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Editorial

Selective reading

Every month approximately 4,000 medical journals are published world-wide and every year more and more new medical and dental journals are appearing in print. The orthodontic literature has also been affected by this increase in published papers with new orthodontic journals appearing on a regular basis. This expansion of the medical and dental scientific literature is in part driven by the increasing demand for academic clinicians to show their productivity by the quantity of their publications. Since the quality, importance and the future applicability of research are often hard to judge the orthodontic literature is growing rapidly. This creates a dilemma for busy clinicians with limited time to read scientific papers. In our training as orthodontists we receive scant education in the science of critically appraising research papers. We often have difficulty in identifying important papers from poor quality studies whose claims should be discounted. It is therefore easy to understand why many orthodontists avoid reading the scientific sections of journals and instead prefer to peruse the less demanding clinical sections which illustrate well treated cases or new appliances.

However, as orthodontics along with the rest of dentistry and medicine moves on to a more evidence-based footing it is increasingly important that we all keep abreast of the scientific literature. The science of evaluating and implementing the results of orthodontic research makes patient care more objective, more logical and more cost effective. This does not mean that we need to read every paper in every orthodontic journal. Selectivity in reading is essential so that we have sufficient time to read the truly important papers in detail. But how can we recognise the good papers and how can we avoid wasting our time on papers of marginal relevance? Fortunately, if we know what we are looking for each section of a scientific paper contains clues, which can help us to identify good research papers. The introduction section of a paper usually provides the first indication of its quality. Clearly stated and tightly focused aims suggest that the research hypothesis was specified in advance while wide-ranging and woolly aims suggest that many different issues were pursued in the hope that something significant would emerge.

The method section is perhaps the single most important guide to the quality of a paper. The best studies are those that have used a prospective randomized study design but this type of investigation is still relatively rare in orthodontic research. A large increase in the number of prospective randomized studies whilst desirable is unlikely due to the time, cost and ethical implications of using this technique. Therefore, it is likely that retrospective and non-randomized studies will continue to dominate the orthodontic literature. Should we be so selective in our reading that we only consider papers where a prospective randomized study design was used? Although a cogent argument can be made to support this approach it does ignore the important contribution that can be made by alternative study designs. If a clinical study is not prospective and randomized we should not discount it immediately but read it carefully and be aware of the potential for bias which arises from factors such as growth, patient preferences and operators' judgements. In orthodontic studies subjects are often included because they are convenient (personal case series) and the selection process can produce an atypical and unrepresentative sample. In good studies the researchers will make every attempt to prevent this from happening but in the end we must use our common sense to decide if the baseline differences between the intervention and control groups have influenced the results.

Researchers often find it more difficult than anticipated to recruit subjects and as a result under-powered studies are ubiquitous in the orthodontic literature. Perhaps as a reaction to this we tend to give more credence to studies with large sample sizes ignoring the fact that a large sample size provides no protection against selection bias. Therefore, another quality sign to look for in the method is how the researcher decided on the number of subjects included in the study. A good study will specify the size of the effect being sought and a formal sample size calculation will have been made to determine precisely how many subjects should be included to detect this effect. In good studies the authors will also report

how the validity and the reliability of the measurement techniques were tested.

When reading the results section of a paper alarm bells should start to ring if the authors use multiple hypothesis testing. This trend towards too many analyses and multiple endpoints examined in numerous subgroups is a symptom of the availability of powerful statistical software. We should be aware of the fact that if 6 independent hypotheses are tested there is a 1 in 4 probability that at least one will be significant by chance alone.

The discussion section also contains useful indicators of the quality of a paper. It is not uncommon to find that the conclusions made by the authors are not fully supported by the results. One should be wary of papers where the authors have relentlessly pursued $p < 0.05$ at all costs and then automatically equated statistically significant as clinically important. In good quality papers the discussion should be an intelligent and impartial interpretation of the results and how they relate to previous similar studies. In the final analysis the quality of a paper depends on whether the authors have convinced you that their findings are correct, that they are important and that they can be generalised to the patients that you treat.

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