An Introduction to the Critical Appraisal Section (including example questions)

Introduction

This section is common to the specialties of Dental Public Health, Oral Medicine, Oral Surgery, Orthodontics, Paediatric Dentistry and Restorative Dentistry.

The Critical Appraisal Section will consist of a written examination lasting 2 hours. Candidates will be given reference material consisting of extracts from published research and other scientific publications, appropriate to their specialty, and sets of questions to which written answers are required. Candidates will normally be given extracts from 2 different publications.

The Critical Appraisal Section will test the candidate's knowledge and understanding of:

Concepts of evidence based practice
This includes:
- the scientific principle
- the evidence hierarchy attributed to different study designs
- grading of scientific evidence
- the principles of the CONSORT and STROBE consortia in reporting clinical trials and observational studies
- the relevance and applicability of scientific information to clinical practice.

Study type and study design
This includes:
- the most appropriate research designs to examine hypotheses
- the epidemiological study sequence
- the limitations and strengths of research methodologies
- the strengths and weakness of different study designs including cross-sectional, prospective and retrospective observational studies, case-control studies and cohort studies and randomised and non-randomised controlled trials, parallel groups, split-mouth, matched pair and crossover designs systematic reviews and meta analysis
- questionnaire design
- quantitative and qualitative studies
- use of techniques such as interviews, focus groups, transcripts of narrative material
- concepts of randomization and stratification
- the potential sources of bias and error in study design
- basic epidemiological terms, including prevalence and incidence
- issues of research ethics as they apply to study conduct.

Concepts of bias and confounding
This includes:
- sources of bias; selection bias, measurement bias, observer bias, publication bias, recall bias, allocation bias
- controlling for bias
- blinding
- confounding
- controlling for confounding via study design
- accounting for confounding via statistical analysis.

Basic statistical concepts

This includes:
- the validity of the sample
- inclusion and exclusion criteria
- sample size estimation
- Type I and Type II errors
- confidence intervals
- probability and correlation coefficients
- interpretation of results from common statistical tests used for parametric data (e.g. t-tests, analysis of variance, multiple regression) and non-parametric data (e.g. chi squared, Mann-Whitney U)
- interpretation but not calculation of: odds ratios and relative risk
- sensitivity and specificity as they apply to diagnostic tests and receiver operator characteristic (ROC) curves
- interpretation of Forrest and Funnel plots as presented in systematic reviews and meta-analyses
- the concept of intention to treat analysis.

Evaluation of research findings

This includes:
- issues of internal and external validity of a study
- statistical vs clinical significance
- appreciation of experimental vs field trials
- the concept of number needed to treat
- appreciation of primary and secondary (surrogate) outcome measures
- risk/benefit considerations
- application (generalisability) of study findings to local populations.

Background Reading

Specialist training will, it is expected, have made candidates familiar with the relevant scientific literature. In this examination candidates will be expected to demonstrate how well they understand the principles of scientific research (study design, statistical treatment, and presentation of results), and to interpret scientific evidence and identify strengths and weaknesses in scientific papers.

These critical appraisal skills may be acquired by reading papers, textbooks or electronic media devoted to the subject or by attending courses. The following resources are recommended:

Books

Greenhalgh T. *(2006) How to read a paper – the basics of evidence based medicine.* 3rd Ed. Blackwell Publishing. BMJ Books. ISBN 1-4051-3976-5

Petrie, Bulman and Osborn (2002) *Further Statistics in Dentistry*, a series of 10 articles in the British Dental Journal starting in volume 193 on page 377 (7 October 2002).

Petrie A, and Sabin C. (2005) *Medical Statistics at a Glance.* Blackwell Publishing. ISBN 978-1-4051-2780-6

Hackshaw A et al. (2006) Evidence-based dentistry. An Introduction. Blackwell Munskgaard: London ISBN 1-4051-2496-2

Questions

The Critical Appraisal Section will comprise a number of question-sets. Example questions are provided here to give you an idea of what this Examination involves. The following examples are representative of the types of questions that candidates are likely to be asked in this section. The list below is not exhaustive and actual questions posed in specific examinations may differ.

