Medical Contraindications to Implant Therapy: Part I: Absolute Contraindications

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In order to ensure implant success, it is essential to select patients who do not possess local or systemic contraindications to therapy. Hence, it is the purpose of this paper to review the medical diseases that reportedly preclude conventional dental implant treatment. Absolute contraindications to implant rehabilitation include recent myocardial infarction and cerebrovascular accident, valvular prosthesis surgery, immunosuppression, bleeding issues, active treatment of malignancy, drug abuse, psychiatric illness, as well as intravenous bisphosphonate use. Any of these conditions bar elective oral surgery, and require judicious monitoring by the physician as well as the dental provider. Noncompliance to the suggested protocol may, in the worst possible case, result in patient mortality. (Implant Dent 2006;15:353–360)

Key Words: medical contraindications, dental implants, implant failure, smoking, osteoporosis

In order to ensure implant success, it is necessary to select patients who do not have local or systemic contraindications to therapy. Failure may arise from 3 major etiologies: impaired host healing, disruption of a weak bone-to-implant interface after abutment connection, and infection.[1] The intrinsic ability of a patient to retain an implant relies on his or her health status. Jolly[2] described dental care modification with respect to medical risk assessment as defined by the American Society of Anesthesiologists; a summary appears in Table 1.

A retrospective analysis of Veterans Administration registry data demonstrated that surgical and healing complications, as well as patient medical status (*i.e.,* medical history, American Society of Anesthesiologists' level, medication history), correlated with implant failure.[3] Smith *et al*,[4] on the other hand, detected no statistically significant association between compromised medical status with perioperative morbidity or failure of implants in 104 patients. These studies differ in the type of medical conditions and degree of disease control included in analysis. It is obvious that incongruous reports exist in the dental literature as to the extent of systemic factor influence on clinical implant failure; the fact that medical status may influence success is not in dispute.

Despite the functional and emotional toll edentulism wreaks on a person, implant therapy remains elective treatment. For any noncompulsory surgery, there exist certain minimal thresholds that cannot be crossed. Absolute contraindications will, if ignored, jeopardize the overall health of a patient. Those with uncontrolled or unknown but suspected metabolic illnesses necessitate an immediate medical consultation prior to dental care. Some of these problems, however, are self-limiting or treatable, so elective oral procedures may be possible in the future. This manuscript reviews medical conditions that categorically preclude implantation and, in some cases, threaten life if unaddressed.

Recent Myocardial Infarction or Cerebrovascular Accident

Given an adequate amount of time, ischemia to the heart or the brain generates necrosis and functional deficits. With intervention and a healing period of roughly 6–12 months after preliminary care, patient stability occurs. In the interim period and for 3–6 months after initial stability, it is necessary to avoid any stress, including surgical, that could trigger postischemia complications. About 75% of patients who had a myocardial infarction experience further complications, often within hours or days after the incident, that range from cardiogenic shock or "pump failure," arrhythmias (*e.g.,* sinus bradycardia, premature ventricular contractions, ventricular tachycardia, ventricular fibrillation, asystole), myocardial rupture, pericarditis, or chronic ischemic heart disease, which is progressive heart failure.[5] In regard to a cerebrovascular accident, or ischemic stroke, 15% of patients die within the first 3 months.[6] Functional recovery occurs within the first month but may continue up to a year following the incident. During that time, complications arise, including recurrent stroke, rebleeding in the case of aneurysm, cerebral vasospasm, seizures, hydrocephalus, and hyponatremia.[6]

Due to the high risk of complications following a myocardial infarction or cerebrovascular accident, the dental provider must wait until preliminary stabilization. The patient may pursue elective dental care only if at

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Table 1. ASA Status and Dental Care Alterations[2]

