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Case Report

Prosthodontic Management of a Diabetic Patient Using BPS Denture: A Case Report

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Abstract

Introduction: Diabetes mellitus affects oral health, wound healing, and the success of prosthodontic treatment, necessitating careful planning and execution of denture therapy. Biofunctional Prosthetic System dentures are designed to provide precision, improved fit, and enhanced esthetics, making them particularly suitable for medically compromised patients.

Case Report: A 62-year-old male patient with type II diabetes mellitus underwent prosthodontic rehabilitation using Biofunctional Prosthetic System dentures. The treatment approach prioritized systemic considerations, material biocompatibility, and atraumatic fabrication techniques to achieve optimal results.

Discussion: This case illustrates how Biofunctional Prosthetic System dentures can enhance retention, stability, and patient comfort while minimizing trauma to compromised oral tissues in diabetic individuals.

Conclusion: Biofunctional Prosthetic System dentures represent an effective and patient-friendly option for the prosthodontic management of diabetic patients, offering improved functional and esthetic outcomes with reduced risk to oral tissues.

Keywords: Biofunctional Prosthetic System, Complete denture, Diabetes mellitus, Geriatric dentistry, Prosthodontics.

Introduction

Diabetes mellitus (DM) is a chronic metabolic disorder characterized by persistent hyperglycemia resulting from insulin deficiency, insulin resistance, or a combination of both. It affects nearly 537 million adults worldwide, with its prevalence steadily increasing, particularly among aging populations who frequently present with edentulism [1]. The interplay of xerostomia, delayed wound healing, heightened susceptibility to infections, and fragile oral mucosa presents unique challenges in the prosthodontic rehabilitation of diabetic patients [2]. Globally, diabetes mellitus is one of the most significant chronic diseases, affecting more than 6% of the population, and its prevalence rises each year [3]. The World Health Organization predicts that the number of individuals with diabetes will reach 366 million by 2030, compared to 30 million in 1985 [4]. Hyperglycemia, the defining feature of diabetes mellitus, leads to both microvascular and macrovascular complications that can affect the eyes, kidneys, nerves, heart, and oral tissues [5]. These complications alter the normal oral flora and reduce salivary flow, resulting in xerostomia, which increases the incidence of caries and periodontal disease and ultimately leads to tooth loss. Tooth loss in turn compromises quality of life due to impaired mastication [6].

Diabetes mellitus is fundamentally a disorder of glucose, fat, and protein metabolism caused by impaired insulin secretion, insulin resistance, or both. It is defined as a chronic, progressive metabolic disease characterized by hyperglycemia resulting from disturbances in insulin secretion or action. The pancreas contains the islets of Langerhans, composed of β-cells that produce insulin, α-cells that produce glucagon, and δ-cells that produce somatostatin, with disturbances in these cell populations contributing to the development and pathogenesis of diabetes mellitus [7].

Type 1 diabetes mellitus occurs due to destruction or dysfunction of pancreatic β-cells, leading to impaired insulin production. This process may result from autoimmune reactions, α-cell abnormalities, or viral infections such as Coxsackie, Rubella, CMV, and Herpes viruses. Autoimmune destruction of β-cells elevates islet cell cytoplasmic antibodies (ICCA) and causes insulin deficiency, thereby disrupting normal metabolism. Under physiological conditions, hyperglycemia suppresses glucagon secretion; however, in type 1 diabetes, glucagon levels remain inappropriately high. Somatostatin therapy is often employed to reduce glucagon, glucose, and ketone body levels, while insulin therapy remains essential to prevent the formation of ketone bodies. Without insulin therapy, type 1 diabetic patients may experience ketoacidosis, and prolonged therapy carries a risk of hypoglycemia that can result in diabetic shock or death. Target cells in type 1 diabetes often exhibit reduced responsiveness to insulin due to alterations in free fatty acid metabolism, with uncontrolled lipolysis suppressing glucose metabolism in peripheral tissues such as muscles. Furthermore, this inability to respond to insulin downregulates hepatic glucokinase and GLUT4 gene expression [8].

