

## 歯科治療における物理療法の有効性

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### Efficacy of physical therapy in dental treatment

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Physical therapy employed in repair of bone and cartilage has been studied in the research of repair after bone fracture since the 1960s<sup>1)</sup>. On the other hand, Duarte first reported the efficacy of ultrasound treatment of bone fracture in 1983<sup>2)</sup> and this treatment received wide recognition when FDA authorized SAFHS<sup>®</sup> made by Exogen, U.S. as a medical device in 1994 (Fig. 1).

Also in Japan, Mizuno et al. reported in 2003 a high healing rate of more than 80% in physical therapy of delayed union of fractures and pseudarthrosis<sup>3)</sup>. Thus, physical therapy has been accepted for more than 20 years as a treatment to shorten time to healing of various types of fractures including fresh fractures (advanced medical care), and complicated and intractable fractures (insurance applicable) (Fig. 2).

It has also been demonstrated that ion flow occurs due to a phenomenon called Wolff's law in which bone will remodel its three-dimensional structure according to the mechanical environment it is under<sup>4)</sup> and a phenomenon called piezoelectric effect of bone in which mechanical stress on bone generates current of injury<sup>5,7)</sup>; as a result, streaming potentials<sup>6,7)</sup> are generated, and stimulate repairing process of bone and cartilage. In addition, physical therapy stimulates cytokines, thus promoting growth of osteoblasts and osteoclasts as well as osteogenesis<sup>8)</sup>.

Physical therapy for bone repair is divided in four main types: (1) totally or semi-invasive direct current (DC), (2) capacitive coupling electric field (CCEF), (3) pulsed electromagnetic fields (PEMF), and (4) low intensity pulsed ultrasound (LIPU). Here, we report some findings on bone tissue regeneration around implant site, which were obtained using the ultrasound fracture treatment device developed for dental treatment (LIPUS or BR-sonic<sup>®</sup>) that is the most commonly used ultrasound device in physiatry.

骨および軟骨の修復における物理療法の研究は、1960年代から骨折後の修復に関する研究として行われてきた<sup>1)</sup>。一方、超音波による骨折の治療は、1983年に Duarte がその効果性に関して報告した<sup>2)</sup>のに始まり、米国の EXOGEN 社が製作した SAFHS<sup>®</sup>が1994

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