



Posterior Bite Collapse: Guidelines for Treatment Based on Form and Function



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The clinical syndrome known as posterior bite collapse (PBC) consists of multiple, often pathognomonic factors that deviate from normal, or an occlusion wherein the posterior occlusion is compromised and may ultimately destroy the functional protective capacity of the entire dentition. Secondary clinical sequelae may include accelerated periodontitis progression, temporomandibular disorders (TMD), increasing mobility/fremitus, additional tooth loss, anterior flaring, and loss of occlusal vertical dimension. Etiologic factors may include tooth loss without replacement, orthodontic malocclusions and dentoskeletal disharmonies, periodontitis, accelerated retrograde occlusal/interproximal wear, severe caries, or iatrogenic and conformational dentistry. Not all PBC cases require treatment, but treatment is dependent upon the periodontium's stability and its ability to maintain its form and function. Treatment decisions can also be dependent upon periodontal health, caries, function, occlusion, TMD, esthetics, and phonetics. The purpose of this article is to provide general treatment guidelines based on form and function of the masticatory system for restoring a PBC case when treatment is necessary. This article does not discuss specific mechanics for restoring PBC cases. Int J Periodontics Restorative Dent 2022;42:351–359. doi: 10.11607/prd.5073

The clinical syndrome known as posterior bite collapse (PBC) was first published by Amsterdam and Abrams¹ in 1964, and it consists of multiple, often pathognomonic factors that deviate from normal, or an occlusion wherein the posterior occlusion is compromised and may ultimately destroy the functional protective capacity of the entire dentition. Secondary clinical sequelae may include, singularly or in combination with, the accelerated progression of periodontitis, temporomandibular disorder (TMD), increasing mobility/fremitus, additional tooth loss (TL), anterior flaring (AF), and loss of occlusal vertical dimension (OVD). Etiologic factors may include, but are not limited to, TL without replacement, orthodontic malocclusions and dentoskeletal disharmonies, periodontitis, accelerated retrograde occlusal/interproximal wear, severe caries, or iatrogenic and conformational dentistry. Not all PBC cases require treatment, but the decision is primarily dependent upon the periodontium's stability and its ability to maintain its form and function. Rosenberg² adds that the decision for treatment should be dependent upon periodontal health, caries, function, occlusion, TMD, esthetics, and phonetics. As Granger³ states, mouth health is related to mouth function: The better the function,

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the longer that natural metabolism can maintain it.

The present authors previously showed that PBC encompasses a wide range of clinical presentations that do not necessarily involve the presence of periodontitis, TL, AF or loss of OVD.⁴ Despite its multiple definitions since its first introduction, only the definition by Amsterdam provides a definite diagnosis and treatment plan.⁵ According to the definition by Amsterdam and Abrams,¹ any malocclusion that deviates from the normal or ideal is diagnosed with PBC.

Historically, the most common erroneous assumption has been that PBC is synonymous with loss of OVD. Chasens⁶ and the present authors have shown that in the presence of PBC, the remaining dentition may have enough periodontal stability to maintain a functional physiologic OVD. However, Rosenberg et al⁷ showed that in a periodontally stable malocclusion in the presence of primary occlusal trauma (OT), if the rate of occlusal wear exceeds the rate of compensatory passive eruption, there may be a net decrease in OVD. This would result in the anterior posturing of the mandible and an increase in the intercuspal (IC)–centric relation (CR), presenting as a dental pseudo–Class III (CLIII) malocclusion. In PBC cases with OVD loss, clinicians may face the challenge of inadequate interarch space for restorative materials.

According to Turner and Missirlian,⁸ it is critical to verify loss prior to restoration at an increased OVD, as rehabilitation at an increased OVD may cause postoperative prob-

lems and should be avoided when possible. Harper⁹ states that when treating OVD, the condyles must be in CR, and that it must be tested using reversible treatment modalities. Most importantly, restoration must be within the neuromuscular adaptation for each patient. The inherent problem is that there remains no clinical practice guidelines on occlusion, and many clinicians adhere to one of any number of occlusal philosophies for treatment. Regarding occlusion, it is generally accepted that there are multiple philosophies that may work, but while one philosophy of occlusion may be successful with one patient, the same approach will not work for every case. The basis in developing a therapeutic physiologic occlusion to restore PBC should conform to the physiologic form and functional demands of individual patient needs. Therefore, the purpose of this article is to provide general treatment guidelines for PBC based on form and function.

Using the database of Temple University, Kornberg School of Dentistry, a search of the literature pertaining to posterior bite collapse, occlusion, and multidisciplinary treatment was performed, ranging between 1964 and May 2020.

Diagnosing the Problem

The foundation in formulating a treatment plan lies in proper diagnosis; there may be many ways to treat a case, but there can only be one correct diagnosis. Because of variations in PBC clinical presentation and in an effort to aid in the

synthesis of a treatment plan, the present authors previously published a grading system for diagnosing PBC based on two fundamental etiologic factors: periodontal health and TL (Table 1).⁴ Sequelae such as increasing mobility/fremitus, OVD loss, and AF are to be diagnosed and annotated secondarily.