In the early stages of type 2 diabetes mellitus, insulin levels are often normal or elevated despite increased blood glucose levels, indicating insulin resistance rather than deficiency. Over time, however, insulin secretion declines, and hepatic glucose production rises, differentiating type 2 diabetes from autoimmune β-cell destruction. Insulin secretion occurs in two phases: an initial rapid release after glucose stimulation and a second sustained release about 20 minutes later. In early type 2 diabetes, this biphasic pattern is impaired, with inadequate compensation for insulin resistance eventually leading to insulin deficiency requiring exogenous supplementation [9].

Gestational diabetes mellitus typically manifests during or after the second trimester of pregnancy and often resolves spontaneously postpartum. Nevertheless, it can result in adverse outcomes for the infant, including congenital malformations, increased birth weight, and heightened perinatal mortality risk. Women with gestational diabetes also have a higher likelihood of developing diabetes mellitus later in life and should adopt stringent dietary and lifestyle modifications to mitigate this risk [10].

Pre-diabetes represents a state of normoglycemia at baseline with elevated glucose levels under certain conditions and increases the risk of developing diabetes mellitus, myocardial infarction, and stroke [11]. If left uncontrolled, it may progress to type 2 diabetes within 5–10 years, necessitating preventive measures such as dietary management, lifestyle modification, and regular exercise [12]. Two major types of pre-diabetes include impaired fasting glucose (IFG), characterized by fasting blood glucose levels of 100–125 mg/dl, and impaired glucose tolerance (IGT), defined as postprandial glucose levels of 140–199 mg/dl two hours after a 75 g glucose load [13]. Diagnosis of diabetes mellitus is established based on clinical features such as polyuria, polydipsia, polyphagia, and weight loss or, in asymptomatic individuals, via fasting blood glucose ≥126 mg/dl or random blood glucose ≥200 mg/dl as per American Diabetes Association criteria [14].

Diabetes mellitus leads to a spectrum of complications, classified as short-term (hypoglycemia, diabetic ketoacidosis) and long-term (retinopathy, neuropathy, nephropathy, and cardiovascular disease) [15]. In the oral cavity, diabetes mellitus predisposes individuals to various conditions including periodontitis, gingivitis, salivary dysfunction, fungal and bacterial infections, impaired wound healing, non-candidal oral soft tissue lesions, mucosal diseases, oral sensory disorders, dental caries, and tooth loss. Periodontitis, a chronic inflammatory disease of the tooth-supporting tissues, is notably more prevalent and severe among individuals with both type 1 and type 2 diabetes mellitus, especially when glycemic control is poor [16]. Advanced glycation end products (AGEs), impaired neutrophil function, and pro-inflammatory cytokines collectively exacerbate periodontal tissue destruction. Studies also indicate that effective periodontal therapy may improve glycemic control, as evidenced by reduced HbA1c levels [17].

Salivary dysfunction in diabetic patients manifests as reduced flow rates and xerostomia, particularly in individuals with uncontrolled disease and neuropathy. Chronic complications such as vascular abnormalities and endothelial dysfunction impair salivary gland microcirculation, contributing to altered saliva quantity and composition. Xerostomia may cause soft tissue irritation, inflammation, and increased calculus formation. Taste dysfunction, often neuropathy-related, further compromises nutritional intake and dietary adherence. Hyperglycemia and reduced salivary flow also predispose diabetic patients to Candida albicans infections, while decreased immune defense facilitates bacterial colonization, particularly by Streptococcus species.

Impaired wound healing is frequently observed following dental surgery in diabetic individuals, driven by vascular compromise, diminished growth factor production, and immune dysregulation. Non-candidal lesions such as fissured tongue, irritation fibroma, and traumatic ulcers are also reported, as are mucosal conditions like oral lichen planus and recurrent aphthous stomatitis, both more prevalent in diabetes due to autoimmune or immunologic alterations. Oral neuro-sensory disorders, including burning mouth syndrome, dysesthesia, tingling, and numbness, are similarly linked to diabetic neuropathy. Collectively, xerostomia, impaired salivary buffering, and hyperglycemia increase susceptibility to dental caries and tooth loss [18].

