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Review Article

PROSTHODONTIC CONSIDERATIONS IN THE MANAGEMENT OF PARKINSON'S DISEASE- A REVIEW

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ABSTRACT

Parkinson's disease is a neurological disorder characterized by tremors, rigidity, bradykinesia and postural instability. It is estimated that 6.3 million people have Parkinson's disease including all races and cultures. It is not contagious and its incidence increases with age. Impairment of motor skills and cognition compromise the patient's diet, nutrition and ability of maintaining proper oral hygiene. As a result dental caries and edentulism seem to be a direct impending predicament. Prosthodontics management of such patients require diligent handling with "Tender, Love and Care" and educating the patient and the family regarding the disease. This article reviews the etiology, clinical features, and general and prosthodontics considerations in the management of a patient with Parkinson's disease.

Keywords: Choreiform, Denture Stability, Implants, Neutral zone, Parkinson's Disease, Saliva.

INTRODUCTION

Background

Parkinson's disease, or Paralysis agitans, is a progressive, neurodegenerative disorder that affects movement, muscle control, and balance, as well as numerous other non-motor functions. It is part of a group of conditions known as Motor Systems disorders. Also known as the "shaking palsy", the disease was named for James Parkinson, a general practitioner in London during the 19th century who first described the symptoms of the disease. Symptoms describing Parkinson's disease are mentioned in writings on medicine in India dating back to 5,000 B.C., as well as in Chinese writings dating back approximately 2,500 years. Parkinson's disease is the most common movement disorder and the second most common neurodegenerative disorder¹.

Epidemiology

It has a typical onset during middle and old age, with peak age of onset between 55 and 65 years. PD occurs in about 1 in 1,000 persons in the general population and in 1% of persons older than 65 years. Approximately 100,000 residents of Canada live with PD. According to the National Institute of Neurological Disorders and Stroke (NINDS), there are approximately 1.5 million people in the U.S. who suffer from

Parkinson's disease — approximately 1-2% of people over the age of 60, and 3-5% of the population over age 85. Various studies have reported the incidence of PD from 8.6-19 per 100,000 people. Approximately 50,000 new cases are diagnosed in the U.S. annually.

The Parsi community in Mumbai has the world's highest incidences of PD where it affects about 328 out of every 100,000 people despite living in a country, India, with one of the world's lowest incidence of PD (70 out of 100,000).

It is more common among Caucasians than in persons of black African or oriental Asian ancestry, and just under twice as common in men than in women. Genetics are implicated in a minority of cases, and exposure to chemicals in the environment might also play a role¹⁻⁵.

Pathophysiology:

Pathologically, the hallmark features of PD are degeneration of dopaminergic neurons in the substantia nigra pars compacta (SNc), reduced striatal dopamine, and intra cytoplasmic proteinaceous inclusions known as Lewy bodies. As described by James Parkinson in 1817, Parkinson's disease is caused by depletion of neurotransmitters, dopamine and nor-epinephrine in the basal ganglion. The deficiency of the neurotransmitter dopamine interferes with the conduction of nerve impulses related to muscle activity^{2,3}.

Etiology

According to the Parkinson's Disease Foundation, two major factors are considered the cause for Parkinson's disease: genetics and environment.

a. Genetic Factors

Based upon the current research, the vast majority of Parkinson's cases are not directly inherited, as about 15 to 25 percent of people with Parkinson's report having a relative with the disease. In large population studies, researchers have found that, as compared to the general population, people with first degree relatives such as parents or siblings suffering from PD have a four to nine percent greater chance of developing PD. Scientists have discovered mutations in genes that play a role in dopamine cell functions. These genes include alphasynuclein, leucine rich repeat kinase 2 (LRRK-2), and glucocerebrosidase (GBA)⁴. While it is possible these mutations may be the cause for the disease directly, they seem to affect only a small number of families.

b. Environmental

Some studies have demonstrated that prolonged occupational exposure to certain chemicals is associated with an elevated risk of PD. Epidemiological research has identified several factors that may be linked to Parkinson's, including rural living, well water, manganese, and pesticides. In 2009, the U.S. Department of Veterans Affairs added Parkinson's to a list of diseases possibly associated with exposure to Agent Orange.