Periodontal diagnosis should be based upon the staging system developed by the 2017 World Workshop on the Classification of Periodontal and Peri-implant Diseases and Conditions¹⁰ and those published by Tonetti et al.¹¹ Occlusal diagnosis should be based upon Angle's classification of malocclusion, with the understanding that the functional physiologic therapeutic occlusion and the conformative dentition restored in PBC may be masking an underlying occlusal pattern, especially in cases where there is anterior posturing of the mandible that gives the appearance of a Class I (CLI) or dental pseudo–CLIII malocclusion in either the presence or absence of AF. It is also recommended that any IC/CR discrepancies be evaluated.

Treatment Guidelines

Irrespective of PBC grade, the initial therapy should always consist of treatment and maintenance of periodontal health; ie, establishing and maintaining correct soft tissue and osseous architecture. Additionally, treatment of any active disease processes, such as caries control, periodontal pathology, and extraction of diseased, nonrestorable teeth.

Table 1 PBC Grading with Associated Clinical Sequelae

	Grade 1	Grade 2	Grade 3	Grade 4
Malocclusion	+	+	+	+
TL w/out replacement	–	+	–	+
Periodontitis	–	–	+	+
Mobility/fremitus	±	±	±	±
AF	±	±	±	±
Loss of OVD	±	±	±	±

PBC = posterior bite collapse; TL = tooth loss; AF = anterior flaring; OVD = occlusal vertical dimension; + = present; – = not present; ± = may or may not be present.

This table is reprinted from Nakamura SS, Donatelli D, Rosenberg ES. Posterior bite collapse and diagnostic grading for periodontitis. *Int J Periodontics Restorative Dent* 2021;41:61–69.⁴

Fig 1 CLII d1 malocclusion presenting with G2 PBC. The mandibular left and right first molars are missing without replacements. The periodontium is stable without AF, no mobility/fremitus is detected, and there is an increased anterior overbite relation due to skeletal malocclusion. Treatment could consist of periodontal maintenance, caries control, and replacement of missing teeth, as desired by the patient. Orthodontic intervention and alteration of OVD may be necessary if there is inadequate room for restorative materials.



For dentitions presenting with Grade 1 (G1) PBC (free of primary OT or OVD loss), no other treatment may be necessary beyond initial therapy and caries control. For a more severe G1 PBC case (presenting with primary OT, severe retrograde wear, increasing mobility/fremitus, and OVD loss), appliance therapy, restoration of surfaces mutilated by OT, and OVD restoration may be necessary.

When unrestored TL is present in the periodontally stable dentition, as in the Grade 2 (G2) PBC case, the missing teeth may need to be restored with either a fixed or removable prosthesis (Fig 1) once

initial therapy is completed. In the presence of drifting and/or supra-eruption of teeth, orthodontic correction may be necessary to obtain adequate space for restorative materials and to restore occlusal planes. As with G1 PBC, G2 PBC cases presenting with primary OT with severe retrograde wear, increasing mobility/fremitus, and/or OVD loss may require adjunctive occlusal appliance therapy along with restoration of surfaces mutilated by OT in order to restore the OVD. Occlusal appliance therapy could be used as both a reversible means to assess OVD and IC/CR discrepancies and as a treatment modality. Dentitions

with a reduced yet healthy periodontium¹⁰ with a previous history of Grade 4 (G4) PBC and tooth loss/replacement are included in G2 and G1 PBC, respectively.

A dentition without TL presenting with stage I or stage II periodontitis and Grade 3 (G3) PBC would likely require more extensive periodontal treatment (and possibly extraction of nonrestorable teeth), as well as stabilizing and restoring occlusal disharmonies. Once periodontal and occlusal stability have been achieved, replacing nonrestorable teeth with either fixed or removable prosthetics may be necessary. Adjunctive occlusal appliance

