利用共振頻率初始值預測牙科植體之癒合時間及可能穩定值：以動物實驗及離體實驗

Predictions of Healing Period & Possible Final RF Values Using Initial RF Values：in Vivo & in Vitro

中文摘要

近年來牙科植體的發展已臻成熟，但卻仍缺乏一套有效裝置可以協助牙醫師評估植體於植入初期，以及在後續的骨癒合過程中的固持狀態。本研究乃分別利用動物實驗與體外模擬實驗，驗證以共振頻率爲理論基礎所發展的牙科植體穩固度檢測系統。藉由量測人工植體在不同的穩固度下之共振頻率，以瞭解其未來臨床使用之特性。在爲期 12 週的動物實驗之量測結果顯示，植體植入時的初始頻率與癒合時間及達高原期時的共振頻率上升比例之間，皆存在著近乎線性相關(y = -1583.9x + 12260, R2 = 0.6587 及 y = -25.949x + 4852.9, R2 = 0.812)，且當植入兔子脛骨中的植體之初始共振頻率值爲 1000~2000 Hz 時，可由其量測值增加了 90~130 %的量來判斷其已近乎完成癒合；而當植入時之初始共振頻率值爲 2000~3000 Hz 時，或大於 3000 Hz 時，則可分別由其頻率值增加 90 %及 50 %來判斷其是否已接近完成癒合。此結果顯示在利用共振頻率法作爲牙科植體穩固度參考依據時，可由初始量測值推估完成癒合的時間，並在此時進行第二次量測，再由其增加的比例來判斷骨癒合是否達到完成。且當植體骨整合失敗時，其共振頻率會有下降趨勢。由此可知，共振頻率法不僅可以偵測植體手術骨整合之進行，亦可早期診斷可能的失敗。預期此一新型牙科植體穩固度檢測方法將可成爲牙醫師於臨床牙科植體手術時之輔助診斷工具。

英文摘要

In the past thirty years, there were numerous studies published on the stability of dental implant during osseointegration, but there have been still no valid and effective devices yet for dentists to determine the appropriate timing for prosthodontic loading of implants. Recently, implant stability assessment with resonance frequency (RF) has been discussed by numerous studies. However, due to the limit space of oral cavity, the traditional harmonic response method is not suitable for intra-oral practice. Therefore, in the present study, a novel device based on vibration theory developed by our lab was tested for clinical use in vivo and in vitro. The results of RF values show that there are nearly linear relationships between both the initial RF values (IRF) and the healing time and the increasing ratio of RF values (IRRF) at plateau (y = -1583.9x + 12260, R2 = 0.6587 and y = -25.949x + 4852.9, R2 = 0.812). These data demonstrate that the implants with

IRF values located at 1000~2000 Hz, 2000~3000 Hz and more than 3000 Hz are stable when their IRRF values reach 90~130 %, 90 % and 50 %, respectively. Therefore, in the clinical practice, we may estimate the healing time of implant by the detected IRF values, and then, make the second detection at the estimated time to judge whether the implant heals from its IRRF value. Furthermore, the RF values might decrease when the osseointegration failed. That is, RF value of implant may help not only to monitor the process of osseointegration of implants, and make the early diagnosis of implant failure, but also estimate the timing of prosthodontic loading. With the optimal modification in the future, it will offer the dentist a useful tool for diagnosis of the dental implant surgery.