



The Influence of Posterior Occlusion When Restoring Anterior Teeth

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ABSTRACT When any type of esthetic restorative procedure is being considered or performed, a comprehensive diagnosis and treatment plan is required. Attention to the diagnostic signs of the loss of posterior support (LPS) and their influence on the anterior dentition will guarantee a more predictable outcome. Historical solutions and their inadequacies are addressed. Patient presentations are utilized to demonstrate contemporary treatment of patients requiring esthetic rehabilitations who are lacking posterior support.

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There is a general consensus that tooth retention amongst the aging population pays credence to preventive dentistry and patient education.¹ Appearance is a common concern for this group of patients. A comprehensive examination allows the clinician to diagnose risk factors that are responsible for the deterioration of oral health and function. These patients often request restorative treatment with indirect restorations to enhance their appearance (**FIGURE 1**). During the diagnostic phase, critical elements of posterior occlusion are overlooked at the expense of longevity of the proposed treatment (**FIGURES 2 AND 3**). Health, function, and esthetics should be the ultimate aim of any medical or dental comprehensive treatment plan.²

Diagnosis

Diagnosis and treatment planning cannot be based on esthetic desires alone. A number of factors need to be evaluated prior to decision making:

- Occlusal stability
- Status of periodontal and dental disease
- Anatomical limitations
- Space management

Posterior support is an important factor to consider in order to achieve occlusal stability. The loss of posterior support is defined as the loss of occluding vertical dimension as a result of the loss or drifting of posterior teeth.³ Secondary occlusal trauma has been defined as the effects induced by occlusal force (normal or abnormal) acting on teeth with decreased periodontal sup-



FIGURE 1. Maxillary anterior teeth restored with porcelain laminate veneers for patient with adequate posterior support and occlusal stability.



FIGURE 2A. Maxillary anterior teeth previously restored but failed due to posterior bite collapse.



FIGURE 2B. Posterior support needs to be established before anterior teeth are restored.

port.³ Hence, it is possible for a patient with an almost intact dentition, but with a reduced periodontium to present with the signs of LPS (**FIGURE 4**).

Clinically, such a diagnosis is based upon five cardinal signs (**FIGURES 2 AND 3**):

- PDL widening
- Fremitus
- Fractured restorations
- Drifting
- Excessive wear

Treatment Solutions for the Loss of Posterior Support

Solutions for the treatment of patients presenting with the clinical signs of the loss of posterior support include:

- Removable partial dentures (RPD)
- Cross-arch splinting
- Implant-supported restorations

Removable Partial Dentures

There remains a group of patients that for medical, psychological, and financial reasons are poor candidates for fixed prosthodontics. These patients can be restored to function with the use of RPDs. Patient selection and the correct diagnosis are critical when deciding if treatment with removable prosthesis is appropriate. When treating a patient who exhibits the cardinal signs of LPS, a tooth or implant (supported and/or retained) RPD can provide additional support. With appropriate diagnosis and case selection these types of RPDs can satisfy the patient's functional needs.

However, there remains a group of



FIGURE 2C. Cardinal signs for LPS are present clinically.

patients who do not have an adequate number of posterior teeth or implants for a tooth-/implant-supported, or retained RPD. For this group of patients, tooth replacement with a mucosal-supported RPD may not have any functional benefits and posterior support will not be re-established, leading to further demise of the dentition.

Restoring posterior support with mucosal-supported RPDs is controversial from a mechanical and periodontal view point. Whilst under load, the mucosa moves millimeters while natural teeth only move a mere 25-50 microns.⁴ This is based on the concept of differential movement of the mucosal tissues (millimeters) and the teeth (25-50 microns). These biomechanical issues compounded with patient compliance (25 percent of denture wearers never use their dentures) make it harder for a mucosal-supported RPD to provide adequate posterior support⁵ (**FIGURE 3**). Prospective controlled studies have also shown that the oral function of subjects with a shortened dental arch (SDA) did not differ compared to subjects who have a SDA and were wearing a RPD.⁶⁻⁸



FIGURE 2D. Cardinal signs for LPS are present radiographically.