Optimal management of diabetic patients in dental settings requires strict glycemic control, which directly impacts treatment success. This control may be achieved through lifestyle modifications and pharmacological therapy. Dietary regulation, physical activity, and weight management can significantly reduce diabetes-related complications. Pharmacological agents such as sulfonylureas, nonsulfonylurea secretagogues, alpha-glucosidase inhibitors, thiazolidinediones, and metformin target different aspects of glucose metabolism, insulin secretion, and hepatic glucose production to achieve normoglycemia [19].

For patients with diabetes mellitus who experience tooth loss, the use of dentures plays a vital role in improving quality of life. Dentures enhance mastication, phonetics, esthetics, and maintenance of oral tissue health. However, the fabrication of dentures for diabetic patients remains a topic of debate, as diabetes mellitus is often perceived as a relative contraindication to prosthodontic treatment [20]. Diabetes can accelerate bone resorption and diminish the resilience of mucosal tissues under dentures or around abutment teeth.

For prosthodontic rehabilitation, minimizing mucosal trauma, optimizing denture retention, and ensuring patient comfort are critical. The Biofunctional Prosthetic System (BPS), developed by Ivoclar Vivadent, combines high-precision impression techniques, anatomical tooth design, and controlled polymerization protocols to provide functional, esthetic, and biocompatible dentures [21]. This case report highlights the prosthodontic rehabilitation of a diabetic patient with complete edentulism using BPS dentures.

Case Report

A 62-year-old male reported to the Confidental Multi-specialty Dental and Orthodontic Clinic, Sahibzada Ajit Singh Nagar (Mohali), Punjab, India, with the chief complaint of difficulty in chewing and dissatisfaction with his appearance due to missing teeth. His medical history revealed a 15-year history of type II diabetes mellitus, for which he was taking oral hypoglycemic agents, with well-controlled blood sugar levels (fasting blood sugar 118 mg/dL; postprandial blood sugar 160 mg/dL). No other systemic comorbidities were reported.

On extraoral examination, no facial asymmetry was noted, although the patient exhibited a reduced lower facial height. Intraoral examination revealed completely edentulous maxillary and mandibular arches with moderately resorbed ridges. The mucosa appeared thin, friable, and sensitive to palpation, and the saliva was scanty.

Considering the patient's systemic status and fragile oral mucosa, a Biofunctional Prosthetic System (BPS) denture was planned to provide superior fit, function, and comfort.

Clinical Procedures

1. Preliminary Impressions

Preliminary impressions were recorded using putty (GC Flexceed Putty, GC Asia Dental Pvt. Ltd., Singapore) in appropriately sized edentulous stock trays (Figure 1). Care was taken to ensure complete coverage of the anatomical landmarks, including the vestibular extensions and posterior palatal seal area, to provide an accurate diagnostic cast. The impressions were poured immediately with dental stone to minimize dimensional changes.

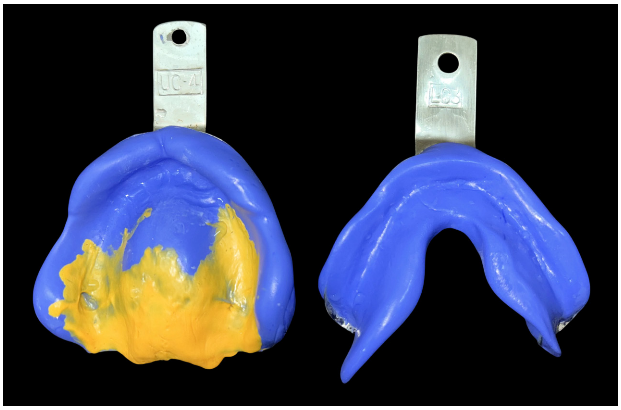

Figure 1: Preliminary Impressions

2. Custom Tray Fabrication

Individualized custom trays were fabricated on the preliminary casts using autopolymerizing acrylic resin following the Biofunctional Prosthetic System (BPS) protocol. Standardized extensions were maintained, with uniform spacing for impression material and relief in critical areas. Tissue stops were incorporated to facilitate uniform seating during the final impression procedure.

