

BIOFUNCTIONAL PROSTHETIC SYSTEM IN PROSTHODONTICS – A SYSTEMATIC REVIEW

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ABSTRACT

Recent advances in removable prosthodontics include biofunctional prosthetic system (BPS), which closely replicates aesthetics, comfort, functional, and phonetic aspects of natural dentition. With this background in mind, we conducted a systematic review to critically evaluate application of BPS over conventional dentures in removable prosthodontics. A search for full text articles with keywords “biofunctional prosthetic system (BPS)”, using PubMed search engine was carried out. Nine full text articles were eligible for final review and among them, three were of original research studies. All the original research articles were questionnaire-based studies. Six articles were reports of edentulous cases rehabilitated using BPS. The clinical findings and questionnaire responses of the studies revealed that the BPS performed better than the conventional dentures in most aspects of clinical evaluation. Moreover, the results showed that BPS systems outperformed conventional dentures in aesthetics, patient comfort, and function. Based on these findings, we concluded that the volume of literature available regarding the comparison of BPS to the conventional denture is insufficient to prove that it has a significant advantage over the conventional system. There is a definite need for larger number of clinical trials to establish the competitive superiority of BPS technique.

KEY WORDS: biofunctional prosthetic system, BPS, prosthodontics, complete denture.

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INTRODUCTION

The goal of treating complete denture patients is to restore normal contour, comfort, function, esthetics, and preservation of residual alveolar ridge. Conventional complete denture prostheses are the most preferred treatment for the replacement of completely edentulous patient. Rehabilitation of complete denture patients sometimes become more challenging in certain clinical

situations. Even though edentulous patients treated with complete dentures are usually satisfied, but there are patients who are not pleased with the outcomes [1]. Patients treated with complete dentures face several problems including insufficient stability, retention, function, pain, and discomfort during mastication. Over a period of time, the resulting pain increases to such an extent that proper mastication, speech, and confidence become a challenge. The psychological problem is

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the effect of unattractive facial appearance and difficulties with speech [2], and psychological factors provide valuable information for the prediction of satisfactory outcome of complete denture treatment [3]. Several factors such as speech and mastication also contribute to the success of treatment [4]. An increase in the average age of the population has caused a rise in the number of patients using removable dentures, even though there have been innovations in complete denture fabrication and techniques. Nowadays, the most advanced method used is the biofunctional prosthetic system, which focuses on bilateral balanced articulation [5]. Biofunctional prosthetic system (BPS) is also called “biogenic” or “bio-functional”, because of the ability to construct dentures, which truly resemble these natural elements they substitute as well as fulfilling aesthetics, and functional and phonetic demands of the patient [5].

Taking into consideration these advantages, we conducted a systematic review with an aim to critically analyze the advantages of biofunctional prosthetic system in comparison to conventional dentures.

MATERIAL AND METHODS

A systematic review was performed to evaluate the application of BPS in removable prosthodontics using the preferred reporting items for systematic reviews and meta-analyses (PRISMA) guidelines [6]. A search for the articles related to the topic was carried out in PubMed using specific key words, along with an additional search in Google. Full text articles in English and articles from the past ten years were included. Reviews, short communications, commentaries, and letters to editors were excluded from the study. The keywords used for the search are listed in Table 1. The end search date was May 13, 2019 across the databases.

The data extraction process was conducted in two phases. In first phase, titles and abstracts from selected electronic databases were reviewed by two authors. Articles not fulfilling the inclusion criteria were excluded from the review. In phase two, full text articles obtained after filtering in phase one were evaluated by the same reviewers. In case of a disagreement in the selection process between the two reviewers, a third author was requested to reach a consensus. Details regarding authors, year of publication, results, and conclusion were evaluated. In case of any relevant missing information, the authors of a paper were contacted by e-mail.

RESULTS

Eleven articles were obtained from the PubMed database. From the Google Scholar search, thirteen articles were primarily found with the above mentioned keywords. A total of thirty two articles were identified in the initial search. The number of eligible articles was reduced to twenty three after removing duplicated articles, and from the second stage of screening, seventeen full text articles were obtained. During the third stage of determination of eligibility, eight articles were excluded for various reasons. Articles in any other language than English were not included in the study (Tables 2 and 3, Figure 1). The earliest article was from 2011, and the most recent one from 2017. The publishing trend revealed a growing interest in this specific area of research. Among the nine full text articles, six were case reports, of which five were from India and one from Mexico. The cases were selected based on the CARE guidelines [7]. The BPS system was used for mandibular rehabilitation in five case reports, while in one report, rehabilitation using combination of tooth supported by BPS overdenture was used along with flexible removable partial denture mandibular and maxillary arches.

