

F O R E W A R D

Orthodontics, authors' opinions and scientific facts: *Cum hoc ergo propter hoc?*



Ph. Amat

Former lecturer at Paris V
Private practice in Le Mans

"One of the biggest mistakes a scientist can make is to always try to prove his own thesis rather than seeking arguments that disprove it."

Karl Popper

INTRODUCTION

When they are seeking possible relations of causality, mightn't it be possible that clinicians sometimes let themselves be deceived by the fallacy *Cum hoc, ergo propter hoc* (*with this, therefore because of this*)?

After reading the exchanges that periodically enliven publications devoted to the relationship between extractions and ALD, orthodontics and idiopathic scoliosis in adolescents, extractions and OSA, etc., it seems appropriate to ask this question. In fact, some authors continue to categorically affirm the existence of a causal link between these factors and

these pathologies, in spite of all the convincing data that presently indicates an absence of any causal relationship.

The Latin phrase *Cum hoc, ergo propter hoc* (*with this, therefore because of this*) is a type of fallacious reasoning. It consists in claiming that if two events are correlated, the relationship is causal in nature. This error is particularly seductive since we have a natural tendency to associate correlation and causality, rather than to look for the presence of other factors, that might exclude the causal link.

Address for correspondence:

Philippe Amat
8 rue Buffon
72000 Le Mans
amatph@noos.fr

THE NOTION OF CAUSALITY

Of course, if two events A and B are correlated, A may be the cause of B. But there are at least four other explanations: B may be the cause of A, A and B may both be the cause of the other, A and B may be caused by a third event C, and there may be no causal relationship between A and B.

If a statistically significant association between a risk factor and the occurrence of a pathology is easily demonstrated, this by itself is not sufficient proof of a causal relationship. This kind of demonstration is more involved and sometimes misleading. In order for a risk factor to be considered a causal factor for the onset of a pathology, the variation in frequency (or of its average value) has to induce a variation in the frequency of the pathology¹.

In clinical research, the only direct method for establishing a causal link is to conduct an experimental study: the clinical investigator controls the risk factor and observes the onset of the pathology. However, due to the cost and ethical considerations involved, randomized controlled trials are less frequently used for epidemiological research than etiological studies. An etiological study (case study/witnesses or a study of an exposed or unexposed cohort) is not, however, sufficient for demonstrating by itself that a risk factor is responsible for the onset of a pathology. The demonstration of causal link must be based on an aggregate of arguments and must include two stages: the internal validity of the study and the Bradford Hill criteria for causation⁶.

CLINICAL IMPLICATIONS

Establishing a distinction between correlation and causality may seem to be superfluous and to only have a limited clinical incidence for dentofacial orthopedics, a specialty where the prognosis for survival is rarely involved. For example, the question of whether or not there is a potential indication for the enucleation of the wisdom teeth does not seem to be a major medical decision.

However, the confusion between correlation and causation is not harmless and can lead to serious medical errors, as shown by the well-known case of the prescription for orally administered hormone replacement therapy (HRT) for menopausal women

in order to preclude the risk of ischemic cardiopathy. This recommendation was based on a number of epidemiological studies^{3,5,9} showing that women who followed the HRT regimen also had a lower incidence of coronary cardiopathy.

In 2002, a randomized, controlled clinical trial, carried out to assess the preventative effects of HRT on certain chronic cardiovascular diseases, was interrupted. This decision was made when the initial results indicated that orally administered hormone replacement therapy caused a slight but statistically significant increase, for the risk of ischemic cardiopathy¹⁰.

An *a posteriori* analysis of the data from previous epidemiological studies then showed that the women on HRT more often came from a higher socio-economic group who exercised more and had a healthier diet than average. The difference in life style between users and non-users of HRT, and not orally administered HRT by itself, was the causal factor for the low coronary risk⁷.

In dentofacial orthopedics, even if a cause-effect relationship is only rarely demonstrated between two correlated elements, the critical judgment and clinical common sense of the clinician compels him to exercise

greater oversight. For example, the high prevalence of associations between idiopathic scoliosis in adolescents and craniofacial abnormalities calls for collaboration between the related disciplines of general orthopedics and dentofacial orthopedics, for early detection as well as therapeutic effectiveness². The orthodontist could contribute to the early management of spinal deformities by recommending a screening examination, whenever a patient presents with certain dentoskeletal characteristics, such as Class II malocclusion or with signs of dentofacial asymmetry^{4,8}.