3. Final Impressions

Definitive impressions were made using the BPS two-stage impression technique. A medium-body elastomeric impression material was used for mucostatic recording, and functional border molding was achieved with a low-viscosity material to capture dynamic movements of the oral tissues (Figure 2). The impressions were evaluated for accuracy and detail reproduction before pouring the master casts.

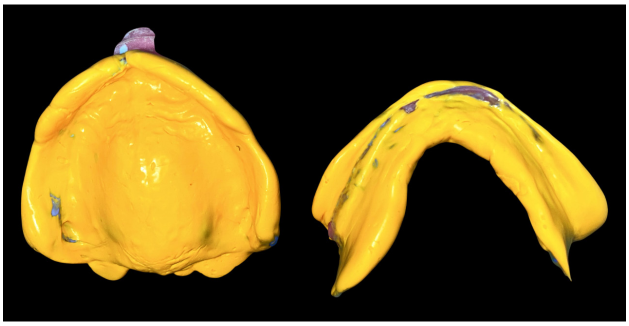

Figure 2: Final Impressions

4. Jaw Relation Records

Jaw relation records were obtained using BPS wax rims carefully contoured to restore the tentative vertical dimension. The records were transferred to the Stratos articulator, and the Gnathometer M device was used to register the centric relation accurately. This ensured a physiologically sound and reproducible maxillomandibular relationship during subsequent steps of denture fabrication.

5. Tooth Selection

SR Phonares II denture teeth were selected based on patient-specific esthetic, phonetic, and functional requirements. Tooth shade, mold, and arrangement were chosen to harmonize with the patient's facial form, ridge morphology, and anticipated occlusal scheme to ensure optimal masticatory efficiency and natural appearance.

6. Try-in

The trial dentures were inserted intraorally to verify esthetics, phonetics, centric relation, and vertical dimension of occlusion. Necessary adjustments were made to the wax-up to refine occlusal contacts, lip support, and overall denture stability before final processing. Patient approval was obtained at this stage (Figure 3).

Figure 3: Waxed-up Try-in

7. Denture Processing

The dentures were processed using high-impact BPS denture base resin through the injection molding technique with the Ivocap system. This system minimizes polymerization shrinkage, improves the fit and adaptation of the denture base to the underlying tissues, and enhances the longevity and comfort of the prosthesis.

8. Insertion and Post-Insertion Instructions

The processed dentures were finished, polished, and inserted intraorally. Minor occlusal and tissue surface adjustments were performed to eliminate pressure points and ensure comfort (Figure 4). The patient was instructed to maintain optimal oral and denture hygiene, including rinsing after meals, cleaning the dentures with a nonabrasive cleanser, and removing them at night to allow tissue rest. Given the patient's systemic condition, strict adherence to glycemic control was reinforced to promote oral tissue health and prevent potential complications.

Figure 4: BPS Complete Denture – in patient's mouth (post-operative view)

Follow-Up

The patient was reviewed after 24 hours, 1 week, and 1 month. He reported improved mastication, esthetics, and speech with no mucosal ulcerations or discomfort.

The complete sequence of clinical procedures followed for BPS denture fabrication is summarized in Table 1.

Table 1: Stepwise clinical procedures for Biofunctional Prosthetic System (BPS) complete denture fabrication followed in the present case.