ASA Classification	Patient Attributes	Examples	Dental Care Alterations
I	• Healthy • Little to no dental anxiety		None
II	• Mild to moderate systemic disease • Is not incapacitating • Does not limit activity • Greater dental anxiety	Well-controlled diabetes, epilepsy, asthma, thyroid conditions; pregnancy; active allergies	None
III	• Severe systemic disease • Is not incapacitating • Limits activity	Stable angina; past myocardial infarction (MI) or cerebrovascular accident (CVA) >6 months; congestive heart failure (CHF)	Routine care generally possible. Careful evaluation needed if extensive fixed prosthetic rehab planned. Avoid procedures that provoke immunosuppressed pts. Most surgery not contraindicated.
IV	• Severe systemic disease • Incapacitating • Limits activity	Unstable angina; MI or CVA in last 6 months; severe HTN; severe CHF or COPD; uncontrolled epilepsy, diabetes, thyroid conditions	Manage only acute disease. Fixed and removable prosthetic rehab may be limited. Surgery exposing bone may require extensive prep. Will need much med management prep.
V	Moribund (will not survive with *or without* operation)		
VI	Clinically dead patient maintained for organ harvest		

least 6 months have passed since the ischemic incident and he or she obtains medical clearance. The health care professional must be aware of any anticoagulant or thrombolytic therapy administered and understand that the desire for oral implants does not necessarily justify interruption of a therapeutic international normalized ratio (INR).

Valvular Prosthesis Placement

Repair of cardiac or vascular defects with autografts or particular materials often become completely encased in endocardium or endothelium within the first month, rendering them relatively impervious to bacterial seeding. Not all materials consistently become fully covered (*e.g.,* polyethylene terephthalate [Dacron®; INVISTA, Wichita, KS]), depending on morphology, location, or inherent constitution, and possible risks from exposure include endocarditis or endarteritis. Especially prone to microbial infection, prosthetic valves restore function to those with progressive congestive heart failure, systemic emboli, or endocarditis.[7] Three forms of prosthetic valve exist: bioprostheses, mechanical valves, and homografts or autografts. All but the autograft fall subject to endocarditis, as well as regurgitation, stenosis, and degeneration. The prevalence of prosthetic valve endocarditis hovers around 1% to 3%, and the greatest risk occurs within the first 3 months.[8] By 6 months, the prosthetic valve endocarditis rate drops to 0.4%. Early seeding arises because as soon as implantation takes place, fibrin and platelet thrombi aggregate at the surgical site (sewing ring and annulus), attracting microbes from intraoperative contamination. With time, endothelialization progresses, sealing the prosthesis off from infective organisms, and, thus, lowering risk. *Staphylococcus epidermidis,* other coagulase-negative staphylococci, *Staphylococcus aureus*, and fungi cause early onset prosthetic valve endocarditis; bacteria responsible for native-valve endocarditis, *Staphylococcus viridans* and its α-hemolytic streptococci brethren, lead to late-onset prosthetic valve endocarditis.

With prosthetic valve replacement, stability occurs at least 6 months to 1 year after cardiac surgery.[7,8] Avoidance of invasive periodontal procedures is mandatory in order to prevent bacteremia and possible subsequent valve loss. Depending on the type of valve used (mechanical or bioprosthesis [porcine]), the patient requires different drug regimens (anticoagulants or plasma volume elevators, respectively).[7] Any dental treatment must take such medications into consideration.

Bleeding

If proper hemostasis cannot occur, elective surgery must not take place. A loss of 500 mL of blood requires volume replacement.[9] Uncontrolled hemorrhage stems from a multitude of conditions, including platelet and clotting factor disorders, but often originates from drug therapy. Patients taking oral anticoagulants (*e.g.,* aspirin, warfarin, clopidogrel, among others) for cardiovascular maladies must receive careful supervision of bleeding time and INR. Little risk of significant bleeding following dental surgical procedures in patients with a prothrombin time of 1.5–2 times is normal.[10] Fazio and Fang[11] suggested an INR of 2.2 or lower for surgical procedures. The medical literature, however, proposes that a patient with an INR of 3 or less tolerates invasive oral therapies, including extractions; tranexamic acid or epsilon amino caproic

acid may be used to treat residual hemorrhage.[12] If for some reason, the INR must be kept higher, elective implant treatment is inappropriate.

A lack of platelets due to infection, idiopathic thrombocytopenia purpura, radiation therapy, myelosuppression, and leukemia may lead to bleeding issues during or after surgery as well. The normal platelet count has a wide range, between 100,000 and 500,000/mm^3. Mild thrombocytopenia, or 50,000–100,000/mm^3, may produce abnormal postoperative bleeding. Levels below 50,000/mm^3 lead to major postsurgical bleeding; spontaneous bleeding of mucous membranes occurs below 20,000 cells/mm^3.[13] Such patients often require transfusion before surgery.