At the start of the examination you are strongly advised to read the questions before reading the extracts: This will indicate to you the information you need to extract from the text. All questions should be attempted as marks will not be deducted for incorrect answers.

Example questions

- What research question did the authors study?

- What was the null hypothesis is this study?

- What type of study is this? What are the other main types of study design?

- Give the advantages and disadvantages of observational versus experimental designs.

- Give the advantages and disadvantages of prospective versus retrospective designs.

- What factors need to be taken into account in study design?

- Explain the basis of the Chi square test and explain why it was used in this study.

- Give the reasons for the exclusion criteria used in this study.

- Discuss the inclusion criteria used in the present study.

- Why is randomisation important in this study?

- Define the term 95% Confidence Interval and explain the significance of the CI in the present study.

- Explain Pearson correlation and what it demonstrates in the present study.

- What are Cohen's kappa statistics used for? What do the values presented in this paper indicate?

- What percentage of subjects either withdrew or were lost from the study? How may this influence the interpretation of the results?

- Explain the basis of the t test and explain why it was used in this study.

- Explain the basis of the Mann Whitney U test and explain why it was used in this study.

- What information is required to calculate the power of this study?

- Discuss how bias may influence the results in the present study.

- This paper describes a cross-sectional study. What are the advantages and disadvantages of this design?

- This study is a randomised controlled trial. What factors were considered during the study design?

- In relation to this randomised, controlled trial, is the method of randomisation adequate? Give reasons for your answer.

- What do you understand by the term 'intention to treat analysis'? Is this method used in the present study?

- What is the purpose of a power calculation?

- What are the possible consequences of omitting a power calculation?

- Kappa values of 0.83 for intra-examiner reproducibility and 0.96 for inter-examiner reproducibility are mentioned. What Kappa values are generally considered to be satisfactory?

- For what type of data is the Chi-square test an appropriate test and why?

- What is a retrospective cohort study?

- State the advantages and disadvantages of a retrospective study.

- What type of study is a cohort study?

- Why was the endodontic specialist looking at the radiographs blinded to the outcomes of the root filled teeth?

- What is the purpose of blinding and explain the terms double and triple blinding?

- P=0.0004. What does this mean?

- Define the term 'the mean'.

- Define the term 'standard deviation'.

- Tests of inter-examiner and intra-examiner reliability are often performed in studies. Explain what these are and why it is important to do this.

- What are reliability coefficients?

- Is the Wilcoxon signed rank test a parametric test or a non-parametric test? Briefly describe how this test works.

- What steps do you have to go through to undertake a sample size calculation?

- The study was a randomised, controlled, parallel group, cluster clinical trial. What does this mean?

- The author described the steps taken to blind the study. Why is this necessary?

- The study received ethical approval. List five issues that the ethics committee would potentially have examined or considered in their approval of the study.

- In the materials and methods section, the factors that should be considered in calculating the sample size are described. What are the study outcome measures? Discuss whether these are appropriate.

- We are told that the data were analysed on an 'intention-to-treat' basis. What does this mean and why is this important?

- What is the prospective study of a representative birth cohort?

- What is logistic regression analysis?

- What are the primary outcome measures in this study?

- What are the secondary outcome measures in this study?

- What are the implications of this study for clinical practice?

- Does this study suggest that further research is required?

PLEASE NOTE THAT THE REFERENCE MATERIAL PROVIDED IN THE CRITICAL APPRAISAL SECTION WILL VARY IN COMPLEXITY, THE QUESTIONS ASKED WILL VARY IN DEGREE OF DIFFICULTY, AND THE PASS MARK WILL BE SET ACCORDINGLY.

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