Step	Clinical Procedure	Details
Preliminary Impressions	Taken using putty in stock edentulous trays	Ensured complete coverage of vestibules and posterior palatal seal area; casts poured immediately to prevent dimensional changes
Custom Tray Fabrication	Fabrication of BPS-specific custom trays with standardized extensions	Used autopolymerizing acrylic resin with tissue stops and uniform spacing for impression material
Final Impressions	BPS two-stage impression technique with medium body and light body elastomeric impression material	Functional border molding achieved dynamically; master casts poured after accuracy verification
Jaw Relation Records	BPS wax rims mounted on Stratos articulator using Gnathometer M	Accurate recording of centric relation and restoration of tentative vertical dimension
Tooth Selection	SR Phonares II teeth chosen for esthetics and functional efficiency	Shade, mold, and arrangement selected to harmonize with facial form and occlusal scheme
Try-in	Verification of trial dentures intraorally	Checked esthetics, phonetics, centric relation, and vertical dimension; adjustments made as needed
Denture Processing	High-impact BPS denture base resin processed using injection molding (Ivocap system)	Minimized polymerization shrinkage and improved fit and adaptation of denture base
Insertion & Post-Insertion Instructions	Denture insertion with minor adjustments	Instructions included oral and denture hygiene, rinsing after meals, removing dentures at night, and maintaining strict glycemic control

Discussion

Diabetes mellitus is a metabolic disorder of glucose, fat, and protein metabolism caused by impaired insulin secretion or production. Its hallmark feature is hyperglycemia, which forms the diagnostic basis for the disease. Persistent hyperglycemia leads to macrovascular and microvascular changes that must be carefully considered during dental treatment, as these vascular alterations can cause both short- and long-term complications. Among the most significant are hypoglycemic shock, diabetic ketoacidosis, and sepsis secondary to infection. Appropriate management of these complications directly influences the success of dental treatment. Patients with diabetes mellitus have a higher risk of tooth loss than healthy individuals and therefore often require dentures to restore function and esthetics. Considering the severity of hyperglycemia and vascular complications, dental surgeons must be able to determine the most appropriate prosthesis for diabetic patients, as dentures can significantly improve their quality of life by restoring masticatory function [22].

Management of diabetic patients in prosthodontics should be systematic and comprehensive. A detailed general health history must be obtained at the first visit, including fluctuations in blood glucose, level of glycemic control, frequency of hypoglycemic episodes, treatment modalities, drug dosages, and duration of therapy. Dental and oral health history should be assessed with particular attention to previous complications. Blood glucose should be checked using a glucometer before treatment; if glucose levels exceed the normal range, the patient should be referred to an internist to determine the feasibility of prosthodontic procedures, and recent laboratory test results should be reviewed. Stress management is also essential, as many diabetic patients experience anxiety related to oral health, with complaints such as tooth mobility due to periodontitis, xerostomia, or burning mouth sensations. Dental surgeons should address these concerns and provide pain control, since stress and pain can worsen hyperglycemia through the release of epinephrine and cortisol [23].

Comprehensive intraoral and radiographic examinations are mandatory to evaluate oral conditions and detect potential complications. Any necessary dental or medical interventions should be completed prior to prosthodontic rehabilitation. In addition, diabetic patients should receive thorough instructions on oral and denture hygiene, as they are more prone to poor hygiene resulting from hyperglycemia, xerostomia, and denture use. Dietary consultation with a nutritionist should be encouraged to optimize systemic and oral health outcomes. Dental surgeons must also carefully select the type of denture based on a thorough evaluation of oral and systemic conditions. Although removable, fixed, overdenture, and implant prostheses may all be considered for diabetic patients, treatment success ultimately depends on glycemic control and adequate preliminary care [24].

