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## MOST COMMON SYSTEMIC DISORDERS: IMPLICATIONS AND CONSIDERATIONS FOR PROSTHODONTIC TREATMENT

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**Abstract:** Prosthodontic procedures need to be carefully judged and planned according the systemic status of the patient. Treatment planning is a consideration of all the diagnostic findings, systemic and local which influence the surgical preparations of the mouth, impression making, maxilla-mandibular relation records, occlusion, form and material in the teeth. So the dentist must not only be aware of the systemic factors but also consider them in the treatment plan. The aim of this paper is to emphasize the implications and considerations of prosthodontic treatment of the most common systemic disorders. Some systemic diseases have a local manifestation with no apparent systemic symptoms and others have both local and systemic reactions. Accordingly, the assessment of medical risks and its relationship to oral health becomes a major area of concern. As certain systemic disorders may produce a pernicious effect on the oral health, it is incumbent for the prosthetic specialists to be aware of the several systemic conditions and also to consider them in the treatment plan. This paper deals with systemic diseases and their management during prosthodontic treatment.

**Keywords:** systemic disorders, implications, consideration, prosthodontic treatment

### 1. INTRODUCTION

The prosthodontic procedures should not be planned until the systemic status of the patient is evaluated. Dental patients vary in their systemic health and prevalence of systemic conditions that might affect dental treatment appears to be high. Surveys indicate that 25% of persons between ages 35 and 74 years are edentulous and require a high amount/degree of prosthetic care. [1] Oral health and systemic health are inter-related. This is particularly more apparent when the patient seeking oral health care presents with some systemic disorder. Presence of medical conditions may alter dental treatment because of direct or indirect effects on oral tissues, bacteraemia, compromise of the immune system, drug interactions, sensory and motor disturbances and disturbances in psychological status of the patients. Prosthodontically, the procedures should not be planned until the overall systemic health status of the patient is thoroughly evaluated as the presence of underlying systemic disorder can cause changes in the oral cavity which can affect the treatment planning as well as prosthetic procedures. The worldwide prevalence of chronic kidney disorder is 10.6-13.4 %, anemia is 24.8%, leukemia is 2.5%, hyperthyroidism is 0.2-1.3% and diabetes mellitus is 8.5%. [2-4] Nearly 422.7 million of the world population suffers from cardiovascular disorder and 43.8 million suffers from dementia. [5] According to a report of WHO (2003), dental diseases are the most prevalent globally and an estimated 5 billion people suffer from tooth decay. [6] Fernandez-Feijoo J et al. found prevalence rate of systemic disease among patients requesting dental consultation to be 35.2% in public system and 28.1% in private system. [7]

### 2. PROSTHODONTIC MANAGEMENT OF PATIENTS WITH SYSTEMIC DISORDERS

#### 1. PULMONARY DISORDERS

There do not appear to be any direct effects of pulmonary diseases on oral health. The medications prescribed for these patients can cause xerostomia, an increased risk of caries, gingivitis, and oropharyngeal candidosis. Patients with chronic obstructive pulmonary disorder (COPD) may experience worsening of respiratory function during dental treatment; therefore a number of precautions are recommended. It is advisable to treat the patient in the vertical position. Modification in rubber dam placement may be required in some cases if the patient complains of suffocating sensation.

While treating asthmatic patients, dental health care providers should be aware of the patient's level of control of his disease. Care should be taken while using dental materials that have powder as a component (eg, alginate and allergens used in latex gloves) which may worsen the patient's airway obstruction if the powder is inhaled. Anxiety can trigger an asthma attack and may exacerbate chronic bronchitis by increasing smooth-muscle contraction hence stress reduction protocol is to be followed. Asthmatic patients can suffer from gingivitis, since they are often oral breathers which may lead to increase gingival inflammation. The use of oral rinses after medication has been found to be of great help in preventing oral lesions. When fixed restorations are given, subgingival finish lines should be avoided. Sulfites used as an antioxidant and preservative for vasoconstrictors, such as epinephrine or levonordefrin in anesthetic cartridges, may trigger an asthmatic attack, hence plain anaesthesia is advisable. [8]

Plaque-biofilm from poor denture hygiene may serve as a reservoir of potentially infectious pathogens by ingestion and aspiration of microbes. This risk can be prevented by means of information, patient education and following appropriate oral and denture hygiene methods that include daily brushing, flossing, and rinsing with antimicrobial mouthwashes. Frequent polishing of the roughened surface of denture base is recommended on recall appointments. [9]

