

PATIENT SCREENING AND MEDICAL EVALUATION FOR IMPLANT AND PREPROSTHETIC SURGERY

Manuel Chanavaz, MD, DDS

KEY WORDS

Patient screening
Implant
Preprosthetic
State of health

Implant and preprosthetic surgeries aim to restore normal anatomic contours, function, comfort, aesthetics, and oral health. As such, they are not life-saving procedures. The prime concern must therefore be to not undermine the patient's overall health and safety. It is then that every step must be taken to select the appropriate treatment plan and maximize the longevity of the implanted system, including the overlying prostheses. One important category into which a number of possible complications may fall is the inadequate systemic screening of patients prior to implant and biomaterial insertion. Without wishing to enter into the whole human pathology, it is no longer appropriate to limit the general contraindications of implantology to the traditionally considered malfunctions of the pancreas, liver or hematopoietic system and to ignore the devastating long-term effect of smoking or inadequate dietary habits. There are, in fact, a number of systemic problems that may create major risk factors. On the other hand, modern standards of care should not systematically exclude the use of implant surgery on patients with relative or marginal health conditions without exploring the possibilities of improving and stabilizing those conditions. As newer techniques of general anesthesia and intravenous sedation are more frequently used on an ambulatory basis, allowing implant surgeons to take their patients into various degrees of consciousness or deep sedation, the patient screening should also take into consideration factors related to this form of management. An arbitrary guideline for patient selection may be based on the classification of the American Society of Anesthesiology. This guideline restricts (with very few exceptions) intraosseous implants and implant-related graft surgeries on patients who fall into ASA1 or ASA2 categories of the classification. In the domain of subperiosteal implants for treatment of advanced atrophy of the mandible, the body response seems to be much less dramatic than to endosseous devices or to grafted sites. The cortical histoarchitecture and metabolism are, by far, less affected by organ disorders than are endosseous structures. This article presents a number of absolute contraindications and analyzes a series of relative contraindications for which the doctor's judgment remains the decisive factor. In this latter case, it proposes treatment patterns that could optimize certain marginal health conditions or stabilize unbalanced biological functions prior to or at the time of surgery. As life expectancy in the industrial countries is continuously increasing, a greater number of elderly patients are equipped with implant-supported prosthetics. The effort must therefore be focused on keeping a regular and watchful eye on their general health and screening for possible geriatric conditions responsible for long-term implant failure. Will a minimum knowledge of internal medicine be a prerequisite for future academic implant education?

Manuel Chanavaz, MD, DDS, is Professor and Chairman of the Department of Oral and Maxillofacial Implantology at Lille University Medical School, Lille, France.

INTRODUCTION

Technically speaking, contemporary implant surgery is a relatively innocuous procedure. It is also conceivable to recognize that a stable, well-integrated implant is as "clean" as a healthy tooth. However, whereas the management of complications in patients with minor systemic disorders is usually straightforward and successful, this may not be the case with patients who are systemically compromised. For example, a treatment plan for a heart-valve patient should not be made without fully considering the gravity of potential immediate or delayed complications when unexpected problems arise. It is not only the implant that may become compromised.

Occasionally there are patients with marginal health conditions who are, in addition, "oral invalids" and urgently need comprehensive dental treatment. The natural inclination for many implantologists in such cases is to put the functional oral rehabilitation in the same priority list as the actual treatment of the critical health condition. They do not easily consider the deferral of the implant treatment. It is my opinion that the patient should be equipped with only provisional conventional prostheses not requiring surgery until general health is stabilized. When a proper state of health has been achieved, definitive implant surgery may be undertaken.

Implant dentistry on the whole has made vast progress during the past 20 years. Every aspect of it, whether scientific or clinical, is taught in academic institutions around the world with an intensity equal to all other medico-surgical disciplines. As the life expectancy in the industrial countries is continually increasing and greater numbers of elderly patients are supplied with implant-supported prostheses, one unexplored domain is the meticulous physical evaluation of the patients prior to, at the time of, and after implant treat-

ment. Most patient follow-ups are restricted to the local oral evaluation of the implanted sites. These evaluations seldom extend beyond 10 years. The long-term implant complications arising from ailing health are often neglected. Our 25 years of clinical experience in implant and preprosthetic surgery has brought us into contact with a significant number of long-term complications (beyond 15–20 years) that were totally independent of the oral environment. That is why the effort must focus on keeping a regular and watchful eye on implanted patients' general health and screening for possible geriatric systemic conditions that might be responsible for long-term implant failure.