For most dental patients, the hematocrit is crucial to outpatient care only when values drop to roughly 60% of low normal range. Patients who are to undergo sedation or general anesthesia require hemoglobin and hematocrit values within about 75% to 80% of normal.[14]

Immunosuppression

The ability to rally an adequate immune response is crucial to wound healing. Oral surgery is typically contraindicated when the total white blood count falls below 1500–3000 cells/mm^3, as the patient becomes susceptible to infection and compromised repair or regeneration.[15] Despite a total white blood count within normal range (5000–10,000 cells/mm^3), a grossly abnormal absolute neutrophil count, which includes polymorphonuclear neutrophils and bands, renders the patient unable to combat an immediate antigenic challenge. A normal absolute neutrophil count level lies between 3500 and 7000 cells/mm^3. A person with levels between 1000 and 2000 cells/mm^3 requires broad-spectrum antibiotic coverage.[14] Those with less than 1000 cells/mm^3 require immediate medical consultation and cannot receive dental implantation.

In order to sustain health and homeostasis, the normal CD4+ T-cell count measures above 600 cells/mm^3; values below 500 cells/mm^3 are considered immunosuppressed.[14] At present, there is not a definitive lower limit of CD4+ lymphocytes that precludes surgery, but the clinician must realize that less than 400 cells/mm^3 increases infection risk, especially from *Candida*. In these cases, broad-spectrum antibiotic coverage is suggested. In addition, the lower the CD4+:CD8 ratio, which normally approximates 2.0, the more immunocompromised the patient.[14]

Active Cancer Therapy

While needed to destroy rapidly dividing malignant cells, both ionizing radiation and chemotherapy disrupt host defense mechanisms and hematopoiesis. Because the patient on such regimens cannot mount an appropriate response to wounding from surgery, implantation is prohibited. The total dose of ionizing radiation for cancer treatment ranges from 50 to 80 Gy. This is given in fractions of 1–10 Gy per week in order to maximize death of neoplastic cells and minimize injury to host cells. Four stages of biological interactions occur with radiation.[16] Ultimately, cell death occurs from necrosis and apoptosis, both p53-mediated and otherwise. Bone loses osteocytes and undergoes osteoclastic and non-osteoclastic resorption.[17] In addition, cell injury fails to regress after termination of radiotherapy; in fact, it compounds. Past the first 6 months post-radiation (in which bone-healing capacity may rebound somewhat), less net vascularity exists and more fibrosis occurs; a hypovascular, hypoxic, and hypocellular state predominates.[16] In 3% to 35% of patients who undergo head and neck radiation, spontaneous and traumatic osteoradionecrosis ensues.[16]

Overall, the tissues and systems of the periodontium have intermediate radiosensitivity compared to those with more rapid turnover (marrow, skin, gastrointestinal cells). Typical head and neck radiation, however, makes the periodontal apparatus prone to injury. Osteocytes of outer lamellar and haversian bone in the direct path of ionizing radiation die, and blood vessels of the haversian canals may be obliterated. Mucositis and xerostomia resulting from radiation damage to mucosa and salivary glands, respectively, contribute also to a poor oral environment. Patency and hemopoietic potential of bone decrease. The posterior mandible in particular experiences osteoradionecrosis simply because it often lies adjacent to the radiation source. Additionally, it is less vascular, and contains less and larger trabeculae. Most studies that involve implant placement in irradiated bone reflect this.[18]

Cytotoxic anticancer drugs induce rapid granulocytopenia, followed by thrombocytopenia. Myelosuppression occurs often from a multiple drug regimen. In addition to bone marrow toxicity and immunosuppression, anticancer agents cause gastrointestinal toxicity and skin reactions. This leads to infection, hemorrhage, mucositis, and pain. Thus, active use of such medications may contraindicate implant rehabilitation. A very limited number of investigations have been conducted on chemotherapeutic effects on implant survival. Case reports on subjects with dental implants who then undergo cancer chemotherapy show conflicting, though mostly adverse, results.[19–21]