## **2. CARDIOVASCULAR DISORDERS (CVD)**

Patients with CVDs should be given as short appointments as possible. Stress reduction protocol is the key factor in treatment planning and surgical procedures in patients with CVDs. Subgingival finish lines and use of retraction cords dipped in vasoconstrictive agents such as epinephrine should be avoided. The CVDs are also known to cause reduced blood flow, oxygen tension and nutrients to the tissues. Therefore they may be expected to have a negative influence on healing process after implant placement and may be associated with an increased risk of implant failure. So, the prosthodontist must be prudent enough for case selection and implant placements in such patients. Antibiotic prophylaxis for bacterial endocarditis is obligatory for high risk patients like previous endocarditis, prosthetic heart valve, rheumatic valvular defect, congenital heart disease. In patients who take anticoagulants, less invasive surgical procedures should be planned, such as flapless insertion of the dental implant which can reduce the associated risks and minimizes the chances of bleeding. [10]

## **3. ENDOCRINAL DISORDERS**

### **• Thyroid disorders**

Hyperthyroidism is an endocrine disorder that occurs due to excessive production of thyroxin by the thyroid gland, often resulting in a generalized increase in the metabolic rate of body, causing an increase in blood pressure, tachycardia and affects the jaws as osteoporosis does causing a decrease in bone density, altered trabecular bone pattern and bone loss. [17,18] Thyroid hormones-related disorders have also been demonstrated to affect cortical bone healing around titanium implants. [19] Therefore implant treatment in patients with hyperthyroidism history is a compromised treatment. However in medically controlled cases of hypothyroid and hyperthyroidism with normal thyroid function and no symptoms of disease within the past 6 months, a normal protocol may be used for all restorative procedures including dental implants. It is important to know that dental implant placement may trigger a congestive heart failure, or may initiate a cardio-respiratory depression in patients who suffer from thyroid disorders and appropriate care should be taken to avoid such complications. [11]

### **• Diabetes mellitus**

Diabetes mellitus is a metabolic disorder. The disease produce various effects in the oral cavity like: aggressive periodontal disease, alveolar bone loss, increased risk of periodontal abscesses, xerostomia, candidiasis and denture stomatitis. Increased residual ridge resorption is seen in patients with diabetes mellitus. Thus, while planning complete denture prosthesis for such patients minimal pressure technique should be used to record impression. To increase the stability of complete denture prosthesis and to prevent further ridge resorption, neutral zone technique, lingualized occlusion or neurocentric concept of occlusion are advisable. Salivary denture reservoir is indicated in severe cases of xerostomia which is commonly seen in diabetics.

For patient's requiring fixed partial denture (FPD), the finish-line of the preparation should be placed supragingivally. A narrow occlusal table, group function or mutually protected occlusal scheme is better choice for periodontally compromised teeth which are frequently present in diabetics.

Usually the masticatory efficiency of removable prosthesis is lower than that of fixed or implant supported prosthesis. Hence, when diabetes is well controlled, implant placement can be accomplished with least trauma under stress free environment to enhance the overall health of patients. [12]

In the initial years after implant insertion, there is relatively no elevated risk of peri-implantitis; but in the long-term observation, peri-implant inflammation seems to be increased in diabetic patients. Therefore, frequent dental recall visits may prove helpful to detect early signs of gingivitis, which can easily be treated by oral prophylaxis and chances of development of severe peri-implant infection can be avoided.

However, implant placement is contraindicated in cases of uncontrolled diabetes mellitus where severe hyperglycemia, microangiopathies, impaired leucocyte function, decreased cellular immunity and reduced collagen production usually hampers wound healing.

## **4. NEUROLOGICAL DISORDERS**

### **• Alzheimer's disease (AD)**

The chief problems of patients with AD are behavioral. The dental appointments and instructions are usually forgotten. These patients usually present with a progressive neglect of oral health as a result of forgetting the need or even how to brush the teeth or clean dentures often leading to poor oral and denture hygiene. Therefore,

dental professionals and caregivers should use behaviour management and preventive oral care techniques. Due to severe dementia, dentures are frequently lost or broken. To prevent breakage of denture during frequent falls high strength acrylic resin can be used for fabrication of removable prosthesis.