Therefore, a distal extension RPD did not appear to provide the patient with any additional posterior support or occlusal stability. Another survey of 77 patients with RPDs, reported social and oral function at levels compared to those with no dentures.⁹ There appears to be little need to replace lost posterior teeth with dentures until the person has fewer than three posterior functional units. The authors could not detect a lasting benefit from RPD wear.

The functional benefits of RPDs remain controversial as definitive controlled clinical trials have yet to be performed. However, based on current data and a logical approach to diagnosis and treatment planning, one should employ more caution when opting to restore a patient who exhibits LPS with a RPD.

Effect of RPD on Periodontal Status

Many studies have looked at the effect of RPDs on dental and periodontal structures.^{10,11} Some have concluded that with a high level of periodontal maintenance and oral hygiene RPDs do not result in periodontal disease.¹⁰ However, there is evidence to the



FIGURE 3A. Patient presented with LPS.



FIGURE 3B. Mucosal-supported RPD failed to provide posterior support.



FIGURE 3C. Cardinal signs of LPS are present.

contrary. In one controlled in-vivo study of 99 patients, it was found that “There was a strong correlation between the presence of local pathological alterations accompanying the use of RPDs and poor oral hygiene.”¹¹

Eighteen to 25 percent of RPD abutments were “loose” and periodontal inflammation was associated with 68 percent of all abutments. In another 10-year study, survival rates of teeth adjacent to treated and untreated posterior bounded edentulous spaces, it was found that survival of teeth adjacent to a single posterior edentulous space was negatively associated with RPD placement compared with no treatment.¹² If the patient with a mucosal-supported RPD is unable to maintain an adequate level of oral hygiene, further tooth loss is more likely. Losing more teeth will worsen the problem associated with LPS.

RPDs functional benefits remain controversial as definitive-controlled

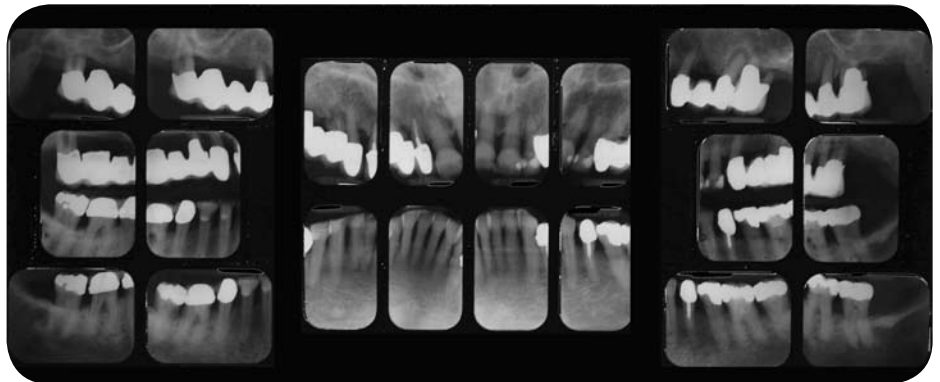


FIGURE 4. Radiographs of patient with almost intact dentition but with reduced periodontium with the signs of LPS.

clinical trials have yet to be performed. The ability to draw consensus on the benefits and impacts based on currently available data may be premature. The majority of evidence is from correlational, poorly controlled studies with biased or select samples. However, current data should not be disregarded as it does provide some useful information in relation to clinical outcomes and trends.

Cross-arch Splinting

Cross-arch splinting has also been used to treat patients diagnosed with LPS. Adequate oral hygiene, and sufficient number of abutment teeth are essential to the success of such treatment modalities¹³ (**FIGURE 5**). The patient in **FIGURE 5** received a periodontal prosthesis more than 20 years ago. This should be considered a successful

