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Dental Implant Complications –Systemic Diseases- PART-I

Pranav S Patil* **and Akanksha P Patil**

Department of Periodontology & Implantology, Sharad Pawar Dental College and Hospital, Sawangi (M), Wardha, Maharashtra, India

***Corresponding author:** Pranav S. Patil, Department of Periodontology & Implantology, Sharad Pawar Dental College and Hospital, Sawangi (M), Wardha, Maharashtra, India, Tel: 9420349157, E-mail: pranavpatil87@gmail.com

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Abstract

Although dental implants have been a successful option for replacement of lost dentition for nearly five decades, their use in the medical and dental treatment plan is still in its youth. Literature on the medical implications of dental implants is surprisingly sparse, with a need for organization. This review is an attempt to begin the process of documenting the science behind this complex, yet critical topic.

Keywords: Myocardial infarction, Stroke, Osteoporosis, Paget's disease, Psychiatric disorders, Alzheimer's disease, Parkinson's disease

Introduction

Our understanding of the mechanisms of implant success, complications, and failure unfolds from documented case histories, medical data, and clinical research. Yet, as certain as the scientific facts are, there are contradictions and cases with unexpected outcomes yielding both good and bad results. Some cases exhibit outcomes that surprisingly cross the frontier of success, while others seem to head toward failure before the clinician realizes something is wrong. The later example may begin with a common systemic disorder or medical history, seemingly straight forward from the start, only to become bewildering and strenuous to manage. For these reasons we must be critical in case selection and customize treatment plans according to medical condition while managing all medical aspects with vigor, academic excellence, and due diligence. With patient selection being the critical factor for implant success or survival, the medical condition, pharmacologic implications, and overall health of the patient cannot be overemphasized. When medical conditions are managed wisely, most patients with diseases discussed in this chapter enjoy far better overall health if they enjoy the comfort and confidence of fixed prostheses rather than the struggle, discomfort, and self-awareness of dentures in an age where esthetics and self-esteem have never been more highly valued. Now more than ever, exceptional care must be exercised to ensure that every implant is placed and restored with the objective of being as successful and as safe as possible for each patient.

Etiology

Myocardial infarction

Any variation in medical condition or difference in systemic health of the dental patient has the potential to affect substantially the outcome of dental implants [1-2]. For example, 15% of patients have cardiovascular disease (CVD), with a history of hypertension occurring in 58% of these patients [3]. Surveys also indicate that 25% of the population between 35 and 74 years of age are edentulous and have a heightened need for prosthetic dental care [4-8]. CVD has many forms and includes a variety of conditions such as hypertension, atherosclerosis, vascular stenosis, coronary artery disease, and congestive heart failure [9-10]. CVDs in general directly affect the blood supply to tissues through a variety of mechanisms. This manifestation alone impairs the process of healing and affects the oxygen supply delivered through blood flow [11]. The presence of adequate oxygen increases fibroblast activity, collagen synthesis, capillary growth, and macrophage activity, which in turn prevents wound infection [12]. These five CVD forms compromise blood flow and reduce oxygen tension and nutrient elements. Thus, we can expect to observe a potential effect on the outcome of the response to osseointegration.

Khadivi., *et al.* undertook a retrospective study to survey implant treatment outcome of patients with CVD [13]. There were a total of 246 consecutively treated patients, which comprised a CVD interest group of 39 patients, control subgroups of 98 healthy patients, and 109 patients with a history of other systemic diseases. In that study, the differences in implant failure rates between groups

were not found to be significant. Though the sample size was small, the results suggest that CVD may not be a strong risk factor for successful osseointegration.

Ischemic heart disease (coronary artery disease) is most commonly manifested as angina or myocardial infarction (MI). MI occurs when the coronary arteries are severely occluded. Thrombus formation and breakup may place the patient at further risk for a cardiac event. MI is associated with discomfort and a severe crushing substernal pain that may radiate to the neck, jaws, or left arm. The greatest risk is ventricular fibrillation and most deaths occur within 12 hours of the event. Elective implant therapy is contraindicated during this period [14].

In short, any elective dental surgery including dental implant surgery on patients having active, uncontrolled, systemic diseases may increase risks for further complications and thus jeopardize the patient. Exercising prudence in patient management, together with thoughtful scheduling of appointments, allows the patient to stabilize medically before undergoing implant surgery and is basic common sense.