Often in these patients, minor changes in oral environment can produce disturbances due to the impaired capacity for adaptation including difficulty in adaptation to new prostheses. Treatment plans should therefore be designed with minimal changes to the oral cavity and should not involve complete rehabilitation. [13]

- **Parkinson's disease (PD)**

Edentulism is commonly seen in patients with PD due to advanced periodontal disease. The semi-reclined 45-degree position during impression procedure should be used to avoid excessive saliva pooling and the risk of choking. It is advisable to record impressions with quick-setting impression materials. The use of monoplane artificial acrylic teeth and reduction in the vertical dimension of the dentures is advisable for these patients to stabilize the occlusion in patients with poor muscular control to accommodate irregular mandibular movement. Lingualized occlusal scheme should be used to limit lateral denture movements and better masticatory efficiency. To enhance stability and retention of denture use of neutral zone technique is recommended. To provide better proprioception, controlled jaw movements and masticatory efficiency implant or tooth supported overdentures are advisable. Magnets can also be used for easy placement of the dentures. [14]

Flexible removable partial dentures can be used to obtain good retention and stability. For the fixed partial denture, the margins of the prepared teeth should be kept supragingival or equigingival. Full coverage design should be followed for maximum retention and resistance. The contacts and contours of the pontic and retainers should be self-cleansing. Resin cement should be used for cementation for metal copings and fixed partial dentures as it reduces the microleakage. [14]

Xerostomia is a common symptom seen in patients with diabetes mellitus, chronic renal disorders and Parkinson's disease. Frequent water sipping and artificial saliva substitute should be advised to these patients to compensate for the oral dryness. For recording impression in xerostomic patients silicone impression materials should be used as they are the best tolerated and least traumatic to the mucosa. Use of zinc oxide eugenol paste, should be avoided as they can may cause the oral mucosa to burn.

Dentures incorporating metal bases should be used as they exhibit improved accuracy of fit and effective wetting contributing to better retention. If resin denture bases are used soft relining can be done to improve comfort.

Patients can be advised to spray/wet their prostheses with artificial saliva before denture insertion and before meals. Water based denture adhesives can be used to augment retention as well as to provide hydration, cushioning and lubricating effect in xerostomic patients. When fixed partial dentures are given they should have full coverage retainers and easily cleaned pontics. The margins of retainers should be supragingival.

## 5. BONE AND JOINT DISORDERS

- **Temporomandibular joint disorders (TMD's)**

Patients with TMDs often suffers from painful mandibular movements which presents a problem for the construction of removable prosthesis. Special impression trays are required because of limited access resulting from reduced ability to open the jaws. Sectional impressions, hinged complete denture prosthesis with swing lock, sectional/collapsible dentures may be used.

Three to five occlusal units are necessary to allow a stable jaw relationship at maximum intercuspation. If sufficient posterior support is missing, the restoration should be made in centric relation; however, a more anterior position may be acceptable if CR is an uncomfortable position for the patient. In the instance of TMJ arthropathies, it is often necessary to restore in a mandibular position that is ahead of CR. It is recommended to test the favored condylar position with the help of an oral splint before prosthetic rehabilitation is begun. Fixed restorations should be temporarily cemented and the patient should be rescheduled on a regular basis. When final cementation is considered, a segmental approach may be advantageous. Additionally, overstretching of the TMJs and the facial muscles should be avoided.

The most common method used to prevent the destructive effects of bruxism on wear of teeth and prosthodontic restorations is through different types of interocclusal appliances (e.g. occlusal splints, nightguards, etc). While doing prosthetic rehabilitation in patients with bruxism efforts should be made to reduce the effects of heavy occlusal loading on all the components that contribute to prosthetic structural integrity. In cases where distal extension removable partial dentures and complete denture prosthesis are required, soft relining should be done to prevent the resorption of underlying residual ridge from the excessive forces of mastication.

When restoring the patients with fixed partial dentures, metal-ceramic seem to be the safest choice in these cases. Zirconia restorations are contraindicated specifically when opposing natural teeth are present as they may lead to severe abrasion of natural dentition. [15]

When implant supported restorations are planned in bruxers, preventive measures should be taken to minimize the forces that are applied to implants. The number of implants should be increased in order to reduce the amount of forces received on each individual implant. The implants with a larger diameter and longest length allowed by the remaining bone should be used to reduce the amount of stress in the cortical bone. Immediate loading of implants should be avoided as excessive biting pressure will prevent the osseointegration of the implants. In addition, before proceeding for any treatment, patients should be informed about the need for regular maintenance to avoid complications and accept the possibility of technical complications that may generate additional costs of maintenance. [15]

#### **Osteoporosis**

Osteoporosis causes a generalized loss of BMD (bone mineral density) including maxilla and mandible. Jaw bones become porous and show microarchitectural deterioration of trabeculae and a decrease in cortical thickness. For the removable prosthesis, mucostatic and open mouth impression techniques are recommended. Also, the denture bases should be lined with soft reline material to provide cushioning effect to the jaw bones.[16]

This clinical situation, however, does not contraindicate the implant placement. Prosthodontist should be more careful during surgery; a proper case selection, the correct diagnosis of bone condition of the implant surgery site, proper bone augmentation, need of post-operative control can make the implant rehabilitation convenient in these patients. A longer period of osseointegration should be provided because the decrease in bone density affects the bone-implant contact.