Prosthodontic treatment aims to restore masticatory efficiency, esthetics, phonetics, and protection of oral tissues through the fabrication of appropriate prostheses. Various denture types are available, each with distinct indications and contraindications depending on systemic health, degree of tooth loss, financial constraints, sociocultural factors, and the patient's level of education. Dentures may be complete, partial, removable, implant-retained, immediate, or lined with soft materials. Complete dentures replace all natural teeth in edentulous ridges and may be immediate or conventional. Partial dentures replace one or more—but not all—teeth and may be fixed or removable. Fixed partial dentures are anchored to abutment teeth, while removable partial dentures are supported by teeth, mucosa, or a combination of both. Removable partial dentures may be fabricated from acrylic resin, metal/acrylic combinations, or thermoplastics [25].

Removable dentures are generally preferred for diabetic patients because they are easy to remove, allow oral tissues to rest, improve blood circulation, and simplify cleaning. When designing these dentures, dental surgeons should ensure optimal distribution of masticatory forces to protect oral tissues and enhance chewing efficiency without introducing new trauma or tissue damage. Acrylic resin remains the material of choice because of its ease of cleaning, repair, and adaptability. The design should include wide embrasures, clear interdental contact points, denture borders set 2–3 mm short of gingival margins, and free-gliding occlusion. Complete dentures should have broad bases that maximize soft tissue coverage, with teeth arranged in reduced buccolingual and mesiodistal dimensions and lower cusp inclinations to protect tissues, minimize bone resorption, and evenly distribute occlusal loads [26].

Accurate vertical dimension measurement and impression techniques are critical to success, as errors may lead to complications such as angular cheilitis. The double impression technique may be used, but wax-based materials or pericompound should be avoided during border molding because heat can irritate delicate mucosa. Mucostatic impression materials are preferable to mucocompressive ones to maintain blood circulation and minimize tissue trauma, and trays should be lined with wax spacers. In cases of xerostomia where saliva normally lubricates mucosa, maintains resilience, and aids denture retention dental surgeons may prescribe symptomatic therapies such as fluid therapy, oral tissue moisturizers (topical vitamin E or lanolin), oral rinsing gels, or artificial saliva formulations containing mucin or carboxymethylcellulose. Regular recall visits are necessary to prevent denture stomatitis and hyperplasia [27].

For fixed prostheses, supragingival finish lines are recommended to facilitate plaque control and improve gingival health, while chamfer finish lines are preferred to minimize stress on abutment teeth. For implants and overdentures, strict blood glucose control is essential to ensure successful surgical outcomes. Antibiotic prophylaxis, meticulous wound care, and proper healing management should be incorporated into treatment protocols for these patients [28].

Diabetic patients present unique prosthodontic challenges due to impaired healing, xerostomia, fragile mucosa, and increased risk of infections. Denture-induced trauma can precipitate mucosal ulcerations and secondary infections such as candidiasis. Consequently, denture fabrication should prioritize maximum accuracy, minimal trauma, and improved adaptation. The Biofunctional Prosthetic System (BPS) incorporates precision techniques such as accurate impressions that capture functional borders and distribute occlusal loads evenly, anatomically shaped teeth that enhance balanced occlusion, and injection molding technology that reduces polymerization shrinkage to improve fit [29].

Multiple studies have documented the advantages of BPS dentures in diabetic and medically compromised patients [30,31]. Schierz et al. reported improved oral health-related quality of life and patient satisfaction with BPS compared to conventional dentures [30]. Celebic et al. observed better chewing efficiency and comfort with BPS dentures [31], while other studies have emphasized reduced mucosal trauma and better adaptation in medically compromised individuals [32,33]. In the present case, the patient benefitted from improved fit and function with no post-insertion complications, highlighting the BPS denture system as a reliable and effective option for diabetic patients where tissue tolerance is a major concern.

Conclusion

The conclusion of the present case report is that prosthodontic treatment may be considered for diabetes mellitus patients. However, dental surgeons must pay careful attention to blood glucose levels and the effects of microvascular and macrovascular complications. Management of diabetic edentulous patients requires a cautious approach, considering their systemic condition and oral mucosal fragility. The BPS denture system offers enhanced precision, comfort, and function, making it a superior choice for such patients. Careful follow-up and patient education on hygiene and glycemic control are essential to ensure long-term success.

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