An arbitrary but practical method of patient selection may be based on the American Society of Anesthesiology's Classification (ASA). This classification defines the limits of risk factors for five categories of patients. As both implant and preprosthetic procedures are elective surgeries aimed at restoring function and comfort of patients, they should be restricted to ASA1 (patients with no health problems) and ASA2 (patients with minor health problems who respond well to treatment). Any patient whose health condition places him in Category ASA3 (major health problems with partial correction) or higher should be carefully screened for relative contraindications or possibly absolute contraindications.

ABSOLUTE CONTRAINDICATIONS

These contraindications relate to health conditions that have the potential to jeopardize the patient's overall health and safety and seriously compromise the survival of implanted systems, causing residual chronic complications. It is therefore essential that they should be well comprehended and methodically sought when examining the patient (Table 1).

Recent myocardial infarction

Contemporary cardiology, including nonsurgical intervention procedures,

has greatly improved the care and treatment of patients suffering from myocardial infarction. This has led to a much reduced use of potent anticoagulants on a permanent basis, while the cardiovascular protectors, beta-adrenergic blocking agents, hypotensive drugs, and mild anticoagulants (aspirin) are extensively used. A stable condition for these patients is usually reached 6–12 months after the primary care. However, it is important to avoid any surgical stress that could trigger uncontrolled vasoconstriction with possible tachyarrhythmia until the stable condition remains unchanged for at least 3–6 months. Furthermore, if anticoagulants are prescribed, their interruption in the early stages of the disease may prove extremely dangerous and filled with risk.

Valvular prosthesis

The onset of bacteremia in patients fitted with valvular prostheses constitutes a major threat to the longevity of the cardiac valve. The oral cavity has traditionally been recognized as the principal gateway to such infections. It is therefore important not to plan any implant surgery until the patient's stable condition is reached, usually 15–18 months after cardiac surgery. According to the type of valve used, the patients may be on permanent potent anticoagulants (for mechanical valves) and mild plasma volume elevators (for porcine valves). Any planned procedure must take into consideration the occurrence of the surgical stress, anticoagulant imbalance, and infection risk, which may, in extreme cases, lead to acute malignant endocarditis responsible for the loss of the artificial valve.

Severe renal disorder

Severe renal disorder is probably the most important single contraindication to any form of implant or bone graft surgery. This can occur for a number of reasons, of which the most common are recurrent kidney infections (nephritis), malignant or voluminous be-

TABLE 1
Impact of implant and bone graft surgery on patients with absolute contraindications*

Health Condition	Risks for Patient's General Health	Severity of Immediate Implant Complications	Long-term Predictability of Implant System
Recent myocardial infarction	++++	+	++
Valvular prosthesis	++++	+	++
Severe renal disorder	++++	++++	0
Treatment resistant diabetes	+++	++++	0
Generalized secondary osteoporosis	++	++++	+
Chronic or severe alcoholism	+++	++++	0
Treatment-resistant osteomalacia	+	+++	+
Radiotherapy in progress	+++	++++	0
Severe hormone deficiency	+++	++++	+
Drug addiction	++	++	+
Heavy smoking habit	++	++	+

*The number of +'s relates to the gravity of the complications consecutive to implant and graft surgery. One + is the least complicated (least predictable) and ++++ is the most complicated (most predictable). Zero corresponds to total unpredictability.

nign tumors (or multiple cystic kidneys), and uncontrolled diabetes and/or complications arising from kidney stones. Most recently, in Europe and industrial countries, the reappearance of tuberculosis of the kidneys has further expanded the list of potential complications. In all events, the damage to the nephrons may cause bone destruction by urinary calcium loss and interruption in the production of active metabolite of vitamin D. In fact, the lack of reabsorption of Ca⁺⁺ together with the malfunction of parathyroid hormone (PTH) in the secondary loop of Henle could lead rapidly to metabolic osteopenia and retention of plasmatic endotoxins with major infection risks.

Treatment-resistant diabetes

This refers to confirmed severe diabetes, which does not respond to proper treatment. The complications are related to the blood hyperosmolarity (sugar, urea, ions, etc.), metabolite disorders (Cl⁻, Na⁺, Mg⁺, etc.), dehydration, and micro/macro angiopathia. This latter condition may in turn predispose the patient to tissue degeneration compromised healing with increased risk of infection.