Careful attention should be given while placing the implant in maxilla mainly in the maxillary tuberosity where the fracture of cortical bone can cause implant locking. One thing of concern to the prosthodontists is that the implants placed in patients with osteoporosis usually presents a greater marginal bone loss than those placed in systemically healthy patients. Placing implants in patients with low bone density might require bone condensation and/or step osteotomy to enhance success. [17]

#### **6. RENAL DISORDERS**

They may produce oral changes such as premature tooth loss, edentulism, xerostomia and hence require prosthetic care. All the dental problems of a patient with chronic renal failure should be treated prior to transplantation because in order for the body to accept transplantation the immune system is suppressed by immunosuppressive agents that simultaneously reduces the ability of the body to cope with systemic infections as well as stress usually caused by the dental treatment.

When implants are to be placed prior to transplantation, an adequate period of time for the osseointegration of the implants should be given. If implants are planned after transplantation than dental surgery has to be postponed until the patient's health has been stabilized and the transplant has been fully accepted by the body. As most of these patients are hypertensive, local anesthesia without vasoconstrictors should be preferred.

Osteodystrophy is a common finding in patients with chronic kidney disorders which can lead to bone demineralization, decreased trabeculation of cancellous bone, decreased thickness of cortical bone of the jaws and may cause jaw fracture either spontaneous or after dental procedures, so implant placement has to be carefully monitored. [18]

In the patients with hemodialysis the implant surgery should be performed on the first day after hemodialysis. Patients receiving hemodialysis three times a week have an interval of 2 days between sessions, so in such cases the implant surgery can also be scheduled for the second day after hemodialysis. [19]

Gingival enlargement around natural tooth as well as dental implant is commonly seen in renal failure patients taking calcium channel blockers. The nephrologist can be consulted in order to exchange a calcium channel blocker for another antihypertensive medication. Proper periodontal maintenance is necessary to avoid the gingival enlargement, peri-implant mucositis and peri-implantitis. The main therapy for this includes nonsurgical approach, such as drug therapy, laser therapy, and photodynamic therapy.

Removable prostheses can be advised thereafter. Considering these possible risk factors, screw retained implant prosthesis are recommended for ease of maintenance. [19]

#### **7. HEMATOLOGICAL DISORDERS**

##### **• Leukemia**

Leukemia is a malignant neoplasm that occurs due to the uncontrolled proliferation of and release of immature blood cells from hematopoietic system. Removable partial or complete dentures that doesn't irritate the soft tissue can be used for the replacement of the missing teeth provided that the patient maintains good oral hygiene. Fixed partial dentures with supra-gingival finish lines and digital impression techniques are recommended to prevent any injuries to the gingiva. Severe bleeding, delayed healing, increased risk of secondary infection and post-operative discomfort contra-indicates the implant placement in these patients.

• **Anemia**

Most of the anemic patients, implant procedures are not contraindicated, however preoperative and postoperative antibiotics needs to be carefully administered. Patients with anemia usually show disrupted and delayed healing pattern and therefore require a longer time for the implants to osseointegrate. Progressive loading of the implants should therefore be followed.

8. **RADIATION THERAPY**

Patients with a history of radiation therapy to head, neck and face region have a plethora of issues with the tissue healing after surgery. Dental implants are generally contra-indicated in this group of patients.

3. **CONCLUSION**

It is the responsibility of the dentists and other health care providers to be aware of the congruous relationships between oral and systemic health. The systemic condition of the patients should be thoroughly evaluated and necessary precautions should be taken prior to and during prosthodontic treatment to avoid any complications. Prosthodontists play an important role in the overall management of such patient's health by prevention and treatment of oral and to some extent systemic diseases, in coalition with the patient and his physician. As each individual differs anatomically and physiologically, the decision-making for prosthetic rehabilitation of such intricate cases in the end should be driven by a combination of information obtained from all sources and clinical experience to make the final diagnosis and treatment planning. The practitioner neglecting the systemic status in the history will step into more serious complication at the cost of individual life.

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