Improvement of bone density with bone matrix osseotensors in oral implantology

As implant dentistry continues to progress worldwide, flapless stem cell stimulation has proven increasingly important because it can increase the number of potential candidates and render treatment more predictable by optimizing future implant placement sites. Recent work in mechanotherapy, for example, has revealed the "gene activation effect" of distraction osteogenesis while noninvasive osseotension procedures are known to stimulate the human body’s capacity for self-repair. Osseotension is also applicable whenever bone grafting procedures are planned.

Unique tools for flapless regenerative medicine, manual, and rotary bone matrix osseotensors allow creation of new blood supply, increase osteogenesis, and improve the initial bone quality and quantity before installation of basal and/or root-form implants. Transparietal penetration of these smooth surface, diamond-like carbon coated instruments through the osteogenic compartments (periosteum, bone matrix, endosteum, vascular walls, and bone marrow) instantly modifies the bone matrix tensions implicated in bone homeostasis. The cascades of biological responses that occur after surgical trauma participate in bone remodeling after 2–3 months.

Earlier techniques for tissue stimulation included “needling” (Henry Goldman, Boston University, 1979) and bone drilling, but these approaches were abandoned since they were painful and results were unpredictable. With bone matrix osseotensors, each impact site is the point of departure of accelerated reparative osteogenesis. The resultant microcracks induce the release of bone matrix growth factors (bone morphogenetic protein, insulin-like growth factor [IGF]-I and II, and IGF-beta) that have a range of biologic properties. Osteoinductive proteins from the bone matrix recruit stem cells at a distance from the microcracks that participate in the bone remodeling process.

Mineralization of the subperiosteal blood clot leads to formation of a bone callus after 45–90 days; this corresponds to the bone consolidation constantly observed for closed fractures without displacement.

For Type III and Type IV soft bone, the microcracks (similar to distraction osteogenesis) created in the bone 45–90 days before implant surgery induce local bony condensation and expansion without destroying the outer architecture of the area, which remains intact. Type IV bone can thus be “hardened” into active Type II bone. While the protocol can be repeated several times at intervals of 45–90 days if necessary, depending on the severity of bone atrophy and the age of the patient, a single session suffices in 90% of clinical situations. Such waiting periods are usually well accepted by oral invalids who have previously experienced implant failure or an unsuccessful bone graft.

More than 10 years of successful clinical use of osseotensors and continuous improvement have led to the establishment of safe, reliable protocols and identification of errors to be avoided (bending of the instrument, fracture of the tip, sinus infection due to the use of osseotensors in an infected sinus, etc.). However, because oral implantology and regenerative medicine are elective and not emergency procedures, bone matrix osseotensors must only be used for physically and mentally healthy patients. When their use proves feasible, they are a simple and inexpensive means to improve the initial quality of the intended bone site for implant placement. This is particularly important for patients with D4 density bone and/or reduced available bone volumes for whom all presurgery measures must be taken to avoid complications that could permanently compromise their oral status, examples being patients with atrophic jaws and patients who have already had previous implant failures. In addition, optimization of bone density and quality is frequently compatible with immediate loading, meaning
that patients can resume a normal lifestyle much more quickly.

As the technique is not “implant brand” specific, bone matrix osseotensors can be used whenever initial bone density is not clearly acceptable for implant installation. As patient demand for implant-supported rehabilitations rises, incorporation of the osseotension concept in routine practice is a safe and effective means for practitioners to provide state-of-the-art treatment for their patients.

For Leonardo da Vinci, one of the most prestigious artists and scientists of his time, the quest for simplicity was always a preoccupation, even when developing his highly sophisticated and complex inventions. In the same way, promoting stem cell activation with a very simple instrument and a minimally invasive approach allows oral implantologists to dramatically improve the initial bone status and thus effectively manage challenging clinical situations.