



CLINICAL RESEARCH

INTO

GLASS IONOMER CEMENTS

A COLLECTION OF PUBLISHED PAPERS

SUBMITTED FOR

THE DEGREE OF DOCTOR OF DENTAL SCIENCE

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## INTRODUCTION

Since graduation I have been interested in the materials used for the restoration of teeth following carious attack. I studied and conducted various minor investigations into materials within my general practice before being invited to lecture in this area to dental students, dental assistants and at Dental Congresses. My first published paper concerned cavity lining and pulp protection and followed an invitation to lecture on that topic at the Australian Dental Congress in 1964. At a subsequent Congress I joined Dr. C.M. Somerville in presenting a television clinic on dental amalgam and this led to further publications on this material. With the assistance of the members of the General Practice Study Group I then embarked on a study of the causes of failure of amalgam restorations and this in turn led to an interest in treatment planning and cavity design modifications for amalgam.

Having presented courses in this area with Dr. Makinson on several occasions for the Post Graduate Committee in Dentistry I was invited to present a series of papers to the New Zealand Dental Association Convention in Wellington in 1976. The resultant three papers in the New Zealand Dental Journal led to further interest in cavity design and subsequently a paper on modifications to the amalgam cavity.

In 1972 I read Dr. A.D. Wilson's initial paper on glass ionomer cements and it seemed that this material could hold some interest for the dental profession. I became aware that Dr. J. W. McLean of London was involved in the clinical development of the cements so I corresponded with him and visited him in his practice. Eventually, at my invitation, he presented ASPA to the profession at the Adelaide Dental Congress in 1976. As often happens, there was an immediate surge of interest which then waned equally rapidly because dentists found it to be different from expectations and in many ways unsatisfactory in the form in which it was presented.

With encouragement and support from Dr. Makinson and permission to use the facilities of the Dental Materials Laboratory at the Dental School, The University of Adelaide, I embarked on a series of experiments to determine how to improve results with ASPA. Having observed Dr. McLean at work and seen some of his three and four year results it was apparent that the material deserved further attention. The manufacturers' instructions for the earliest batches of the product were very poorly written and failed to direct the operator into safe and reliable methods of use. The prescribed powder/liquid ratio was 3:1 but there were no means provided for measurement of the powder. At my suggestion the manufacturers included a

measuring device which they had previously packaged with their polycarboxylate cement because I had shown that this would provide approximately the correct quantity of powder required.

Initially there was no sealant provided to isolate the newly placed restoration from the oral environment. It was apparent that some type of varnish was desirable and it was equally apparent that the traditional copal varnish was entirely inadequate. Correspondence with the manufacturers encouraged them to correct these and other deficiencies and provided a guide to other manufacturers as they entered the market.

I began at that time to record all restorations placed in my own practice and these were monitored as closely as possible for the next seven years. Over the subsequent years, other manufacturers introduced variations of the glass ionomer formula to the market and the original company (Densply) upgraded their product. I was encouraged to continue my investigations with the support and advice of Dr. Makinson and this work has resulted in the following series of papers.

The significance of these papers lies largely in the interpretation of the scientific facts as defined by Dr. Wilson and others and the translation of those facts to the successful clinical application of the material in the oral cavity. As with all dental materials there are significant parameters to their successful placement and these can only be defined through careful laboratory experimentation and translation of those results to the clinic.

Over the years manufacturers developed a number of modifications and variations to the original formula and suggested new clinical applications. It became apparent that a classification was required to guide the manufacturers, researchers and the profession in further developments. I worked on defining such a classification and, eventually, just prior to the publication of the first definitive text book on the glass ionomer cements by A.D. Wilson and J.W. McLean, I had the opportunity of discussing this with the authors. They accepted my definitions and they were duly published. This is now the recognised classification used throughout the profession.

By 1988 it was becoming obvious that there was a serious lack of text books on the subject of the glass ionomer cements. I was aware that Dr. Wilson and Dr. McLean were working on a major text but no one had attempted an atlas type publication which would be of value to the practising clinician who had no particular interest in the deeper aspects of the science of these materials. Using my published papers as a

basis, as well as the clinical photographs that I had been collecting since the material was first introduced in 1976, I assembled a text which was published in December 1989 under the title of "An Atlas of Glass Ionomer Cements: A clinicians guide".

My knowledge of chemistry limits my ability to define developments to this material but my understanding of clinical limitations and my observation of clinical results over a period of fifteen years has led to a clarification and definition of the profession's ability to utilize these cements to achieve optimum results.

The papers are listed strictly in the chronological order of publication. This does not, in fact, represent the order in which the work was carried out because the lag time for publication in the Australian Dental Journal is generally between two and three years.

The series of five papers concerning the composite resin/glass ionomer cement laminate technique, which were published in 1989, were the result of a concentrated three years work in the Dental Materials Laboratory beginning in early 1983. During that period I spent two days a week conducting an intensive series of experiments to determine the parameters for a successful laminate restoration and in December 1986 the initial series of four papers was submitted and accepted for publication. As this work was carried out under the auspices of the Australian Dental Research Fund, who had provided a grant of \$2,500 for materials used, I had an obligation to publish in the Australian Dental Journal. The delay was rather embarrassing because other workers overseas were duplicating this work and having their results published earlier. However it is apparent at this point that these papers represent the first clear and definitive description of the parameters of the laminate technique which has subsequently been supported but not disproven.

The final paper in this series "The effect of etching on a number of glass ionomer cements" was submitted in 1988 and finally published in 1990.