Evidence-based outcomes of periodontal therapy
A legacy of Sigurd P. Ramfjord

In the early 1960s, Dr. Sigurd P. Ramfjord and his colleagues at the University of Michigan began the first controlled longitudinal human clinical trials comparing periodontal therapeutic approaches for treatment of patients with periodontitis. In the current era of evidence-based medicine and dentistry, “comparative effectiveness” and the gold standard of randomized controlled clinical trials, it may be difficult for some readers to comprehend the magnitude of innovative thinking that Dr. Ramfjord introduced to dentistry. Periodontology and much of medical practice has been profoundly impacted by the evidence-based outcomes of periodontal therapy, which were initially proposed and studied by Dr. Ramfjord.
science before the early 1960s were transitioning from microscopic observations of pathology samples to hypothesis-driven clinical experimentation. Opinion leaders at the time speculated on disease causation and processes by interpreting what they observed in microscopic and clinical material. The differing opinions about what caused periodontitis led to a broad variety of approaches to treatment and unpredictable treatment outcomes.

This landmark article presented the rationale for controlled clinical trials of periodontal therapy, previewed ongoing trials, summarized the results achieved at the time and raised fundamental issues in periodontal care that remain valid to this day. Most importantly, Dr. Ramfjord reviewed the first evidence from long-term clinical trials demonstrating that periodontal therapy is highly successful and that the majority of teeth affected by periodontitis can be maintained in health and function for many years. In sharp contrast with existing empirical concepts of periodontal therapy, both nonsurgical and surgical approaches to treatment of periodontitis were similarly effective in achieving sustained repair of periodontal lesions when combined with a regular maintenance program.

Sigurd Ramfjord’s remarkable career and his profound influence on the science and clinical practice of all disciplines in dentistry have been documented extensively. In brief, Dr. Ramfjord completed dental training at Oslo University School of Dentistry and practiced in Norway for 12 years. He subsequently entered the graduate program at the University of Michigan under the mentorship of Dean Russell Bunting and earned a master’s degree in periodontics and PhD in oral pathology. A prolific writer and fluent in several languages, Dr. Ramfjord established an international reputation for systematic and innovative studies on the biology and treatment of periodontal diseases. He was honored with many professional and academic accolades and was the first recipient of the Norton M. Ross Award for Excellence in Clinical Research, conferred by the American Dental Association in recognition of singular contributions to clinical research that had a positive effect on the oral health of the public. He also was intensely involved in professional service, including extensive collaboration with the World Health Organization and as president of the American Academy of Periodontology.

In a notable contribution to professional service, Dr. Ramfjord joined with colleagues Drs. Major Ash and Don Kerr to organize the first World Workshop in Periodontics in 1966. The format included discussion of evidence-based preplenary reviews, rigorous debate on current concepts and identification of directions for future research. The Workshop’s concept and format were subsequently adopted by a number of dental disciplines.

Dr. Ramfjord led the series of Michigan Longitudinal Studies, which focused on the outcomes of periodontal therapy for more than 20 years and set new standards for the conduct of controlled longitudinal clinical trials in periodontics. A unique feature of the study protocol was the measurement of probing clinical attachment levels from the cementoenamel junction. This fixed landmark approach provided an objective measurement of changes in the levels of supporting bone or connective tissue attachment associated with the progression and treatment of periodontitis. As well, the method allowed related measures of probing pocket depths and the position of the gingival margin.

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Dr. Ramfjord used this examination system to design the Periodontal Disease Index for use in epidemiologic studies with the World Health Organization. Ultimately, the use of probing attachment levels became a fundamental measurement in clinical periodontal practice, and the addition of a fixed landmark for periodontal probing allowed clinical investigators to study and compare the longitudinal effectiveness of various approaches to periodontal therapy. Moreover, recent case definitions for surveillance of the prevalence, severity and extent of periodontitis by the Centers for Disease Control and Prevention are based entirely on probing pocket depths and attachment levels.

The longitudinal trials conducted by Ramfjord and his Michigan colleagues were designed to assess clinical results following different modalities of periodontal therapy. Early studies
compared the response after gingival curettage and pocket elimination surgery that were randomly assigned to groups of patients. All subsequent trials used a split-mouth methodology, wherein the treatment approaches were applied randomly to each of the four quadrants of the dentition. Treatment in these trials included scaling and root planing, subgingival curettage, modified Widman access flap surgery and pocket elimination surgery. The patients were given professional tooth cleaning and oral hygiene instructions every three months. The duration of the trials ranged from five to eight postoperative years. A comprehensive periodontal examination that included measurements of plaque accumulation, gingival inflammation, probing attachment levels and probing pocket depths was conducted once a year.