Stroke: cerebrovascular accidents

Fatahzadeh and Glick reviewed the underlying pathogenic mechanism for cerebrovascular accidents as the interruption of blood flow and delivery of essential oxygen and glucose to the brain tissue [15]. The brain does not store glycogen and requires 60-70 ml of perfusion per 100 g of tissue per minute for normal function [16]. A drop in the blood flow to 25 ml/100 g/minute leads to neuronal ischemia, energy failure, and neurologic symptoms, followed by irreversible tissue damage within minutes should ischemia continue [17-18]. Four neurologic phenomena have been defined for stroke based on their duration: transient ischemic attack (TIAs), reversible ischemic neurologic defect (RIND), stroke in evolution, and completed stroke. A TIA is a sudden, short-lasting, focal neurologic deficit or "mini" stroke caused by transient and localized brain ischemia [19]. These neurologic deficits are reversible within days.

RIND refers to a neurologic impairment that is reversible but recovery from which will exceed 24 hours [20]. A stroke in evolution is defined as stroke-associated symptoms that progressively worsen over time. In contrast, neurologic signs and symptoms that have been stable for more than 24 hours define a completed stroke.

The oral manifestations of stroke include loss of sensation of oral tissue and unilateral paralysis of orofacial structures [21-22]. Impaired movement of oral structures may manifest as an inability to manage oral secretions, maintain a protective gag reflex, articulate speech, expectorate, or reproduce a jaw posture necessary for a functional occlusion [23]. More than 50% of stroke patients suffer from dysphagia, often having more difficulties managing liquids than solids [24]. Dysphagia-related changes in mastication and dietary habits can potentially lead to poor nutrition, weight loss, and subsequent problems such as poor fit of oral appliances [25-26]. Oral sensorimotor impairment may result in pocketing of food and neglect or oral hygiene on the affected side, both of which predispose patients to caries, periodontal disease, and halitosis [27]. Poststroke depression and lack of motivation often result in the failure of patients to keep their appointments, appreciate treatment objectives, or comply with recommendations.

In summary, CVD and stroke do not directly impact on the success or failure of dental implants. The complications we need to concern ourselves with are directly related to management of these medically complex patients. We need to be vigilant with monitoring blood pressure, patient stress, and interactions of medications. Coumadin (warfarin), aspirin, plavix, and other anticoagulant or thrombolytic drugs need to be respected. Keep appointments short, efficient, personable, and relaxed. Consider using nitrous oxide analgesia or oral anxiolytics as appropriate to make the patient feel at ease. Monitor vital signs and be sure to have profound anesthesia for additional patient comfort. It is always wise to review emergency procedures with your staff well in advance and be mindful of head position and airway freedom on a stroke patient to prevent aspiration of objects or saliva.

Valvular prosthesis placement

Valvular heart disease occurs when the heart's valves do not work the way they should. Valve disease can be congenital or acquired and often the cause is unknown [28]. According to Rees and Mealey, the most important goal of dental and implant therapy in patients with valvular heart disease is the need to prevent infective endocarditis [29]. Dental procedures often cause a transient bacteremia that rarely lasts longer than 15 minutes, but the bacteria may lodge on abnormal or damaged cardiac tissue, especially valves, which may result in endocarditis [30]. The percentage of patients with endocarditis who have had recent dental treatment varies widely in the literature, from 3 to 40 percent [31-33]. Once again, valvular heart disease does not directly affect implant outcome; however, the heightened risk of infection needs to be recognized. If the implant becomes infected and does not quickly respond to antibiotics, do not postpone appropriate action. Without delay, remove the implant and proceed accordingly. Again, this is preventive patient management. Above all, the primary focus is to prevent bacteremia and to be mindful of changes in premedication protocols. Consider chlorhexidine mouthrinses before dental procedures as a further precaution.

Osteoporosis

Osteoporosis is a skeletal condition characterized by decreased mineral density (mass/volume unit) of normally mineralized bone [34]. The concern that osteoporosis is a risk factor for dental implants is grounded in the assumption that the bones of the mandible

and maxilla are similarly affected to other bones in the body by impaired bone metabolism [35]. However, since a potential relationship between osteoporosis and decreased oral bone mass or density is controversial it is not easy to assess whether bone quantity and quality in the mandible and maxilla parallel those in the rest of the skeleton [36]. Also of concern is the assumption that impaired bone metabolism as it occurs in osteoporosis may affect osseointegration of implants. However, the process of bone remodeling is a non-uniform process. Bone remodeling differs from one bone to another, between cortical and trabecular bone and from one trabecular bone site to another. Trabecular bone is much more affected by metabolic changes in the skeleton and is lost at an annual rate of 0.7% in males and 1.2% in premenopausal females [37]. After menopause the decrease in trabecular bone density exceeds that of cortical bone [38]. Because of this decrease, bone in the maxilla, which consists mainly of trabecular bone, is more susceptible to rapid and severe atrophy than the mandible, which consists primarily of cortical bone [39]. Osteoporotic fractures often heal readily. This suggests that the repair process in osteoporotic patients remains satisfactory, indicating that bone remodeling processes after implant placement in osteoporotic patients may not differ fundamentally from those seen in healthy patients [40,41].

