Changing paradigms in implant dentistry

The field of implant dentistry continues to evolve through research and innovation. With the advent of implant dentistry, early pioneers evaluated patient response to implant therapies and sought to develop protocols that would provide predictable and long-term outcomes. Many concepts that were used in conventional dentistry were also applied to implant treatment. Dr Burt Melton stated that "implant dentistry is a prosthetic discipline with a surgical component". The prevailing opinion at the time was that implant treatment planning should be prosthetically driven and directed by biomechanical principles. Numerous in vitro studies showed that functional loading of dental implants results in higher stress concentrated around the implant neck. This led to the commonly held belief that biomechanical overload of implants would cause marginal bone loss and increase the risk of implant failure. Dr Carl Misch proposed the Stress Treatment Theorem for Implant Dentistry[1]. He stated that if stress is the most common cause of implant complications, the treatment plan should address the greatest force factors in the system and establish mechanisms to protect the overall implant-bone-prosthetic system. Treatment planning was biomechanically centred, with approaches intended to reduce stress on implants. The preferred option was to select the longest and widest implant possible to increase the implant surface area and thus decrease stress on the surrounding bone. Fixed prostheses required multiple implants in organised and biomechanically favourable positions to better distribute stress on the supporting bone. Adjacent posterior implants were routinely splinted with crowns to share the load. Implant positioning favoured axial loading wherever possible to avoid greater moments caused by offset forces. Likewise, use of cantilevered pontics was discouraged as they too would result in higher stress. Collectively, these concepts often necessitated bone augmentation of the maxilla and mandible to allow for the placement of wider and/or longer implants in the preferred positions.

Although it still holds true that implant dentistry should be prosthetically driven, many of the previous biomechanically based theories are outdated and flawed. In vitro models of dental implants cannot replicate bone as a dynamic organ that adapts to loads placed upon it. After 40 years of clinical experience and research, the effect of implant overload on bone and implant loss in clinically well-integrated implants is still poorly reported and provides little unbiased evidence to support a direct cause-and-effect relationship[2].

In fact, the loading of dental implants elicits a positive biological response that is beneficial for bone maintenance. According to Frost's mechanostat theory[3], overload leads to bone gain, not loss. I applaud the contributions made by our predecessors as they paved the way for the advancement of implant dentistry; however, we must continue to test and verify assumptions that were made in the past. Over time, much of the dogma we believed and followed has been challenged by a trend towards more minimally invasive approaches. To avoid the need for bone augmentation, clinicians began using shorter and narrower implants or tilted implants to avoid the sinus or mental foramen, placing fewer implants for fixed prostheses, and designing the latter with cantilevered pontics. Many clinicians were sceptical of these treatment concepts that defied well established theories; however, as clinical evidence began to mount, it became evident that these minimally invasive strategies were indeed viable alternatives. They offered patients the advantages of reduced treatment time, cost and morbidity rate, fewer complications and high predictability. Contrary to previous beliefs, the use of short and narrow implants, high crown–implant ratios, tilted implants, fewer implants for fixed prostheses and cantilevered pontics does not necessarily result in significantly higher biological complications such as greater marginal bone loss and higher implant failure rates[4-7]. Nevertheless, clinicians must respect the biomechanical consequences of these treatment alternatives, as prosthetic and technical complications can occur. Dr Carl Misch used to say "protect the prosthesis" as a reminder to emphasise the longevity of prostheses in treatment planning and be wary of biomechanical complications. Today, there are certainly still cases where bone augmentation and/or greater numbers of implants are indicated or preferred, but clinicians should remain open to new treatment strategies that can improve patients' experience of implant treatment. Graftless solutions for full-arch treatment using tilted and/or zygomatic implants are a proven strategy to reduce morbidity and treatment time[8]. With evolving clinical therapies, it is important to maintain high levels of success with predictable outcomes. It is also prudent to rely on high-level evidence before incorporating new approaches into routine clinical practice.

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