**INTRODUCTION**

Humans have for millennia sought various different ways of replacing their lost dentition. The earliest examples of such endeavors include the Etruscans of ancient Greece who are believed to have created bridgework fashioned from oxen bones some 2,500 years ago. Similarly, according to archeological findings, occupants of what is now Honduras had developed a way to use tooth-shaped stones as dental implants about 1,000 years ago. A toothshaped iron implant has been reported in a 2000-year-old human skull1. Shells and ivory have been tried as dental implants in the past. This long period of evolution and constant innovation, has led to the development of the currently most widely accepted and recommended modality of replacing missing teeth using titanium implants. This modality owes its success to the phenomenon of “Osseointegration” which is a unique property of metals such as Titanium.

Missing teeth and their various attempts to replace them has presented a treatment challenge throughout human history. Different procedures initiated have resulted with varied success. However with studies conducted by Branemark and colleagues using titanium chamber gave rise to the concept of osseointegration. Osseointegration was initially defined on the light microscopic level as “a direct structural and functional connection between ordered, living bone and the surface of a load caring implant”.

Implants are no longer a last resort to failed traditional restorative methods. Today, implants have become an integral part of the dental therapy. A fourty year of osseointegration has revolutionized the way dentists approach patients in need of restorative therapy. **A** fortuitous finding by an innovative bone researcher literally transformed the prospects for the fully edentulous patients. No longer must this patient settle for diminished function and poor esthetics; today, implants now offer such patients fixed bridges with both excellent function and appearance, and a resulting enhancement in quality of life.

Over the 40-year period, there has been tremendous change in both the surgical and prosthetic aspects of implant dentistry. Deficient ridges are now being rebuilt with the assistance of guided bone regeneration. Sinuses are being grafted with impressive predictability. Temporization is now easily achieved. Wider and narrower diameter implants are available for diverse clinical situations, and optimal esthetics is now an expected outcome of the process.1

In the past two decades, replacement of missing teeth with implant- or tooth-/implant-supported prostheses has become a widely accepted treatment for the oral rehabilitation of partially or fully edentulous patients. This revolutionary breakthrough is the result of research efforts conducted by two pioneers in implant dentistry, P.-I. Branemark (University of Gothenburg, Sweden) and A. Schroeder (University of Berne, Switzerland), who first put forth the concept of osseointegration or functional ankylosis, respectively2-4. Both researchers described this biologic phenomenon as "direct bone deposition upon the implant surface". Later, the existence of a direct biochemical bond without any space between the titanium surface and the bone has been investigated with the aid of transmission electron microscopy5.

The term “Osseointegration” was coined by Dr Per-Ingvar Branemark, Professor at the Institute for Applied Biotechnology, University of Goteborg, Sweden in the year 1985 to describe the direct connection between an ordered living bone and load-carrying endosseous implant at the light microscopic level. In January 1986, the Branemark Clinic for Osseointegration & Implant treatment was established within the School of dentistry at Goteborg University. Since then the science of osseointegration evolved in both laboratory and clinical environments and also as a result of extensive multidisciplinary co-operation. Branemark has also been credited for finding out the most biocompatible implant material as titanium.

Even though Branemark team was the first to suggest a direct bone anchorage and its potential clinical advantages, the scientific community remained unconvinced of this. The reason for this reluctance to accept the new ideas was partly a methodological shortcoming. Literature suggests that the fact that bone becomes directly integrated with bone tissue was described by as early as 1939 by Strock6 and also by Schroeder from Switzerland. Schroeder worked from the mid 1970s, quite independently from Branemark, with research on direct bone anchored implants. Other pioneering work on osseointegration was conducted at roughly the same time by the German clinical scientist Schulte (1978). Schroeder of Switzerland published his first paper on bone-anchored oral implants in 1976 and Schulte of Germany published clinical results for his aluminum oxide implants in the late 1970s.

The word osseointegration is derived from Latin “os” which means bone and “integration” which means the state of being combined into a complete whole. A basic prerequisite for establishing true and lasting tissue integration of a non-biologic prosthesis with minimal risk of adverse local or general tissue reactions consists of a detailed understanding of the response behavior of highly differentiated hard and soft tissues to surgical preparation of recipient site, and installation of the prosthesis, as well as the long-term tissue adaptation to functional demands on the anchorage unit.

As for the mechanism of attachment, clinicians have long sought an analog for the periodontal ligament. This attachment mechanism differs from the one retaining the natu­ral dentition because teeth are anchored to their surrounding bone by means of a highly differenti­ated connective tissue attachment with ordered fibers: the periodontal ligament.

The distribution of stresses and strains in tissues around implants depends upon the in­terface; implant geometry, and forces on the implant. According to Hobkirk5a, from the clinical viewpoint it has been considered that a periodontal membrane-like structure around an implant would be ideal; unfortunately it has not proved possible to produce this result. Implants anchored in bone by means of a surrounding sheath of connective tissue, has not shown the degree of organization and specialization that would allow it to pass as a substitute for a periodontal ligament. In most cases, loading leads to gradual widening of the fibrous tissue layer and loosening of the implant, with consequent implant failure. In contrast to the periodontal ligament, a fibrous tissue sheath is a poorly differentiated layer of scar tissue.

Osseointegration as applied to the development of anchorage in various prostheses has been one of the most significant developments in dentistry or medicine in the past three decades. The principle of osseointegration is a proven biologic phenomenon owing to the discovery of Professor Per-Ingvar Branemark, and the carefully controlled research studies in Sweden. Validation of this concept has been provided by numerous multicenter studies on several continents. The majority of edentulous patients who are treated according to the osseointegration principle can be characterized as routine cases. However, it is the responsibility of every dentist to know how does bone integrates to an implant surface, and what is the phenomenon behind it before attending to a patient who is in need of this service.

This monograph is an attempt to describe this phenomenon known and accepted as osseointegration.