Generalized secondary osteoporosis

This is an anatomic and structural syndrome with significant loss of bone mass and volume leading to rarefaction of cancellous bone and thinning of the cortical plates. Bone becomes devoid of osteoid and presents osteoclastia and medullary fibrosis. It results in nonintegration of endosseous implants. One practical and useful screening tool to evaluate the extent of osteoporosis is bone densitometry (dual photon absorptiometry), which should be used systematically on all patients who present clinical signs of bone fragility.¹

Chronic or severe alcoholism

This is a major condition leading frequently to liver disorder, cirrhosis, and medullary aplasia with a cascade of possible complications such as platelet disorders, distress infarction, aneurysm, and risk of insidious hemorrhage.²⁻⁴ Patients suffering from severe alcoholism often present retarded healing aggravated by malnutrition, psychological disorder, inadequate hygiene, and major infection risk. The most common tests for hepatic disorders by the implant surgeon focus on measuring

- γ -glutamyl-transpeptidase (γ -GT; <25 mU/mL): elevations in alcoholic cirrhoses to 50, hepatitis to 100, jaundice to 200–300, and pancreatic cancer to 1000;
- transaminases: serum glutamo-oxalic transaminase (SGOT, 5–35 IU) and serum glutamopyruvic transaminase (SGPT, 5–25 IU), which are increased in hepatic cytolysis, infectious and toxic hepatitis, and prolonged salicylic treatment; in myocardial infarction, SGOT alone is increased;
- bilirubin (total < 10 IU or 6 mg \pm 2): increased in cases of hemolysis, cholestasis, and jaundice;
- alkaline phosphatases: with a pH 9.2 (13–39 IU or 0.22–0.65 mmol/second/L), which are increased in hyperparathyroidism, Paget's disease, hepatic disorders, and bone metastases;
- kephalin activated partial thromboplastin time test (KAPTTT) or prothrombin activated kephaline test, which is a coagulation indicator; vitamin K participates in coagulation with factors II, V, VII, IX, and X.

Treatment-resistant osteomalacia

Rickets is a rare disease in the industrial countries, seldom found in adults. This mineralization deficit (hypophosphocalcic bone with osteoidosis), which leads to demineralized osteopathy (soft bone), responds favorably in more than 95% of the cases to vitamin D-25 therapy in conjunction with the intake of calcium supplements. However, when the treatment fails, osteomalacia may lead to nonintegration of an implant and increased infection risk.

Radiotherapy in progress

Disruption of defense mechanisms, a compromised endosseous vascular system, and the inhibition of osteoinduction are the main insults to the body while radiotherapy is in progress. However, the periosteum is the principal "organ" affected, with its physiologic activities being virtually entirely disrupted. This may lead, depending

Downloaded from [http://meridian.allenpress.com/jof/article-pdf/24/4/222/2032640/1548-1336\(1998\)024_0222_psametf_2_3_co_2.pdf](http://meridian.allenpress.com/jof/article-pdf/24/4/222/2032640/1548-1336(1998)024_0222_psametf_2_3_co_2.pdf) by guest on 10 November 2024

on the proximity of the irradiated zone to soft- and hard-tissue necrosis, to major infection risk and disruption of osteoconduction.⁵

Severe hormone deficiency

This refers to patients with more than two different families of hormone disorders. The endocrine systems most affected that may be screened are the thyroid, parathyroid, pancreas, adrenal, pituitary, and reproductive.

Drug addiction

Most drug addicts suffer from the loss of sense of priorities, low resistance to disease, predisposition to infection, malnutrition, psychological disorder, lack of hygiene, and difficulty in maintaining follow-up.

*Heavy smoking habit
(more than 20 cigarettes per day)*

This factor was added to our list of absolute contraindications in 1996 due to the occurrence of a number of long-term implant complications in heavy smokers who presented with no other systemic disorder. The main problems, other than early stage poor healing, arose from relatively accelerated bone loss and disorders related to poor oral hygiene.

RELATIVE CONTRAINDICATIONS

These contraindications are in direct relation with the nature and severity of the systemic disorders and whether or not they can be satisfactorily corrected prior to surgery. They require a meticulous screening of the patient's medical records. In reality, patient selection in relation to relative contraindications is much more subtle, where, among other criteria, the doctor's judgment remains the critical factor. For a dental practitioner who is not medically oriented, it may mean referral to other specialists. If the disorder is adequately corrected, the treatment plan may be carried out; otherwise, the procedure should be postponed until optimal conditions prevail (Table 2).