Paget's disease

Osteitis deformans or Paget's disease of bone (PDB) is a chronic disorder of the adult skeleton in which localized areas of bone become hyperactive, resulting in replacement of the normal bony matrix with a highly vascular, softened, enlarged bone. PDB is a localized bone disease that may have widespread distribution, as opposed to a generalized disease such as hyperthyroidism [42].

Under normal physiologic conditions, the skeleton is remodeled to maintain its structural integrity. When the rate of bone turnover is increased, as in PDB, the new bone is formed with less structural order and appears on histologic examination as a disorganized mosaic of woven and lamellar bone [43]. Although bone production is disorganized and there is very rapid deposition of new bone in PDB, the primary cellular abnormality in patients with PDB resides in the osteoclasts. The osteoclasts appear to be normal but have increased activity in response to the markedly increased bone resorption [44]. The number of osteoclasts in pagetic bone can be increased by up to ten-fold compared with normal bone. The osteoclasts of pagetic bone are also much larger than normal and may contain as many as 100 nuclei in a single cell, compared with three to ten nuclei in a normal osteoclast [45].

The epidemiology of PDB shows a slight male predominance (male:female ratio of 3:2). It is believed to affect 2-3% of the population over the age of 50 years [46]. The disease demonstrates increasing prevalence with age [47-48]. The etiology of PDB is unclear. When first described by Paget, it was thought to be inflammatory and to have an infectious origin [49]. Current theories have focused on genetic and viral factors. The genetic theories are supported by epidemiologic studies; viral theories stem from ultrasonic studies demonstrating nuclear and cytoplasmic inclusions [50-53]. More recent studies demonstrate that the inclusions resemble paramyxoviruses [54-55]. Common dental complications include malocclusion, tooth mobility, root resorption, hypercementosis, excessive bleeding on extraction, osteomyelitis, and poorly fitting dentures [56]. Incidence is more frequent in the maxilla, by a 2:1 ratio.

The diagnosis of PDB is established through clinical and radiographic findings together with biochemical analysis. Serum alkaline phosphatase is a biochemical marker of bone formation and in PDB is an accurate indicator of bone turnover and disease activity. The radiographic appearance of PDB depends on the stage of the disease. The resorptive phase is characterized by radiolucent lesions (ground glass appearance) and the appositional phase by irregular radiopacity (cottonwool appearance) [57]. The agents of choice for treating PDB are the bisphosphonates [58].

The development of osseointegrated dental implant treatment has enabled the dentist to establish greater retention, stability, and support for dental prostheses. Improvements in bite force and chewing efficiency have been demonstrated with the use of implants [59-60].

Complications for patients with Paget's disease and dental implants mirror the complications indicated for bisphosphonate drug side-effects. Unlike patients with other systemic diseases that do not directly affect implant success, PDB patients have compromised bone density and may be contraindicated for dental implant surgery.

However, the clinician cannot assume from the dental literature that PDB patients need to be denied implants as a viable option in their dental treatment plan. With intelligent management of the PDB patient, it is possible for them to enjoy the benefits of fixed prostheses. Professional consultation with the patient's physician may provide the guidance needed to incorporate shortterm bisphosphonate cotherapy, in order to strengthen bone and increase density before implant surgery and ensure maximum success.

Psychiatric disorders

The advice and information in the dental literature regarding dental implant treatment for patients with psychiatric disorders are sparse and contradictory [61-62]. When considering contraindications to implant treatment, psychiatric disorders sometimes have been described in terms of being severe or mild, which is to some extent unhelpful. Psychiatric illness encompasses a wide spectrum of heterogeneous disorders and with appropriate care many psychiatric disorders have a favorable prognosis.

Several psychiatric disorders such as anxiety and mood disorders are extremely common and, therefore, it is inevitable that dentists will see partially dentate or edentulous patients with these disorders who need replacement of missing teeth. Dentists, however, are generally ill informed about the nature of psychiatric disorders [63].