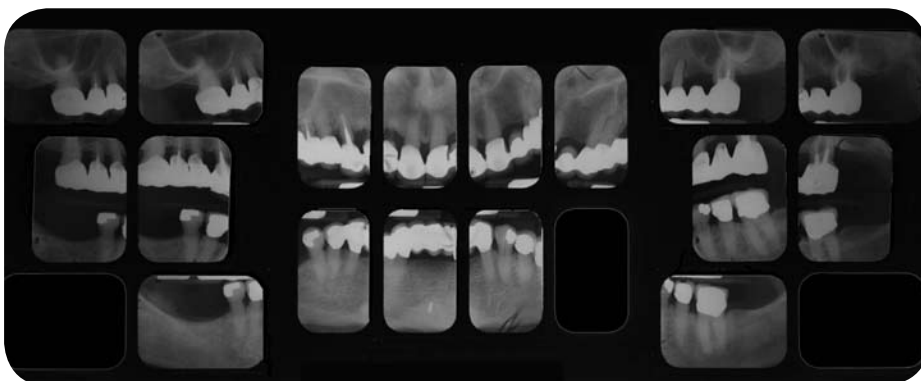


FIGURE 5A. Radiographs of maxillary reconstruction with cross-arch stabilization at 20 years.



FIGURE 5B. Occlusal view of maxillary reconstruction with chipped ceramics, dental caries, and fractured connector necessitating replacement of prosthesis at 20 years (Courtesy of Nikitas Mordohai, DDS).

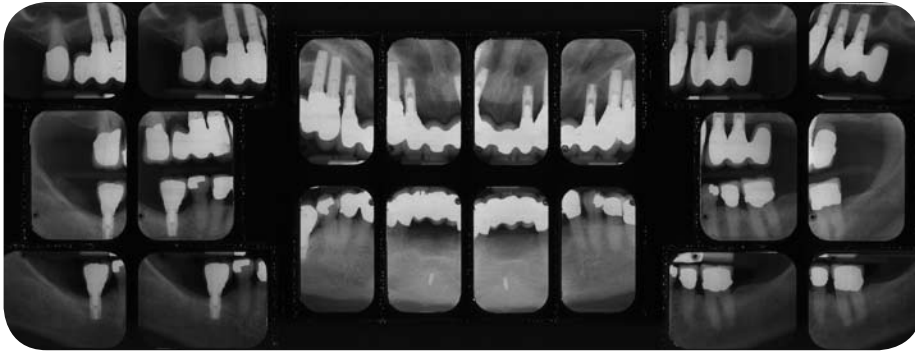


FIGURE 6A. Radiographs of patient in Figure 5 after maxillary reconstruction with dental implant supported restorations (Courtesy of Dr. Mordohai).



FIGURE 6B. Right lateral view of maxillary implant-supported restorations.



FIGURE 6C. Left lateral view of maxillary implant-supported restorations.

restoration. However, had failure occurred a short period after delivery of the definitive restorations, the consequences may have been catastrophic. As every tooth is joined together in a single prosthesis, a localized problem may deem the restoration or a large part of it nonfunctional, requiring replacement. The risk-to-benefit ratio for these restorations is unfavorable.¹⁴ It has been said that “for every advantage splinting has to offer there is at least one disadvantage that must be accepted.”¹⁵

FIGURE 6 demonstrates how the failed prosthesis in **FIGURE 5** was remade with the use of dental implants for support. “New sophisticated techniques are available, but the concept of a correct diagnosis, identifying the etiological factors, formulating a treatment plan and developing a logical sequence of therapy hold true today as they did five decades ago.”¹⁶

Implant-supported Restorations

The use of osseointegrated dental implants have defied many of the empiri-

cal guidelines previously accepted.¹⁷ The survival of cantilevered restorations supported by four to five short dental implants in the symphysis of the mandible is well documented.^{18,19} These complete mandibular prostheses, which replace 12 to 14 teeth, with up to 10-15 mm posterior cantilevers clearly defy the empirical rules that have been religiously followed in clinical dentistry (**FIGURE 7**). A new era in clinical dentistry has arrived. Two patients are selected to demonstrate the contemporary treatment of the loss of posterior support.

The patient in **FIGURES 4 AND 8** presented with the cardinal signs for LPS. In order to establish posterior support the treatment plan for this patient consisted of:

1. The removal of the teeth with poor or nonmaintainable prognosis¹⁴;
2. Bilateral sinus lifts²⁰; and
3. Replacement of missing teeth with implant-supported restorations.