TABLE 2
Impact of implant and bone graft surgery on patients with relative contraindications*

Health Condition	Risks for Patient's General Health	Long-term Implant Predictability in Absence of Proper Diagnosis or Treatment	Patient's Possible Response to Medical Treatment Prior to Implant Surgery	Long-term Implant Predictability after Proper Diagnosis and Treatment
AIDS	++++	0	++	0
Seropositive cases	++	++	++	+++
Prolonged use of corticosteroids	+++	++	++	+++
Disorders of P-Ca metabolism	+++	+	++	+++
Hematopoietic disorder	+++	++	++	++++
Bucco-pharyngeal tumors	+++	0	++	+++
Chemotherapy in progress	+++	0	++	+++
Mild renal disorder	+	0	++	+++
Hepato-pancreatic disorder	+++	0	++	+++
Multiple endocrine disorder	+++	0	++	+++
Psychological disorder, psychosis	+	+	++?	+++
Unhealthy lifestyle	++	+	+++	+++
Smoking habit	++	+	++?	+++
Lack of understanding, motivation	0	+	++	++
Unrealistic treatment plan	0	?	?	++

*The number of +'s relates successively to the degree of gravity of the complications, patients' responses to treatment, and predictability of the implanted system. One + is the least complicated or least favorable and ++++ is the most complicated or most predictable. Zero corresponds to total unpredictability. Question mark (?) represents variable and uncertain response.

AIDS and seropositive cases

A seropositive (HIV+) patient may be considered as normal since current statistical life expectancy after primary infection is about 15–20 years. On the other hand, the implant indication for a confirmed AIDS patient is evaluated in accordance with the Atlanta Centers for Disease Control classification. The stage of development of the disease, life expectancy, and patient's wishes are very important considerations. A careful assessment of possible systemic complications arising from the disease may entirely contraindicate any form of surgery or may dictate a pragmatic treatment plan with more realistic objectives based on function, comfort, and relief.

Prolonged use of corticosteroids

This scenario is often associated with retarded healing, disorder of phosphocalcic metabolism (osteoporosis), and

medullary aplasia.⁶ A number of authors have also reported bone fragility, renal and adrenal deficiency, metabolic disorders including blood sugar metabolism, and water retention.^{7,8} Furthermore, the prolonged use of corticosteroids may inhibit bone formation. It is therefore important to determine why such treatment is being administered and to evaluate the patient's response to it.⁹ If corticosteroids are used exclusively for their anti-inflammatory properties, reversal of this contraindication may be as simple as changing the medication to one of the many newer nonsteroidal anti-inflammatory drugs.

Disorders of phosphocalcic metabolism

An imbalanced diet (excessive protein, inadequate Ca and/or vitamin D) may frequently lead to such disorders. However, minor hormone deficiencies,

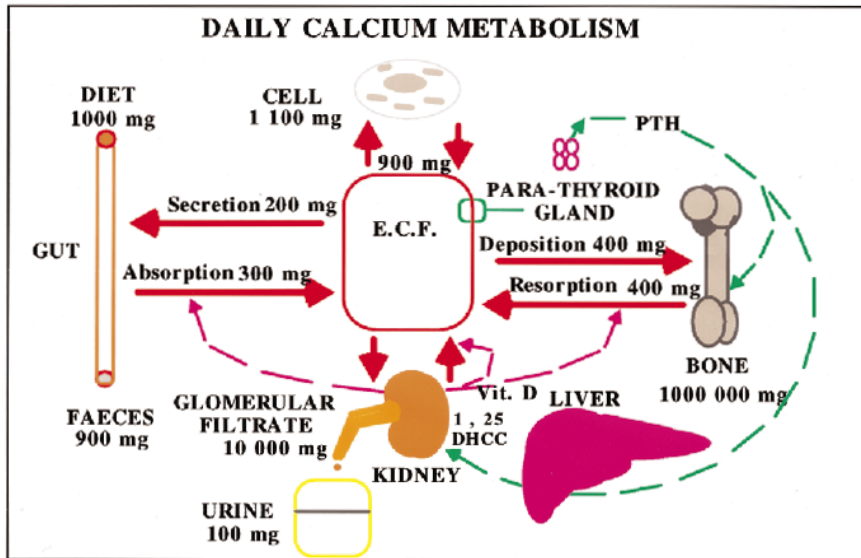


FIGURE 1. The diagram shows the daily calcium metabolism and the close interaction that exists, via the extracellular fluid, among the organs intervening in this metabolism. Of note is the importance of screening for normal functioning of the gastrointestinal tract, parathyroid and thyroid glands, liver, entire osseous skeleton, and, most significant of all, the kidneys, which filter initially some 10 g of calcium per day into the primary urine. The kidneys immediately reabsorb almost the entire amount of calcium and allow only 100 mg to be excreted in the final urine.

especially during menopause, in conjunction with systemic disorders and inappropriate lifestyle may combine to bring about a phosphocalcic (P:Ca) imbalance. One typical example is disorder of the gastrointestinal tract such as repeated colitis, chronic diarrhea, and so forth, which may be corrected or contained by carefully planned, long-term treatment.¹⁰ In patients for whom such problems are not managed effectively, daily calcium absorption may be completely disrupted, leading to metabolic bone disease (phosphocalcic imbalance) and poor quality of mineralized bone.