TABLE 1. List of keywords used for database search

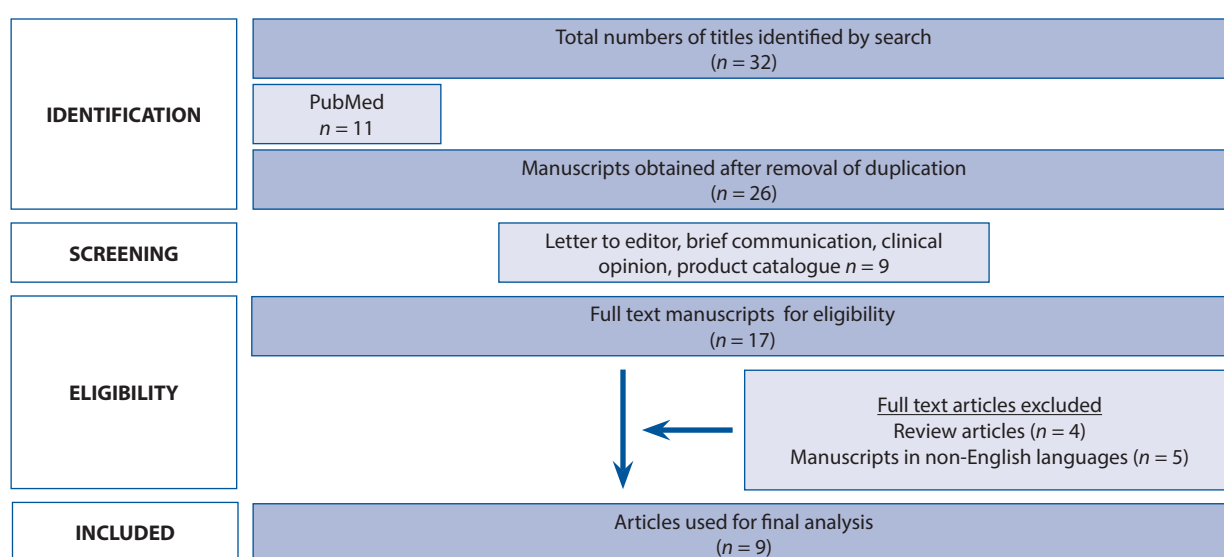
Database	Key words used
PubMed	Biofunctional prosthetic system, BPS, case report, case series, clinical study, clinical trial, removable prosthodontics
Additional Google search	Biofunctional prosthetic system, BPS, case report, case series, clinical study, clinical trial, removable prosthodontics

TABLE 2. List of case reports obtained during database search

Author and year	Type of case
Jhambekar <i>et al.</i> 2015 [10]	Total mandibular reconstruction and rehabilitation
Lugo <i>et al.</i> 2012 [11]	Rehabilitation of mandibular arch with complete denture
Mohsin <i>et al.</i> 2015 [12]	Rehabilitation using combination of tooth-supported BPS overdenture and flexible removable partial denture
Nabeel 2012 [13]	Rehabilitation of mandibular arch with complete denture
Saini <i>et al.</i> 2011 [14]	Rehabilitation of mandibular arch with complete denture
Upadhayaya <i>et al.</i> 2016 [8]	Rehabilitation of mandibular arch with complete denture

TABLE 3. List of clinical studies obtained during database search

Author and year	Type of study	Evaluation based on	Conclusion
Matsuda 2015 [15]	Cross-over trial	Questionnaire (oral health impact profile for edentulous subjects [OHIP EDENT])	Within the limitation of their study, BPS produced high quality complete dentures with satisfactory results. In terms of efficacy, it was as good as conventional denture
Khajank <i>et al.</i> 2017 [5]	Case-control study	Post-insertion case evaluation and six-year follow-up	In terms of aesthetics, function, and comfort BPS was superior over conventional dentures
Baskaran <i>et al.</i> 2017 [18]	Case-control study	Questionnaire	Form patient's point of view, results were satisfactory for BPS dentures in comparison to conventional dentures

**FIGURE 1.** Flowchart of the study

Among the three clinical studies, one was conducted in Japan, and the other studies were carried out in Albania and India. In the Japanese and Indian studies, the evaluation of BPS rehabilitation was carried out using a questionnaire, whereas the evaluation in the Albanian study was completed using feedback and clinical examination.