After removal of the maxillary teeth and prior to dental implant placement, an immediately loaded provisional prosthesis was delivered to restore the dentition and establish posterior support. Three transitional dental implants were used as abutments for the immediately loaded prosthesis in order to establish posterior support (**FIGURE 9**). The pa-



FIGURE 7A. Photo of mandibular hybrid prosthesis supported by five short dental implants and cantilevered.



FIGURES 7B. Radiograph of mandibular hybrid prosthesis.



FIGURE 8. Preoperative photo of patient. Cardinal signs of LPS are present with an almost intact dentition. Generalized periodontal attachment loss is the cause of LPS.

tient was stabilized in terms of disease control, occlusion, function, phonetics, and esthetics. The immediately loaded transitional dental implants were removed once the definitive dental implants were osseointegrated and loaded. The additional step of providing the patient with a transitional implant-supported provisional restoration ensured patient comfort during the osseointegration period while minimizing the risk of uncontrolled loading and micromotion of the definitive dental implants.²¹

Once osseointegration of definitive dental implants had been established, indirect provisional restorations were fabricated to maintain posterior support. The provisional restorations (**FIGURE 10**) allowed objective evaluation of occlusal stability, phonetics, and esthetics prior to the fabrication of the definitive restorations²² (**FIGURE 11**). Comparison of the photos in **FIGURES 10 AND 11** demonstrates how the treatment objectives that were established and tested with the provisional restorations were duplicated in the definitive restorations. Posterior support had been established with the aid of implant-supported restorations.

The patient in **FIGURE 12** presented with pathological loss of tooth structure, which resulted in posterior bite collapse and loss of vertical dimension of occlusion.^{3,23-25} Radiographs clearly show the extent of damage to the dentition (**FIGURE 12**). Many teeth had also been affected by pathological tooth surface loss associated with attrition and erosion.²³ Signs of both diurnal



FIGURE 9A. Three transitional dental implants are used to provide posterior support and function.



FIGURE 9C. Occlusal view showing copings on transitional dental implants indexed to maxillary provisional restoration with acrylic resin.



FIGURE 10A. Right lateral view of definitive implant-supported provisional restorations.



FIGURE 11A. Right lateral view of definitive restorations.

and nocturnal bruxism were clearly visible on presentation. The proximity of the chin to nose distance and the presence of angular folds and angular cheilitis confirmed the diagnosis of the loss of vertical dimension of occlusion (**FIGURE 13**).



FIGURE 9B. Intaglio surface of maxillary immediately loaded provisional restoration.



FIGURE 9D. Satisfactory esthetics achieved with the implant-supported and immediately loaded provisional restoration.



FIGURE 10B. Left lateral view of definitive implant-supported provisional restorations.



FIGURES 11B. Left lateral view of definitive restorations.

In order to re-establish posterior support for this patient, it was decided to restore the maxillary teeth with tooth-supported cast restorations, and the mandibular teeth with implant-supported restorations. The provisional



FIGURE 12A. Radiographs of a patient with a severely compromised dentition on presentation.

restorations allowed objective evaluation of occlusal stability, phonetics, and esthetics prior to the fabrication of the definitive restorations.²² The decision to immediately load the mandibular arch for this patient was based on a combination of factors (**FIGURE 14**).

Firstly, success with immediate loading of the mandible is well documented.^{26,27} Secondly, patients wearing complete mandibular dentures opposing a fixed prosthesis in the maxilla tend to have poor acceptance of treatment. Thirdly, the provision of a fixed prosthesis in the mandible for this patient will immediately overcome the two major diagnostic findings for this patient. Posterior support and vertical dimension were both re-established with immediate effect. The osseointegration period may coincide with the testing of form, function, phonetics, and esthetics with the provisional restorations.²² The patient was stabilized in terms of disease control, occlusion, function, phonetics, and esthetics.

After the process of osseointegration definitive restorations were fabricated. Full-mouth radiographs confirmed optimum oral health and anatomic harmony (**FIGURE 15**). **FIGURE 15** demonstrates how occlusal stability and functional harmony were re-established for this patient. Adequate esthetics was achieved in a controlled, objective, and predictable fashion (**FIGURE 16**). A hard occlusal guard was delivered to protect the restorations from excessive forces created during diurnal and nocturnal bruxism.²⁸



FIGURE 13. Patient presented with persistent angular folds and cheilitis relating to loss of vertical dimension of occlusion.