A synthetic neurotoxin agent discovered in the 1980s called MPTP can also cause immediate and permanent Parkinsonism. The compound was found mainly in individuals who injected themselves with a synthetic form of heroin contaminated with MPTP. However, cases of MPTP-induced Parkinson's in the general population are exceedingly rare.

c. Recent evidence

Indicates some other contributing factors which when integrated with the major cause may lead to a high PD rate. They are:

- Oxidative damage: Some researchers consider free radicals or even endogenous toxins circulating in the body to be a contributing factor in PD^{5,6}.
- Toxins: Chronic exposure to toxins such as pesticides, considering the geologic location and living conditions of the patient, can lead to considerable loss or degeneration of the dopamine-producing cells.
- Occupational hazards: A high prevalence of PD is thought to be present in patients related to occupational fields such as welding, cleaning, or farming. Even drinking water from wells with high concentrations of heavy metals like mercury, iron, zinc, manganese, and so on for an extended period of time may increase the incidence for PD^{6,7}.
- Aging: The latest evidence indicates the normal aging process is a natural cause in reduced or even accelerated death of dopamine-producing cells in PD patients^{7,8}.

Clinical characteristics:

The characteristic manifestations of Parkinson's disease are tremor (trembling in hands, arms, legs, jaw, and face); rigidity (stiffness of limbs and trunk); bradykinesia (slowness of movement); akinesia (reduction in muscle movement); and postural instability (poor balance and coordination). The

tremor occurs at rest, is rhythmic, and usually involves primarily the hands ("pill rolling tremor"); it typically stops during intended movements. Akinesia and bradykinesia lead to infrequent blinking, as well as posture and gait abnormalities, such as rapid, short, shuffling steps^{1,8-12}.

Patients usually stand in a slightly stooped posture with arms flexed. They often have difficulty in starting to walk; when they finally succeed, their steps are short and arm swing is reduced or absent. When they turn, normal fluid movements are replaced by turning the body as a whole, and they may have difficulty stopping immediately.

Pain [musculoskeletal, sensory (burning, numbness, tingling), and akathisia (subjective feeling of restlessness restless leg syndrome)], and bowel and bladder dysfunction (e.g., constipation and bladder urgency/frequency) occur in about 50% of persons with PD.

Other symptoms include a soft, barely audible voice with pitch monotony, as well as progressive difficulty writing, which results in micrographia (tiny script). Cognitive impairment of memory and concentration occurs to a variable degree. Mood disturbances (depression, anxiety, apathy) and insomnia, and fatigue are common. Dementia occurs in approximately 25% of patients/clients.

Drug-induced psychosis (related to dopaminergic medications) occurs in up to 20% of persons treated for Parkinson's disease. PD medications can also result in nausea and tardive dyskinesia (involuntary repetitive movements of facial, buccal, oral, and cervical muscles). Several conditions may mimic Parkinson's disease in their clinical presentation, due to lack of dopamine in the brain. These include "Atypical Parkinsonism" or "Secondary Parkinsonism" health problems (e.g., AIDS, encephalitis, meningitis, stroke, carbon monoxide poisoning, mercury poisoning, and narcotic overdose), as well as the side effects of drugs such as antipsychotics (e.g., haloperidol and phenothiazines) and the gastrointestinal medication metoclopramide^{12,18,19}.

Orofacial findings:

Patients with Parkinson's disease have a typical "mask like" appearance due to reduction in the movements of the facial muscles. Tongue thrusting and lip pursing are common symptoms. The voice changes to soft, hurried, monotonous, barely audible as a result of rigidity. The taste is altered because of medications and they need more time to consume food, due to slow chewing movements, reduced tongue movements and dysphagia. Drooling of saliva from the corners of the mouth is followed by angular cheilitis, skin irritation and fetid odour. Food and saliva may get collected at the back of the tongue, resulting in choking. This is due to inability to swallow and anterior bowed head position. Bruxism, attrition and some cracked teeth are due to the orofacial musculature tremors and levodopa medications.

Medications used for the management of PD like anticholinergics, dopaminergics and levodopa generally cause xerostomia. Burning mouth syndrome affects 25% of the Parkinson's patients. Irrespective to whether the patient is dentulous or edentulous, removable denture wearer or dentate subject, symptoms like burning sensation of the tongue, hard palate, floor of the mouth, lips, cheeks and edentulous alveolar ridge are noted.

Because of these progressive changes that accompanied entulism, the fundamental dynamics that define the oral cavity, the loss of patients capability to adapt due to neuromuscular disease such as parkinsons disease and increased life expectancy have posed a challenge for the dentist when restoring and rehabilitating the oral cavity¹³⁻¹⁶.