Psychiatric Disorders

In a patient unable to comprehend and anticipate dental treatment logically, it is best not to place implants. Often, mental illnesses are undiagnosed or unreported. Blomberg[22] identified several conditions as incongruous with implant placement. These include psychotic disorders (*e.g.*, schizophrenia), severe character disorders (hysteroid and borderline personalities), dysmorphophobia, cerebral lesions, and presenile dementia, as well as alcohol and drug abuse. There exist no biological reasons for patients with most of the above disorders to lose implants (at least none that have been determined), but various case reports blame removal of osseointegrated fixtures on psychiatric factors.[23,24] Addictions to alcohol and other drugs, however, lower resistance to disease, increase possibility of infection, retard healing aggravated by malnutrition, cause incoherence, and result in poor oral hygiene.[25] Alcohol abuse in particular induces hepatic disease and subsequent platelet disorders, hypertension, distress infarction, aneurysm, and insidious hemorrhage. A patient who abuses alcohol or drugs may suffer from an inability not only

Table 2. Types of Bisphosphonates

Drug	Administration	Treats	Notes
Etidronate	Oral IV	Paget's, hypercalcemia of malignancy, osteoporosis (with alendronate)	Not popularly used now, as it causes osteomalacia with prolonged use
Pamidronate	IV	Refractory Paget's, hypercalcemia of malignancy, osteoporosis	
Zolendronic acid	IV	Hypercalcemia of malignancy	
Alendronate	Oral	Osteoporosis	Good for long-term use
Tiludronate	Oral	Paget's	
Risedronate	Oral	Paget's, osteoporosis	

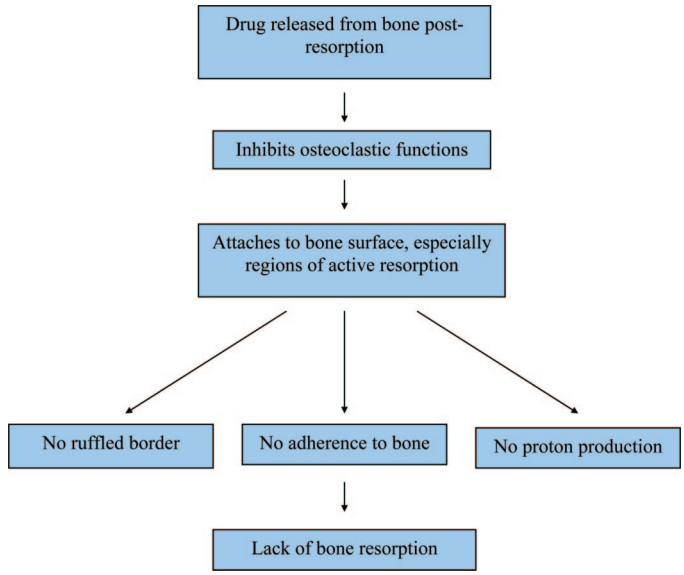

Fig. 1. Bisphosphonate mechanism of action.

to recognize or accept realistic treatment outcomes but also to heal.

Intravenous Bisphosphonate Treatment

Recently, a number of clinicians published links between intravenous (IV) bisphosphonate use to osteonecrosis of the jaws. Bisphosphonates inhibit bone resorption, and, thus, treat osteoporosis, hypercalcemia of malignancy, and Paget's disease. They tend to dwell in the bone for long periods of time. There exist both oral and IV routes of administration for bisphosphonates (Table 2). The mechanism of action is unclear, though it is proposed to work in the manner shown in Fig. 1. Bisphosphonates also may inhibit osteoclast precursors and cholesterol synthesis, as well as promote osteoclast apoptosis and osteoblast proliferation.

A rash of recent case reports suggest a link between IV bisphosphonate use (*i.e.,* pamidronate and zoledronic acid) to osteonecrosis of the jaw. In 2003, Marx[26] found 36 cases of osteonecrosis of the jaw in cancer patients receiving such a treatment regimen. Twenty-five percent of the cases occurred spontaneously, the rest post-extraction. Eighty-one percent had mandibular involvement. That same year, Migliorati[27] as well as Wang *et al*[28] described 3 and 5 mostly mandibular osteonecrosis of the jaw cases, respectively, in IV bisphosphonate users. The only drug used by all patients was a bisphosphonate; both authors stated that it directly caused osteonecrosis. The largest case report described 63 cases of osteonecrosis of the jaw in cancer and osteoporosis patients on pamidronate, zoledronic acid, or both.[29] Again, most patients experienced mandibular necrosis (62%) and had recent dentoalveolar procedures performed on them (86%). In 2005, Bagan *et al*[30] published 10 cases of osteonecrosis of the jaw in the mandible or in both jaws.