DISCUSSION

The use of dedicated impression materials, face bow transfers, articulators, teeth and denture-base materials, make BPS a popular technique in the field of complete denture prosthodontics [8]. Currently, the biofunctional system is the innovative available approach, which prioritizes the principles of bilateral balanced articulation. BPS is also called as “biogenic” or “biofunctional” system, due to its ability to construct dentures, which really resemble the natural elements they substitute as well as fulfilling patient aesthetics and functional demands [5]. The BPS system was intended to negate the shortcomings of conventional complete denture techniques. The system employs a combination of standardized impression making procedures, a unique method of recording maxillo-mandibular relationship, teeth arrangement, and denture fab-

rication, with minimal number of patient's visits. The border molding and impression making was controlled by the patient's functional composition, hence yielding denture bases that were extremely comfortable in use. This technique presents ideal form, function, and aesthetics in complete denture prosthesis, since it is based on multidisciplinary effort and methodical approach [9]. Apart from the removable complete denture, the BPS system manufactured by Ivoclar Vivadent (Liechtenstein) is also used for implant-supported overdenture in maxillary and mandibular reconstruction procedures [10–12]. Reports regarding the use of BPS in preventive prosthodontics for tooth-supported overdenture have also been published recently [13]. In a clinical report published in 2011, BPS technique was used in rehabilitation of a sixty-year-old denture user who was dissatisfied with her previous denture. The patient was comfortable and satisfied with her new BPS denture [14].

CLINICAL STUDY DESIGNS

In a recently published clinical trial, the researchers attempted to evaluate the clinical acceptability of biofunctional prosthetic system based on complete dentures in

comparison with conventional denture fabrication techniques [15]. The significance of this study was its cross-over design. The study subjects used either a complete denture, which was made using the BPS, or a complete denture fabricated with conventional procedures for three months before swapping to other dentures [15]. To evaluate the feedback of the patients, the OHIP-EDENT-J (oral health impact profile for edentulous subjects, Japanese version) questionnaire was used [16]. The OHIP-EDENT survey encompasses seven domains, which replicate the grading system of complex problems. The key domains include functional limitations, physical pain, and psychological discomfort [17].

In another case control study conducted in Albania [5], one group consisted of 133 patients wearing biofunctional prosthesis, whereas second group included 112 patients with conventional full dentures. The patients from both groups were evaluated every two weeks for a period of three months. During three-year follow-up, clinical parameters such as resorption status of residual ridge and health of the underlying mucosa were evaluated. Other factors including passive stability, functional stability, and interferences were also assessed.

In the study conducted by Baskaran published in 2017, fifty patients received conventional complete denture, and fifty other patients obtained BPS complete denture [18]. A questionnaire was administered to every patient (in mother tongue), which contained an opinion regarding various aspects of the denture, ranging from retention and aesthetics to thickness and smoothness of the denture [18].

CLINICAL STUDY FINDINGS

In a Japanese study, there was no significant difference in the satisfaction and the OHIP-EDENT scores between BPS and conventional denture groups. However, BPS had higher preference level in terms of comfort, occlusion, esthetics, and retention. The advantage of this study over the other contemporary studies was its cross-over design [15]. In a Albanian study [5], the group using BPS performed better in terms of clinically observed parameters such as denture stability, aesthetics, and phonetics. However, unlike the study by Matsuda *et al.*, no standardized questionnaire and cross-over design of the study were used. Findings of the questionnaire-based Indian study by Baskaran [18] revealed that BPS technique showed “very satisfactory” or “satisfactory” with regards to retention, aesthetics, and phonetics.

CONCLUSIONS

In spite of sparse literature, we were determined to extensively analyze the case reports and clinical studies on BPS. The available data is restricted to few case reports and small number of clinical trials. However, the data

obtained from these reports and trials suggested that BPS was comparatively superior over the conventional system. Nevertheless, there is a need for more cross-over design clinical studies to systematically validate the BPS technique as significantly better than the conventional system.

CONFLICT OF INTEREST

The authors declare no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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