In this landmark article, Dr. Ramfjord used evidence from the Michigan Longitudinal Studies, expressed as changes in probing attachment levels, to explore two central concepts about predictable therapy for patients with periodontitis. The first concept was that long-term gain or loss of periodontal attachment depends on removal of bacterial deposits on the root surface, supragingival plaque control and routine maintenance care, rather than the particular surgical approach employed. All procedures that involved shallow 1- to 3-millimeter sulci in the overall surgical field resulted in slight loss of attachment. In sites with initial probing pocket depths of 4 to 6 mm, all procedures resulted in the maintenance or gain of attachment. Sites with advanced periodontitis that exhibited initial probing pocket depths greater than 6 mm yielded the greatest gain of attachment. In these sites, access flaps were equally effective as flaps combined with osseous recontouring to achieve pocket elimination.

The second concept was based on evidence showing that postsurgical probing pocket depths were not related to changes in attachment levels. Tables included in this landmark article illustrate that significant attachment loss five years after treatment by all procedures was essentially equal for sites with one-year postoperative probing depths less than 4 mm versus sites with a one-year postoperative probing depth greater than 4 mm. Dr. Ramfjord concluded that relying solely on a 3-mm probing-depth rule to determine prognosis or need for periodontal retreatment was not consistent with long-term outcomes of periodontal therapy.

Dr. Ramfjord combined these two concepts to conclude that since the long-term outcome of the various forms of periodontal therapy were similar, pocket elimination procedures with recession and root denudation associated with osseous surgery were not necessary for maintenance of the dentition in long-term health and function. Dr. Saul Schluger, a highly respected and insightful clinician who initially described the principles of osseous surgery, was joined by a number of other practitioners in disagreement. This group held that pocket elimination surgery provided an acceptable method of resolving defects with a highly irregular osseous component, although some attachment would be lost in the process. Some of the debate at the time centered on whether the Michigan studies accurately applied the detailed surgical approaches that others advocated.

Motivated by publication of results from the Michigan studies, many investigators throughout the world initiated controlled human studies comparing the long-term outcomes of various modes of periodontal therapy using a broad range of experimental designs. Summaries of these international studies are given in a number of comprehensive reviews. In general, the results of these studies were consistent with the central themes reported by the Michigan Longitudinal Studies. Both surgical and nonsurgical forms of therapy produced improvement in periodontal health. In deeper pockets, surgical therapy tended to create greater short-term reductions in mean probing pocket depths than did nonsurgical therapy, but the difference was lost over time. In most studies, there were no long-term differences among therapeutic approaches for changes in mean probing attachment levels. From a historical perspective, both views on pocket elimination procedures were valid in that all tested therapeutic approaches showed relative success. While extensive accumulated evidence shows that the majority of sites respond well to approaches that do not involve removal of bone, some studies suggest that osseous surgery may be appropriate for sites requiring increased biological width or that exhibit irregular bony contours. More importantly, a critical contribution of these international longitudinal clinical trials was to define the elements of periodontal therapy that are essential to a predictable clinical outcome, while at the same time focusing both research and clinical practice on therapeutic procedures best suited to the individual nature of the periodontally involved site and specific needs of the patient.

In an address to the American Academy of Restorative Dentistry, Dr. Ramfjord observed that the knowledge base in any field will always
be time related and that there is no absolute truth in science, including the science of dentistry. His legacy includes demonstration that carefully controlled longitudinal research is essential to developing new concepts of diagnosis, treatment and prevention of the periodontal diseases and the discovery of new concepts that allow maintenance of a healthy and functional dentition. Advances in knowledge usually require a long trailblazing expedition through the dangerous jungles of existing and long-standing paradigms. Those who successfully complete such efforts must have a clear vision, be able to mobilize resources to support the expedition, and have the determination to complete the many years required to succeed in the mission, often in the face of strong resistance. Dr. Sigurd Ramfjord’s landmark paper provides a look back on a journey of profound value to dentistry. 

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Disclosure. Drs. Robertson and Kornman did not report any disclosures.