FIGURE 12B. Intraoral photograph of patient in Figure 12a.



FIGURE 14. Provisional restorations. The mandibular arch with immediately loaded prosthesis at two weeks.

Discussion

LPS is a true disease that is most often overlooked. The diagnosis of such disease is defined with cardinal clinical signs and symptoms. Although there is a new tool in our armamentarium (dental implants), the principles of diagnosis and treatment planning remain the same. The treatment for LPS is still controversial and a comprehensive treatment should include detailed occlusal and periodontal diagnosis in order to ensure the longevity of the restorations. Adequate posterior support should be one of the requirements for long-lasting anterior restorations.

Historically, a common misconception has been related to the deleterious effects of the loss of posterior teeth on the remaining dentition and health.²⁹ A common belief was that 80 medical and dental abnormalities would result from the loss of posterior teeth.²⁹ The belief that missing teeth result in arch collapse and the loss of arch integrity is also evident in more recent dental literature.³⁰⁻³² In fact,

it is apparent that missing posterior teeth do not necessarily result in LPS or the loss of occlusal integrity.³³ It is unnecessary to replace all missing posterior teeth to avoid problems associated with LPS.³⁴ The efficacy of a shortened dental arch has been confirmed.³⁵ A shortened dental arch has been defined as a dentition with a reduction of occlusal units (pairs of occluding premolars and molars) starting posteriorly.³⁵ The prevalence of the shortened dental arch has been estimated at 25 percent for 41- to 45-year olds and 70 percent for 61- to 65-year olds.³⁶ The question about the function, occlusal integrity, adaptive capacity, and esthetics in relation to the latter group has been addressed and answered. It appears that functional demands can be met even with some loss of molar support.³⁷

Epidemiological studies show a lack of correlation between the loss of molar support and impaired oral function.³⁸ There is sufficient adaptive capacity to ensure acceptable oral function in the shortened dental arch when premolar

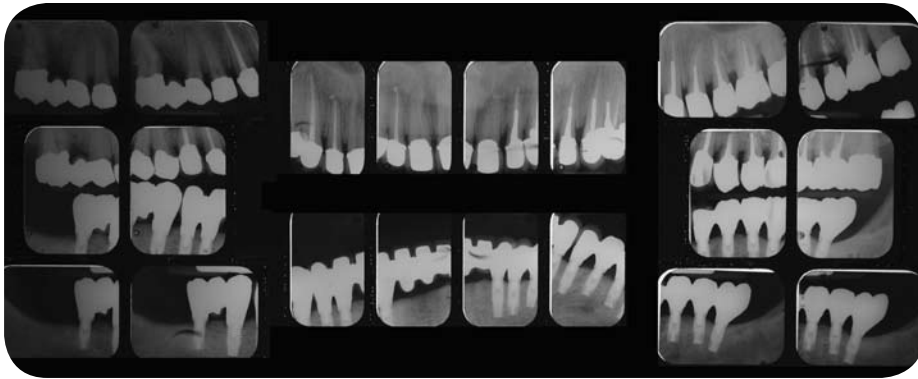


FIGURE 15. Full-mouth radiographs and photograph of definitive restorations.



FIGURE 15B.



FIGURE 16. Patient smiling with definitive restorations.

teeth are present.³⁸ The SDA can provide long-term occlusal stability.⁶⁻⁸ Esthetics does not seem to be adversely affected by missing posterior teeth either. In a survey of patients with a shortened dental arch it was evident that these patients rate their appearance as acceptable.³⁷

The decision to intervene when a patient is missing posterior teeth should be based on a comprehensive diagnosis and treatment plan. The main diagnostic findings of LPS must be established before any intervention and treatment. The combination of existing periodontal involvement and increased occlusal loading, such as in a reduced dentition, appear to be potential risk factors for further loss of teeth.³⁹

Conclusion and Clinical Significance

When any type of esthetic restorative procedure is being considered or performed, a comprehensive diagnosis and treatment plan is required. This should include a close analysis of the total stomatognathic system with particular attention to posterior support. ■■■■

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