Hematopoietic disorder

The possible complications arising from hematopoietic disorders in the short and medium terms are not as dramatic as those encountered in other forms of frank bone pathology and osteoporosis. However, satisfactory functioning of the hematopoietic system remains an essential factor for the long-term success of implant and reconstructive surgery.¹¹ In a suspected bone marrow disorder, in addition to ex-

ploring the maturation cycle of the megakaryocytes, which are precursors of the platelets, it is important to screen the transformation of the premonocyte lineage to macrophages, osteoclasts, and circulating monocytes. The same attention must be paid to the lymphocyte cycle.^{12,13}

Buccopharyngeal tumors

These tumors should be analyzed in terms of their malignancy or nonmalignancy, their proximity to the proposed implant site, and the oncologic treatment carried out. Obviously, if radiotherapy has been used very close to the future surgical site, the contraindication becomes absolute. However, routine refusal to graft or implant patients after resective surgery should be resisted. If there is no obvious reason to suspect short- and medium-term metastases or extension of the tumor in a patient presenting otherwise satisfactory systemic screening, he/she may be offered improved oral health rather than an indefinite period of waiting until a possible recurrence of the tumor is excluded.

Chemotherapy in progress

The administration of anticancer drugs has rarely been a subject of study by implant and bone graft surgeons, who have frequently followed a more restrictive general guideline with some ambiguity. In fact, many of the drugs used in contemporary anticancer regimens have a very limited or unknown direct destructive role relative to implantology. For instance, methotrexate, a common chemotherapeutic agent, is extensively used (in smaller dosage) in contemporary rheumatology. The contraindication of chemotherapy is essentially related to the damage caused to the vital organs, which may also be involved in calcium metabolism. Furthermore, when chemotherapy is used for bone metastases, patient screening should preferably take into account the extension of the metastasis rather than the actual drugs used to contain it. One additional factor to analyze prior to implant surgery is the patient's degree of tolerance to the administered drugs. In any event, a close collaboration between the implant surgeon and the oncologist is mandatory.^{14,15}

Modern chemotherapy uses a wide range of drugs belonging to 10-12 pharmacological families. The treatment for each patient may include a complex combination of these drugs. Table 3 shows the principal cancer treatments, which may present absolute contraindications to implantology at the time of their administration for up to a minimum of 6 months thereafter.¹⁶

Mild renal disorder

These common disorders (uremia and creatininemia) are frequently revealed by an initial blood test after the first physical examination. However, such disorders may be predictors of the onset of major renal disorders or other systemic conditions, which will then become absolute contraindications to implant and preprosthetic surgery (*cf*, absolute contraindications). It is therefore wise to investigate all renal problems and make sure that they are no

TABLE 3
Anticancer drugs incompatible with simultaneous insertion of implant devices

Type of Anticancer Drug or Agent	Drug Family	Commercial Brand	Principal Complications, Disorders, or Affected Organs
Antimetabolic	Antifolic	Methotrexate*	Thrombopenia, osteogenesis
Alkylating	Nitrogen-mustards (III)	Isosfamide	Blood, bone (osteogenesis)
	Nitrogen-urea (IV)	Streptozocin	Renal, hepatic, blood
Spindle poisons	Mitomycine	Ametycin	Renal, hepatic, blood
	Vinca alkaloids (III)	Vincristin	Renal, hepatic, blood
Interpolating†	N/A	N/A	N/A
Splitting	Bleomycine	Bleomycine	Pulmonary fibrosis
Cytolytic	Plicamycine	Mithramycine	Renal, hepatic, blood, (Ca ⁺⁺)
Steroids	Progestates	Medroxyprogesterone	
		Ethinodiol	
		Norethistone	Renal, hepatic
	Estrogenes	DES	
		4 NaFosfestrol	
		Introna	Dehydration, thyroid, parathyroid
Interferons (Int-F)‡	Int-F. alfa-2a	Roferon-A	
	Int-F. alfa-2b	Proleukin	
Interleukin-2‡	Aldesleukin-2		Cardio-nephro-hepato-myelo-toxic

*Methotrexate, which is used in rheumatology in small doses, may produce severe thrombopenia and disturbed osteogenic cycle when used in massive doses in oncology.

†The interpolating agents on the whole seem to be devoid of adverse effects on implantology.

‡The interferons and interleukins prescribed in advanced stages of pathology are particularly contraindicated.

more than mild disorders, that they are responding to treatment, and that they do not compromise calcium metabolism.