Common-sense approaches to psychiatric disorders must be first and foremost in the mind of dental clinicians, with or without implants in the proposed treatment plan. While psychiatric disorders are not directly linked to an increased risk for implant complications or failure, patient expectations, understanding of treatment and comprehension related to informed consent can be directly linked to successful management of dental implants in the long term.

Alzheimer's disease

Alzheimer's disease is the most common form of dementia. It accounts for 60% of cases of people with loss of cognitive function [64]. It is a cerebral degenerative disease of unknown cause that is characterized by memory loss with relatively normal emotional effect [65-66]. The onset of Alzheimer's disease is usually imprecisely dated. The disease has a mean age of onset of 53 years, and is thought to represent an accelerated form of dementia with noticeable inability to initiate spontaneous movement and gradual impairment of intellect and memory.

The clinical course of the disease will vary from patient to patient. The first stage is characterized by memory loss, spatial or temporal disorientation, flat effect, lack of spontaneity, and errors in judgment. This stage is thought to last from 2 to 4 years [67-69]. People in this stage prefer familiar people, places and things, and are easily upset. Less attention will be paid to appearance and hygiene.

The second state is characterized by more rapid and focal losses of cognitive function and partial or total intermittent speech loss. The ability to carry out purposeful movement is lost (apraxia), rendering the person partially or totally unable to perform the activities of daily living.

During the third phase the patient becomes profoundly apathetic, disoriented, bed- or chair-ridden, and incontinent. Seizures are common. Patients tend to touch and grasp objects within range. This often results in bringing an object to the mouth to suck on it [69].

When considering dental implants for the patient with Alzheimer's disease it is wise to thoroughly review prescribed medications along with evaluating caregiver commitment and responsibility. Postsurgical oral hygiene, management of drug-induced xerostomia, and regular preventive maintenance are critical for the longterm success of the patient with Alzheimer's. For these patients, all postsurgical homecare, attendance at appointments, and daily oral hygiene are juxtaposed with third party assistance at home. While there is no reason to deny Alzheimer's patients access to dental implants, a responsible patient agent needs to be included in the treatment plan and management strategy.

Parkinson's disease

Parkinson's disease (PD) is a chronically progressive neurologic disorder caused by neurodegeneration (predominantly of the substantia nigra) and leading to an insufficiency of dopaminergic neurotransmitters [70-72]. PD affects predominantly older adults and in the USA the disease prevalence is estimated at 400 000-600 000 patients with projected figures of 1-3 million by the year 2040. Three cardinal symptoms characterize PD and cause disability in patients: rigidity, tremor, and bradykinesia. The rigidity is caused by an increase in muscle tone. The muscles are stiff, and movement is jerky and slow. Tremor is a shaking at rest which is observed at a frequency of 3-5 Hz. Voluntary movements are slowed and their initiation is difficult or impossible.

In addition, PD patients experience numerous gastrointestinal symptoms, such as nausea, anorexia, abdominal bloating, heartburn, dysphagia, and constipation [73-74]. In view of the digestive problems associated with the disease, the optimal oropharyngeal preprocessing of food is particularly important.

PD patients have great difficulties in adjusting to the use of complete dentures. The same considerations may apply for the patient with PD as for the patient with Alzheimer's disease. Unlike patients with Alzheimer's though, the patient with PD may not necessarily be an older adult. Advanced stages of PD may require management of certain forms of dementia, but many people with PD are fully functioning, productively employed individuals having needs similar to you and me. While the patient with PD struggles with the sequelae of their disease, the overriding symptom, aside from tremor and muscle rigidity, is that PD patients are slower in accomplishing most common tasks and are seriously stressed if someone is not patient with their inability to move with normal speed. PD patients are particularly self-conscious of this disability and will appreciate others who can respect their inability to move more quickly. With this in mind, the treating clinician should be compassionate in scheduling their appointments and not rush them while they are in the chair. Increasing emotional stress in this manner usually exacerbates outward symptoms of tremor, making it far more difficult to complete the dental work planned for that day.

Helping PD patients with fine motor skills related to oral hygiene around dental implants, suggesting oral hygiene supplies designed for disabled individuals along with caries-preventive therapeutics are additionally helpful.

Conclusion

Patient selection is the critical factor for implant success and survival in any medically complex situation. When medical conditions are managed wisely most patients with diseases have improved overall health with fixed replacements as opposed to removable appliances. Exceptional care must be taken so that any implants placed will be successful and safe for the clinician and the patient. It is essential to routinely review the literature and expect that protocols for patients with systemic diseases or taking medications will be regularly updated as our knowledge of dental implants advances.

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