THE SPECIAL EDITION EXTRACTION/NON-EXTRACTION

This special edition *extraction/non-extraction*, is the second issue in a series of two, that the RODF Review of Dentofacial Orthodontics is devoting to the theme of extractions in orthodontics. The objective of these special edition issues is to offer an up-to-date synthesis of the debate between the defenders and the detractors of the therapeutic indication for extraction.

The authors, who were invited by the RODF editorial committee to participate in this second special issue, were each asked to present a key point of this debate.

Sarah Chauty undertook a review of the literature to investigate whether or not self-ligating brackets were at least an equivalent alternative to traditional braces for non-extraction treatments. The agreed upon criteria are indications for extractions, a biomechanical approach, the stability of the

therapeutic results, the iatrogenic effects and ergonomic principles.

Jean-Michel Salagnac poses the relevant question concerning the indication for enucleation or extraction of the 3rd molars for patients during, or at the end of dentofacial orthodontic treatment. He provides a perspective, tempered and supported by the published findings, of a practitioner with 40 years of experience in orthodontics.

Alain Bery presents the ethical and judicial factors involved with the extraction of healthy permanent teeth. In a media-hyped environment, where extractions have become routine, this concern that is not addressed during consultation, poses a problem for the patient-practitioner relationship.

Hervé, Clémence and Charles Poulet suggest that we should change paradigms in cases of agenesis of the incisors. Based on a study of an

orthodontic patient population, they evaluate the various therapeutic options, from the least invasive to the most invasive.

Hélène Desnoës presents developmental abnormalities that occur during the course of orthodontic treatments without extraction of the premolars. Through a retrospective study, she offers us some decision criteria in an attempt to stifle the argument concerning the prevalence of developmental accidents of the second molar.

Among the usual sections in the Review of Dentofacial orthopedics

(RODF), the heading *Clinical Case* welcomes Patrick Guézéneec, who presents the treatment of a Class II without extractions using the Bioprogressive method.

Julia Cohen-Lévy shares with us her *Radiological Reflections* regarding fetal alcohol syndrome and one of its innocent victims. Finally, Alain Benauwt comments on the indication for extraction of premolars, recommended by Jacques Faure in the clinical case that he published in our preceding issue.

CONCLUSION

The maxim attributed to Henry Louis Mencken, "There is always an easy solution to every human problem-neat, plausible, and wrong." humorously sums up both how difficult it is to provide a definitive proof of a causal link in epidemiology and the recurrent theme of scientific uncertainty.

We have to admit that even if the prudent interpretation of the little available data is not as easy as just applying without careful consideration the opinions of the authors, this is however what our patients prefer and what we prefer when they come in for consultation.

BIBLIOGRAPHY

1. Amat P. Dentisterie fondée sur les faits : en omnipratique et en orthodontie. Paris : Éditions CdP, 2012.
2. Amat P. Chapter 2 - Scoliosis, Orthodontics and Occlusion, are there Evidence? 49-72 in Scoliosis: Causes, Symptoms and Treatment. New York: Nova Science Publishers, 2012.
3. Barrett-Connor E, Grady D. Hormone replacement therapy, heart disease, and other considerations. *Annu Rev Public Health* 1998;19:55-72.
4. Ben-Bassat Y, Yitschaky M, Kaplan L, Brin I. Occlusal patterns in patients with idiopathic scoliosis. *Am J Orthod Dentofacial Orthop* 2006;130:629-633.
5. Grady D et al. Hormone therapy to prevent disease and prolong life in postmenopausal women. *Ann Intern Med* 1992;117:1016-1037.
6. Hill AB. The environment and disease: association or causation? *Proc R Soc Med* 1965;58:295-300.

7. Lawlor DA, Davey Smith G, Ebrahim S. Commentary: the hormone replacement-coronary heart disease conundrum: is this the death of observational epidemiology? *Int J Epidemiol* 2004;33:464-467.
8. Lippold C, van den Bos L, Hohoff A, Danesh G, Ehmer U. Interdisciplinary study of orthopedic and orthodontic findings in pre-school infants. *J Orofac Orthop* 2003;64:330-340.
9. Stampfer MJ, Colditz GA. Estrogen replacement therapy and coronary heart disease: A quantitative assessment of the epidemiologic evidence. *Prev Med* 1991;20:47-63.
10. Writing Group for the Women's Health Initiative Investigators. Risk and benefits of estrogen plus progestin in healthy postmenopausal women. *JAMA* 2002;288:321-333.