The medical establishment responded to this information, and the International Myeloma Foundation conducted a survey in 2004. Ten percent of 211 patients on zoledronic acid and 4% of 413 patients on pamidronate developed osteonecrosis of the jaw within 36 months of therapy initiation.[31] Like the previous case reports, the majority of victims had a history of dental infection or extraction. Due to this and other literature, Novartis (Basel, Switzerland),[32] the manufacturer of pamidronate (Aredia®) and zoledronic acid (Zometa®), published an addendum to drug guidelines warning of a potential risk of osteonecrosis of the jaw beginning September 2004. The corporation suggested to dentists to follow this protocol: (1) examine cancer patients prior to IV bisphosphonate initiation, (2) avoid "invasive" dental procedures during the period the patient is on such treatment, and (3) report any serious adverse effects to Novartis or the Food and Drug Administration.

The American Dental Association and the American Academy of Periodontology reiterated those positions.[33,34] Only initial data exist, however, and there are no studies on osteonecrosis of the jaw risk after drug discontinuation. Nevertheless, a patient considering IV bisphosphonate therapy requires a thorough oral examination, and must attain dental and periodontal stability before drug instigation. Elimination of any active infection, whether it is periodontitis, gingival abscess, or caries, is a prerequisite. If any issue warrants oral surgery, healing must be complete prior to bisphosphonate use.[35] The patient already taking pamidronate or

zoledronic acid should be monitored judiciously and, unless necessary, nonsurgically.

With respect to oral bisphosphonate use, 1 case report links it to osteonecrosis of the jaw, and the American Dental Association does not suggest modification of treatment plans for most people on such drugs.[36] If other risk factors (*i.e.,* prolonged use, concomitant estrogen or glucocorticoid therapy, older age) exist, however, and the patient requires dental surgery that involves the periosteum or bone, he or she should be informed of potential complications.[37] Surgery is not contraindicated with use of oral bisphosphonate, but the dental provider must exercise caution. In the case of IV bisphosphonates, on the other hand, elective surgery is not allowed.

Conclusions

Patient selection is the critical factor for implant survival. In most cases, an appropriate healing response allows for, if not ensures, success. Not all of those who desire implant rehabilitation, however, are candidates for surgery. Absolute medical contraindications exist and must be adhered to, lest the clinician contend with infection, implant failure, or even patient death. There are conditions that, if stabilized, do not seem to interfere perceptibly with repair; a subsequent paper concerns these relative contraindications to elective oral surgery. The careful practitioner understands the nature of a number of diseases evaluates evidence regarding implant therapy in such patients and picks his or her cases based on this knowledge. It is an informed choice that we make, and if we choose properly, predictability results.

Disclosure

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ID Abstract Translations

GERMAN / DEUTSCH

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Implantierungsbehandlungen und ihre medizinischen Gegenanzeigen: Teil I: Absolute Kontraindikationen

ABSTRACT: Um den Erfolg einer Implantierungsbehandlung zu garantieren, müssen die Patienten sorgfältig auf das Bestehen eventueller lokaler oder systemischer Gegenanzeigen zur bevorzugten Therapiemethode hin ausgewählt werden. Daher zielt die vorliegende Arbeit darauf ab, diejenigen medizinischen Krankheiten auszuloten, die nachgewiesenermaßen eine konventionelle Zahnimplantierung ausschließen. Zu den absoluten Kontraindikationen einer Wiederherstellungsbehandlung durch Implantierung gehören vorangegangener Herzmuskelinfarkt sowie zerebrovaskuläre Unpässlichkeit, chirurgischer Einsatz einer neuen Herzklappe, Immunsuppression, Blutungsprobleme, aktive Malignitätsbehandlung, Drogenmissbrauch, psychische Erkrankungen und die Einnahme von IV-Bisphosphonaten. Jede der oben genannten Gegenanzeigen stellt einen Hinderungsgrund für eine elektive Operation im Mundraum dar und bedarf der genauen Überwachung durch sowohl den behandelnden Arzt als auch den Zahntechniker. Wird das vorgeschlagene Protokoll nicht befolgt, kann dies im schlimmsten Fall sogar zum Tod des Patienten führen.