Hepato-pancreatic disorder

Gall stones and infectious and viral hepatitis (except the severe B, C, and E family) are among hepatic disorders that have very little destructive effect on the long-term success rate of implant surgery. Nevertheless, further hepatic tests, after a thorough physical examination, may reveal the onset of more serious liver or pancreatic conditions that would be detrimental to the outcome of implant treatment.

Multiple endocrine disorder

This is a complex syndrome, ranging from metabolic loss of calcium (PTH) to secondary osteoporosis induced by hyperadenocortism or glucocorticosteroid disorders (Cushing syndrome), mineralocorticosteroid syndrome (Conn's syndrome), or hyperandrogenism, that may lead to the failure of the implanted material.

One arbitrary but practical method of screening a suspected hormone deficiency for an implant candidate may be the preoperative evaluation of the hormones involved in bone remodel-

ing. These hormones can be classified into two categories according to their dependence levels on calcium homeostasis (Ca-H): (1) Ca-H dependent and (2) Non-Ca-H dependent.

(1) Ca-H dependent hormones are essentially parathormone, which stimulates bone resorption (SBR), vitamin D or 1-25 dihydroxycholecalciferol (SBR), and calcitonin, which inhibits bone resorption (IBR).

Parathormone (PTH) is a monocatenary hormonal polypeptide secreted by the parathyroid glands. It has four principal functions that are of interest to implant and bone graft surgeons, namely,

- it is hypercalcemic (or less accurately referred to as osteoporotic) by removing the calcium ions from bone and transferring them to the circulating blood,
- it increases the urinary elimination of phosphates by reducing their tubular reabsorption,
- it contributes to maintaining an optimal calcemia by intervening in physiologic kidneys' tubular reabsorption of calcium, and
- it plays an important role in the intestinal absorption of calcium in synergy with vitamin D.

Vitamin D₃ (1-25 dihydroxycholecalciferol) is a renal metabolite, intimately linked with PTH activity. Principal functions are (a) the active absorption of calcium in the proximal intestine and (b) increasing the number and the activity of the osteoclasts *in vitro*. It also increases the production of collagen and GLA bone proteins and alkaline phosphatases. Direct action on PTH secretion, however, has not been shown.

Calcitonin is a 32 amino acid peptide synthesized by the C cells of the thyroid. Its principal functions are related to inhibiting bone resorption (antios-teoclastic and hypocalcemic; Table 4).

(2) Non-Ca-H dependent hormones include thyroid hormones (SBR), estrogens (IBR and SBR), glucagon (IBR), insulin (stimulates bone formation [SBF]), growth hormones (SBF), and corticosteroids (inhibit bone formation [IBF]).

Thyroid hormones include thyroglobulin (iodoprotein; *ie*, iodothyronins and iodotyrosines). T₃ (triiodothyronin; 70-190 ng/100 mL), T₄ (thyroxine or tetraiodothyronin; 4-12 µg/100 mL), and TSH, that is, thyroid stimulating hormone (adenohypophysis hormone; 0.5-3.5 µU/mL) are the main

TABLE 4
Thyroid pathology and treatment*

Thyroid Hormones and Drugs	Nature of Disorder	Antithyroid Drugs
(a) <u>Inferior origin</u> (lower): thyroid gland disorder T3: liothyronin T4: L-thyroxine L-thyroxin Levothyrox	Hyperthyroidism Hypothyroidism	T3: propylthiouracil Benzythiouracil—basdene T4: carbimazol (imidazole) Neo-mercazole
(b) <u>Superior origin</u> (upper): adenohypophysis disorder TSH: thyroid extracts		

*The two possible origins of thyroid disorders and the standard treatment regimens prior to implant surgery. The inferior origin is related to the thyroid gland itself. The superior origin is related to the pituitary.

hormones that can be screened before surgery.

Psychological disorders and psychoses

This is one of the most difficult contraindications to evaluate and implement. It depends essentially on the severity of the disorder and the patient's response to psychotherapeutic medication. A number of the psychoactive drugs severely alter the oral environment, cause dryness of the mouth, mucosal irritation, or polyaphtosis. All of these conditions can potentially cause damage to peri-implant tissues. In all events, these conditions should be analyzed in collaboration with the treating psychiatrist considering the patient's priorities, function, comfort, and aesthetics. The patient must be made clearly aware of the costs involved. Implant surgery should be avoided in schizophrenic patients who are not under strict surveillance.

