy of streptokinase and APSAC. These agents are administered outside hospital, and the recording equipment was, until now, too cumbersome for use in this setting.

COMPARISON OF PLANAR AND SINGLE PHOTON EMISSION COMPUTED TOMOGRAPHY TECHNIQUES FOR IMAGING MYOCARDIAL PERFUSION DEFECTS USING A ^{99m}Tc -LABELLED ISONITRILE

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Myocardial perfusion imaging with thallium-201 has become a routine part of the clinical evaluation of patients with coronary artery disease. Recently a number of isonitrile analogues have been labelled with

technetium-99m. One of these Tc-99m labelled myocardial agents (2-methoxy-2 methyl isopropyl-isonitrile: MIBI) (RP30) provides several advantages over Tl-201. Its short physical half-life reduces the radiation burden, while the higher photon flux allows planar and tomographic images of high technical quality to be obtained. 15 mCi of RP30 was injected at peak exercise and again at rest one day or so later with imaging by planar and tomographic methods one hour after injection. In tomography the data were acquired over a 180° arc taken anteriorly about the patient's chest, starting at LPO 45°. Filtered back-projection techniques were then used to generate transaxial slices through the body at the heart level and these were compared with the standard planar images, anterior, LAO 45° and LAO 75°. In normal patients the tracer distribution was homogeneous and identical at rest and exercise. Myocardial infarction was well defined at rest and at stress, while ischaemic segments were well perfused at rest but not at stress. It is concluded that RP30 is a promising new agent to image regional myocardial perfusion using tomography.

A PHOTOELASTIC AND FINITE ELEMENT APPROACH TO PROSTHETIC DESIGN EVALUATION

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A two-dimensional photoelastic model of the proximal tibia, with cemented tibial component is presented. The materials used in the model were polymers and resins. CT200 was used to model the cement layer and the methods used to produce a stress-free CT200 layer are discussed. Two prosthetic designs were investigated, a polyethylene component with central fixation post and polyethylene component with metal, backing plate and fixation post. Two different methods were used to load the models non-symmetrically, with a disc and a square punch. Square punch loading was found to result in lower cement stresses and a metal backing plate resulted in lower stresses than the polyethylene component. This work was complemented by a two-dimensional finite element analysis of the proximal tibia using the same material properties and dimensions. It is concluded that photoelasticity is a reliable method of verifying two-dimensional finite element models of tibial components. An outline for the three-dimensional analysis of tibial components using finite element techniques with experimental verification is presented.

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Table of Contents Environment Abstracts Annual 1989 Vol19

1. Understanding the eBook Environment Abstracts Annual 1989 Vol19
 - The Rise of Digital Reading Environment Abstracts Annual 1989 Vol19
 - Advantages of eBooks Over Traditional Books
2. Identifying Environment Abstracts Annual 1989 Vol19
 - Exploring Different Genres
 - Considering Fiction vs. Non-Fiction
 - Determining Your Reading Goals
3. Choosing the Right eBook Platform
 - Popular eBook Platforms
 - Features to Look for in an Environment Abstracts Annual 1989 Vol19
 - User-Friendly Interface
4. Exploring eBook Recommendations from Environment Abstracts Annual 1989 Vol19
 - Personalized Recommendations

- Environment Abstracts Annual 1989 Vol19 User Reviews and Ratings
- Environment Abstracts Annual 1989 Vol19 and Bestseller Lists
- 5. Accessing Environment Abstracts Annual 1989 Vol19 Free and Paid eBooks
 - Environment Abstracts Annual 1989 Vol19 Public Domain eBooks
 - Environment Abstracts Annual 1989 Vol19 eBook Subscription Services
 - Environment Abstracts Annual 1989 Vol19 Budget-Friendly Options
- 6. Navigating Environment Abstracts Annual 1989 Vol19 eBook Formats
 - ePub, PDF, MOBI, and More
 - Environment Abstracts Annual 1989 Vol19 Compatibility with Devices
 - Environment Abstracts Annual 1989 Vol19 Enhanced eBook Features
- 7. Enhancing Your Reading Experience
 - Adjustable Fonts and Text Sizes of Environment Abstracts Annual 1989 Vol19
 - Highlighting and Note-Taking Environment Abstracts Annual 1989 Vol19
 - Interactive Elements Environment Abstracts Annual 1989 Vol19
- 8. Staying Engaged with Environment Abstracts Annual 1989 Vol19
 - Joining Online Reading Communities
 - Participating in Virtual Book Clubs
 - Following Authors and Publishers Environment Abstracts Annual 1989 Vol19
- 9. Balancing eBooks and Physical Books Environment Abstracts Annual 1989 Vol19
 - Benefits of a Digital Library
 - Creating a Diverse Reading Collection Environment Abstracts Annual 1989 Vol19
- 10. Overcoming Reading Challenges
 - Dealing with Digital Eye Strain
 - Minimizing Distractions
 - Managing Screen Time
- 11. Cultivating a Reading Routine Environment Abstracts Annual 1989 Vol19
 - Setting Reading Goals Environment Abstracts Annual 1989 Vol19
 - Carving Out Dedicated Reading Time
- 12. Sourcing Reliable Information of Environment Abstracts Annual 1989 Vol19
 - Fact-Checking eBook Content of Environment Abstracts Annual 1989 Vol19

- Distinguishing Credible Sources
- 13. Promoting Lifelong Learning
 - Utilizing eBooks for Skill Development
 - Exploring Educational eBooks
- 14. Embracing eBook Trends
 - Integration of Multimedia Elements
 - Interactive and Gamified eBooks

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