SCHLÜSSELWÖRTER: Medizinische Kontraindikationen, Zahnimplantate, Versagen eines Implantats, Rauchen, Osteoporose

SPANISH / ESPAÑOL

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Contraindicaciones médicas a la terapia de implantes: Parte I: Contraindicaciones absolutas

ABSTRACTO: Para poder asegurar el éxito del implante, es esencial seleccionar pacientes que no posean contraindicaciones locales o sistémicas a la terapia. Por lo tanto, el propósito de este trabajo es evaluar las enfermedades que se saben impiden el tratamiento convencional con implantes dentales. Las contraindicaciones absolutas a la rehabilitación con implantes incluyen un infarto reciente del miocardio y accidente cerebrovasccular, cirugía para colocar una prótesis valvular, inmunosupresión, cuestiones de sangramiento, tratamiento activo de malignidad, abuso de drogas, enfermedades psiquiátricas así como el uso de bisfosfanato por vía intravenosa. Cualquiera de estas condiciones, excepto cirugía oral elegida y requiere una monitorización sensata del médico así como el dentista. El incumplimiento del protocolo sugerido podría, en el peor caso posible, resultar en la mortalidad del paciente.

PALABRAS CLAVES: *Contraindicaciones* médicas, implantes dentales, falla de un implante, fumar, osteoporosis

PORTUGUESE / PORTUGUÊS

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Contra-indicações Médicas à Terapia de Implante: Parte I: Contra-indicações absolutas

RESUMO: A fim de assegurar o sucesso do implante é essencial selecionar pacientes que não possuam contra-indicações locais ou sistêmicas à terapia. Daí, é objetivo deste artigo revisar as doenças médicas que notadamente impede o tratamento convencional de implante dentário. Contra-indicações absolutas à reabilitação de implante incluem infarto do miocárdio recente e acidente cerebrovascular, cirurgia de prótese valvular, imunossupressão, questões de sangramento, tratamento ativo de malignidade, abuso de drogas, doença psiquiátrica, bem como uso de bisfosfonato IV. Qualquer dessas condições impedem a cirurgia oral eletiva e exige monitoramento criterioso pelo médico, bem como pelo fornecedor dentário. O não-cumprimento do protocolo sugerido pode, no pior caso possível, resultar em mortalidade do paciente.

PALAVRAS-CHAVE: Contra-indicações médicas, implantes dentários, falha de implante, tabagismo, osteoporose

JAPANESE / 日本語

インプラントセラピーの禁忌：パート1：絶対的禁忌

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要約：インプラントが成功するためには、インプラントセラピーの局所または全身的禁忌症を持たない患者を選ぶことが不可欠である。本論文の目的は、従来のインプラント療法に禁忌とされている疾患について論じることにある。インプラントセラピーの絶対的禁忌症には、最近の心筋梗塞と脳血管障害、人工心弁膜手術、免疫抑制、出血、悪性腫瘍のactive treatment、薬物乱用、精神病、IVビスフォスフォネート使用などが挙げられる。これらの症状はどれもelective oral surgeryを禁止し、医師、歯科医師の的確な監視が要求される。正しいプロトコルからの離反は、最悪の場合には患者の死にもつながる。

キーワード： 禁忌症、デンタルインプラント、インプラント失敗、喫煙、骨粗鬆症

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CHINESE / 中国語

植體治療醫學禁忌症：第一部分：絕對禁忌症

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摘要：為了確保治療成功，應善選對移植方法沒有局部或全身性禁忌症之患者。因此，本論文的目的旨在檢討據報導會阻礙傳統牙科移植治療的醫學疾病。植體重建的絕對禁忌症包括最近的心肌梗塞與腦血管事故、瓣膜植入手術、免疫抑制、出血組織、惡性腫瘤積極性治療、藥物濫用、精神疾病、以及靜脈注射雙磷酸鹽類藥物等。以上任一狀況均會阻礙部分口腔手術，同時需有醫師與牙科供應商的審慎監控。若未能遵循上述建議，最糟的情況可能導致病人死亡。

關鍵字：醫學禁忌症、牙科植體、移植失敗、抽煙、骨質疏鬆

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