Unhealthy life style

Poor nutrition, chronic dieting, lack of exercise, inadequate hygiene, and excessive use of drugs, alcohol, and tobacco contribute to an unhealthy life-style. Irregular feeding habits, repeatedly identical or unvaried menus, fast foods (imbalanced diet), and inadequate time allocated to consuming each meal are common problems in modern society. Chronic or "yo-yo" di-

eting, especially in the female population, may cause serious health and bone disorders. This contraindication is further aggravated by the lack of regular physical exercise. If the patient is amenable to correcting these habits, implant and preprosthetic surgeries are viable forms of therapy; otherwise a markedly unhealthy lifestyle becomes an absolute contraindication.^{17,18}

Smoking habits

Tobacco is one of the most severe limitations because it damages the angiogenic mechanisms for forming and maintaining bone and peri-implant and periodontal soft tissues. Depending on the daily consumption of cigarettes, the patient's awareness of the dangers of smoking, and his/her willingness to drastically reduce or completely stop the habit, this particular contraindication may be removed. If not, smoking remains, in the author's opinion, an absolute contraindication for the long-term success of implant systems.

Lack of understanding and motivation

Patients who do not have a clear understanding of implant techniques in spite of repeated explanations or who remain entirely passive to any form of motivation may constitute a category of patients for whom extensive implant treatment should be avoided. On the other hand, if they respond positively to motivation,

comprehend the explanation of the proposed treatment and the necessity of a close collaboration with their doctor, and recognize the importance of regular follow-up sessions, they may become satisfactory candidates for implant surgery. Attempting to treat an ignorant, unmotivated patient is a disaster for all concerned.

Unrealistic treatment plan

This contraindication can be lifted if an in-depth analysis both from the clinical and economic standpoints is carried out. This analysis should consider whether there is a gross disproportion between the proposed treatment plan and the patient's chief complaint, cultural predisposition, life style, social environment, and finances. Overall, the assessment of the physical and psychological status of a patient must be realistic in relationship to the proposed treatment.

CONCLUSION

The implantology of tomorrow in economically advanced Western countries will evolve in two principal directions. There will be a dramatic decrease in full-mouth extractions and advanced atrophies of the jaw bones because of improved hygiene, diet, water fluoridation, access to medical and dental care, prophylactic practices, communication, and information.

On one hand, implantology will essentially be carried out in routine dental practices, where implants with or without grafting and bone manipulation to repair small bony defects, will serve to replace single lost teeth and lost 2-4 teeth segments. There will also be activity in orthodontically motivated implantology.

On the other hand, advanced implantology in the hospital environment will be subject to decreases in health care costs. It will gradually become limited to multiple simple root-form implants inserted in reconstructed sites, occasionally during or after orthognathic and microvascular procedures where extensive preprosthetic bone grafting and manipulation may have been carried out. Extraoral implant techniques and distrac-

tive osteogenesis procedures prior to implants will also have limited occasional applications and will be performed depending on the training of the surgeons and specific policies of the health centers. It is feared that truly advanced implant techniques such as ramus frames and mandibular tripod, subperiosteal, and symphyseal staples will gradually be abandoned in training programs because there will be a shortage of patients leading to a shortage of teachers.

In all events, implant surgery will have to be considered as a totally medical discipline where all the efforts must be focused on meticulous patient selection and on keeping a regular and watchful eye over implanted patients' general health to treat possible geriatric conditions responsible for long-term implant failure.