A. General considerations in management :

- a. Short Visits:- Before beginning with the treatment, the dentist has to consult the patient's physician for any modification in the treatment plan. An informed consent by the patient or caregiver has to be obtained. These patients should be scheduled for short appointments of less than 45 minutes early in the morning as the symptoms are least bothersome 60 to 90 minutes after the administration of the drugs like levodopa. Patient should empty his/her bladder to prevent urinary urgency and incontinence. As the disease progresses, the amount of time the patient/client responds optimally to PD medications decreases, and therefore shorter, more frequent dental hygiene visits may be more realistic and productive^{17,19}.
- b. Chair position:- Depending on the severity of PD, patients/clients may be ambulatory but using assistive walking devices or may be confined to a wheelchair. They may have difficulty rising from a sitting position and trying to turn from one side to another in the recumbent position. The dental chair should be raised slowly so that the patient is adjusted to the upright sitting position to prevent orthostatic hypotension. In some patients to prevent anxiety or frustration behaviour, the dentist has to identify himself each time, use simple words, short sentences and limit the use of face mask; smiling, direct eye contact and gentle touch may help. Patient's caregiver can sit next to the patient to reduce the anxiety¹⁹.
- c. Role of dental hygienist :- The dental hygienist who treats adult patients/clients can play an important role in recognizing the features of Parkinson's disease and encouraging medical consult for definitive diagnosis and treatment. The dental hygienist may need to provide the patient/client with treatment breaks, depending on degree of muscular and mental fatigue^{20,22}.
- d. Role of caregivers:- As the disease progresses, more of the oral healthcare will necessarily be performed by caregivers. Therefore, caregivers need to be instructed in effective plaque control procedures, as well as client positioning for optimal stability and access.
- e. Role of speech therapist:- A speech and language therapist may be able to help with swallowing problems with exercises to strengthen lips, tongue, and throat plus dietary advice to include foods and liquids that are easier and safer to swallow.
- f. Use of physical restraints:- For some persons with PD, maintenance of body stability may be a concern, given the presence of tremors and/or choreiform(rapid jerky) movements. The patient/client may need to be secured in the dental chair with restraints or support devices, such as soft ties, belts, or pillows. A caregiver may play a role in holding patient/client.
- g. Salivary substitutes:- Because Xerostomia is a common medication side effect, saliva substitutes can be recommended. This will reduce dysphagia and improve denture retention. Topical fluoride should be considered to prevent root caries.
- h. Sedation:- Relaxation and diversion methods can be implemented to reduce the stress. The patient/client's involuntary muscle movements can create a safety concern for the dental hygienist. Choreiform movements, dyskinesias, and tremors associated with the use of levodopa or its derivatives may require sedation techniques. Local anesthesia containing epinephrine must be cautiously administered if the patient is treated with levodopa and entacapone, as it may lead to an increase in blood pressure and heart rate. In very severe cases, it may be necessary to refer the client for treatment under general anesthesia^{8,9}.
- i. Use of mouth props:- Patients of Parkinson's disease cannot keep their mouth open, there can be drooling of saliva and tongue and head movement may interfere with the treatment. Mouth props like an extraoral ratchet-type prop or intraoral rubber bite block may help when there are impaired oral reflexes, muscle weakness and tremors. To facilitate the patients swallowing, the dental chair can be inclined to around 45 degree and an aspirating tip can be placed under a rubber dam to aspirate the saliva²⁰.
- j. Airway obstruction:- If there is swallowing difficulty and a diminished gag reflex, the patient/client may need to be seated in a more upright position to avoid choking and aspiration. Optimal suctioning and limiting use of water can help prevent airway obstruction^{22,24}.
- k. Oral hygiene instructions:- Major components of oral hygiene and home care programs require muscle-eye coordination, digital dexterity and tongue-cheek-lip control. Tremor or associated loss/reduction of above faculties mitigate against oral hygiene procedures. Oral hygiene maintenance is compromised in these patients because of poor motor function. In addition to the motor difficulties , the behavioural changes like apathy, depression and amnesia also have a negative impact on the oral hygiene. Instructions for individualized self care should be customized based on the patient/client's level of motor coordination (e.g., hand strength, ability to use toothbrush). Toothbrush and toothpaste dispenser modifications (e.g., Collis curve toothbrush or power toothbrush and pump/flip top toothpaste dispensers) may be indicated, as may be alternatives to dental floss. Only patients/clients with the ability to adequately control gagging and swallowing can safely use fluoride and chlorhexidine rinses at home^{21,23-26}.
- l. Diet modifications:- A non-cariogenic diet should be recommended, especially to patients/clients with mastication and swallowing difficulties who might be inclined to consume soft, carbohydrate rich foods. Appropriate nutrition and caloric intake should also be ensured, because persons with PD often avoid nutrition rich foods such as vegetables, which require the ability to chew well^{9,10}.

B. Prosthodontics considerations in management :**1. Removable prosthesis:**

Patients of PD have difficulty in controlling and retaining the dentures due to tremors, rigidity of the orofacial musculatures and drooling of saliva. Therefore, the denture retention, stability and support are compromised. Impressions should be recorded with quick setting impression materials especially in severe form of PD. Patients being treated for complete denture, wax or compound should be used for recording jaw relations (as it registers instantaneously) after proper training. Patience and practice helps in improving the coordination. Jaw exercises are helpful. Neutral zone technique, flange technique and selective grinding of the occlusion (to remove the interferences) to obtain the maximum stability and retention of the dentures are useful techniques. Monoplane teeth are generally selected to compensate for the oro-buccal dyskinesia^{23,27}. The dentures should be fabricated by using metal denture base or with reinforcements or high impact denture base resin.

Moisture based denture adhesives or artificial salivary substitutes can be prescribed depending on the patient's manual disability and xerostomia²⁸. Patient's oral hygiene and denture cleanliness is to be followed efficiently. Denture cleansers can be prescribed for cleaning the dentures. In the patients with PD, "one handed preventive strategies" allows the person to use the stronger side of the body can prove to be useful. For instance, some find that caring for the dentures is made easier by attaching nailbrush to a household surface with a suction cup and then moving the brush back and forth across the brush.^[29] In removable partial dentures, the design of major connectors should not be small so as to prevent its aspiration and choking. Denture retainers should be designed for adequate retention. Precision attachments are not advocated as the patient lacks the necessary stable movement for insertion of the prosthesis. Flexible dentures (valplast, lucitone), a recently available prosthetic material for removable partial dentures provide good retention and stability, but its effect on the tissue surface has to be studied.

Overdentures can provide better masticatory efficiency as compared to patient wearing conventional complete dentures. Abutments used for overdentures should be self cleansing. The metal copings should be cemented by using resin cement so as to reduce the microleakage. Magnets can be used for easy insertion of the dentures and provide added retention^{22,30}.

2. Fixed partial denture:

The margins of the preparations should be kept supragingival or equigingival. Full coverage design is followed for maximum retention and resistance. Suction aids, and rubber dam are essential if there is drooling of saliva. An expanding vinyl polysiloxane gingival retraction material (GingiTrac) can be used for retraction of the gingival sulcus.^[29] The contours and contacts of the pontic and retainers should be self cleansing. Over contouring may cause plaque accumulation, followed by gingival hyperplasia. Telescopic crowns can also be given

as they reduce lateral stress on abutment teeth by allowing stress release or stress conversion. In addition to this telescopic dentures act as a bruxism appliance or habit breaking appliance^{22,28}. If the patient has bruxism then porcelain fused to metal or gold bridge can be advocated. Resin cement should be used for cementation for fixed partial dentures as it reduces the microleakage.

3. Implant Surgery:

The quality of oral health and general health has improved by using implant supported prosthesis and is associated with marked increase in masticatory ability¹⁵. Mandibular overdenture with magnetic attachment can be utilized as it is easy for insertion by the patient or by the caregiver. Although some patients find it inferior to long bar overdentures with more implants on grounds of stability, comfort, and ease of chewing. The denture body can be connected to the two implants using a variety of connectors, such as bar connections, single spherical attachments (otherwise known as ball anchors), magnets, rigid or cylindrical telescopic copings and non-rigid telescopic copings(resilient copings).^[29,30]

CONCLUSION

Parkinsonism is a degenerative disorder that affects the muscles of the face, tongue, palate and pharynx. The psychological and behavioural pattern associated Parkinson's disease can cause major difficulties during the fabrication of a dental prosthesis. The success of the prosthesis will depend on the careful approach with diligent handling of the patient during the entire therapy. Educating the patient and the family regarding the post insertion care of the prosthesis is essential for the long term success of the treatment.

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