REFERENCES

- Pouillés JM. Apport de l'ostéodensitométrie à la définition et au diagnostic des ostéoporoses. *Rev Praticien*. 1995;1096-1101.
- Desombere I, Willems A, Leroux-Roels G. Response to hepatitis B vaccine: multiple HLA genes are involved. *Tissue Antigens*. 1998;51(6):593-604.
- Pasanen M, Rannala Z, Tooming A, Sotaniemi EA, Pelkonen O, Rautio A. Hepatitis A impairs the function of human hepatic CYP2A6 in vivo. *Toxicology*. 1997;123(3):177-184.
- Coquard R. Late effects of ionizing radiations on the bone marrow. *Cancer Radiother*. 1997;1(6):792-800.
- Gagnon L, Boulet LP, Brown J, Desrosiers T. Influence of inhaled corticosteroids and dietary intake on bone density and metabolism in patients with moderate to severe asthma. *J Am Diet Assoc*. 1997;97(12):1401-1406.
- Boot AM, de Jongste JC, Verberne AA, Pols HA, de Muinck Keizer-Schrama SM. Bone mineral density and bone metabolism of prepubertal children with asthma after long-term treatment with inhaled corticosteroids. *Pediatr Pulmonol*. 1997;24(6):379-384.
- Crowley S, Trivedi P, Risteli L, Risteli J, Hindmarsh PC, Brook CG. Collagen metabolism and growth in prepubertal children with asthma treated with inhaled steroids. *J Pediatr*. 1998;132(3 Pt 1):409-413.
- Woodcock A. Effects of inhaled corticosteroids on bone density and metabolism. *J Allergy Clin Immunol*. 1998;101(4 Pt 2):S456-S459.
- Gastrointestinal dispersal of the organism and prevention of the diarrhea that accompanies *E. coli* infection. *Science J*. 1998;280:2114-2118.
- Richardson ML. Bone marrow abnormalities revealed by MR imaging. *AJR Am J Roentgenol*. 1998;171(1):261-262.
- Hellstrom-Lindberg E, Ahlgren T, Beguin Y, et al. Treatment of anemia in myelodysplastic syndromes with granulocyte colony-stimulating factor plus erythropoietin: results from a randomized phase II study and long-term follow-up of 71 patients. *Blood*. 1998;92(1):68-75.
- Vallespi T, Imbert M, Mecucci C, Preudhomme C, Fenaux P. Diagnosis, classification, and cytogenetics of myelodysplastic syndromes. *Haematologica*. 1998;83(3):258-275.
- Nguyen QH, Roberts RL, Ank BJ, Lin SJ, Thomas EK, Stiehm ER. Interleukin (IL)-15 enhances antibody-dependent cellular cytotoxicity and natural killer activity in neonatal cells. *Cell Immunol*. 1998;185(2):83-92.
- Dombret H. Intensive chemotherapy in myelodysplastic syndromes. *Pathol Biol (Paris)*. 1997;45(8):627-635.
- Foa P, Massaro P, Caldiera S, et al. Long-term therapeutic efficacy and toxicity of recombinant interferon-alpha 2a in polycythaemia vera. *Eur J Haematol*. 1998;60(5):273-277.
- Sanchez-Perez J, Moreno-Otero R, Borque MJ, Rios-Buceta L, Garcia-Diez A. Lichen planus and hepatitis C virus infection: a clinical and virologic study. *Acta Derm Venereol*. 1998;78(4):305-306.
- Saitz R. Patients with alcohol problems. *N Engl J Med*. 1998;339(2):130-131.
- etiodronate treatment of postmenopausal osteoporosis; three year of blinded therapy followed by one year of open therapy. *Am J Med*. 1993;95:557-567.
- Civitelli R, Gonnelli S, Zacchei F, et al. Bone turnover in post menopausal osteoporosis. Effect of calcitonin treatment. *J Clin Invest*. 1988;82:268-724.
- WHO Study Group. Assessment of fracture risk and its application to screening for postmenopausal osteoporosis. In: *WHO Technical Report*. Series 843. Geneva: World Health Organization; 1994:1-129.
- Consensus development conference: diagnosis, prophylaxis and treatment of osteoporosis. *Am J Med*. 1993;94:646-650.
- Meunier PJ. Les Osteoporeuses. *Rev Praticien*. 1995:1059-1135.
- Botta Fridlund D. Acute diarrhea. *Rev Praticien*. 199:113-120.
- Matson MA, Cohen EPÆ. Acquired cystic kidney disease: occurrence, prevalence, and renal cancers. *Medicine (Baltimore)*. 1990;69(4):217-226.
- Leroy J, Potron G, Samama M, Guillin MC, Tobelem G. Hémostase et thrombose. *La Simarre*. 1988:1-179.
- Mini Book. Vol 3. *Endocrinologie-métabolisme-nutrition*. 1991:9-76.
- Marolleau JP. L'hématopoëse. *Pathol and Sci J*. 1996:1-13.
- Krouse DS, Fackler MJ, Civin CI, et al. CD34: structure, biology, and clinical utility. *Blood*. 1996;87:1-13.
- Chomienne C, Da Silva N. Hematopoietic growth factors, receptors, intracellular signals. *Pathol Sci J*. 1996:15-28.
- Spikkelman A, de Wolf JT, Vellenga E. The application of hematopoietic growth factor in drug induced agranulocytosis. A review of 70 cases. *Leukemia*. 1994;8(12):2031-2036.
- Cline JL, Czarniecki-Maulden GL, Lonsky JM, Sipe CR, Easter RA. Effect of increasing dietary vitamin A on bone density in adult dogs. *Anim Sci*. 1997;75(11):2980-2985.
- Juturi JV, Hopkins T, Farhangi M. Severe leukocytosis with neutrophilia (leukemoid reaction) in alcoholic steatohepatitis. *Am J Gastroenterol*. 1998;93(6):1013.

SUGGESTED READING

Harris ST, Watts NB, Jackson RD, et al. Four-year study of intermittent cyclic