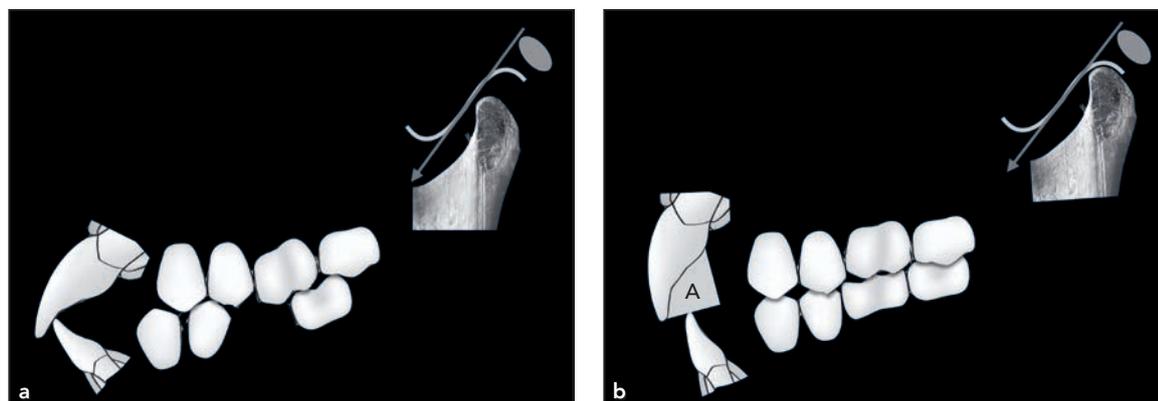


Fig 2 (a) Illustration of a CLI or CLId2 malocclusion in G4 PBC. There is TL, drifting of teeth, AF, and loss in OVD. (b) Restoration of such a case would involve periodontal therapy and maintenance; leveling and aligning the mandibular anterior teeth; occlusal appliance therapy to determine a therapeutic physiologic OVD; determining the centric relation position; correction of posterior occlusion at restored OVD; and retraction of the maxillary anterior teeth into a functional OB/OJ relation. Platforming the lingual aspect of the maxillary anterior teeth with fixed prosthodontics may be necessary (A). Therapeutic physiologic malocclusion is such that IC is equal to CR in long centric.

therapy may also be considered in the presence of increasing mobility and fremitus. Careful consideration should be taken when retrograde wear is present in conjunction with increasing mobility/fremitus, as this indicates possible secondary OT with underlying primary OT, as well as OVD loss.

Stage III and IV periodontitis presenting with G4 PBC could require more complex, multidisciplinary treatment.^{1,12-15} These cases would require extensive periodontal treatment, additional TL, stabilization and restoration of occlusal disharmonies, replacement of missing teeth with fixed or removable prosthetics, and OVD restoration.

Restoring Vertical Dimension in PBC

When the decision is made to restore OVD in PBC, evaluation and an Angle's malocclusion diagnosis are

required; each case presents collapse differently, especially with respect to mandibular position. In the presence of OVD loss with CLI, Class II division 2 (CLId2), and CLIII malocclusions, the mandible may be positioned more anteriorly, resulting in an increased IC/CR discrepancy. Restoring the OVD of the CLI or CLId2 malocclusions in the presence of AF would likely result in retrusion of the mandible into CR, and it would require retraction of the anterior teeth in order to restore a functional overbite (OB) and overjet (OJ) relationship. As OVD is restored, the mandible will retrude into CR, resulting in a decrease in OB and increase in OJ (Fig 2). Restoring the OVD in CLIII and orthodontic pseudo-CLIII malocclusions could result in the anterior teeth remaining in an edge-to-edge or reverse edge-to-edge relationship due to the skeletal discrepancy.⁷

Restoring OVD in the Class II division 1 (CLId1) malocclu-

sion presents a greater challenge. These PBC cases often present with a deep OB anterior relation with no AF, increased occlusal retrograde wear, and increased mobility/fremitus. As OVD is restored, the mandible retrudes into CR. Although this may decrease and possibly improve the OB relation, the OJ could potentially significantly increase, thus worsening the anterior functional relationship. Often, the anterior teeth may require a lingual platform in the final prosthesis in order to establish adequate anterior function (Fig 3).

Periodontally stable dentitions with PBC with OVD loss due to severe retrograde wear, primary OT, or missing/displaced teeth may present with mandibular protrusion appearing as a CLIII malocclusion (dental pseudo-CLIII). Restoring the OVD of such cases may result in a CLI, CLId2, or true CLIII malocclusion, as the mandible retrudes

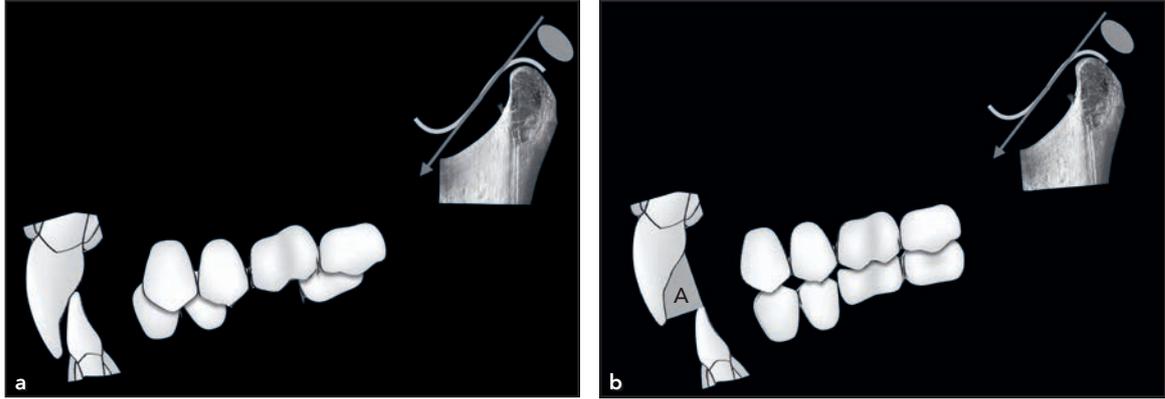


Fig 3 (a) Illustration of a CLId1 malocclusion in G4 PBC. There is TL, drifting of teeth, no AF, and loss in OVD. (b) Restoration of such a case would involve periodontal therapy and maintenance; leveling and aligning the mandibular anterior teeth; occlusal appliance therapy to determine the therapeutic physiologic OVD; determination of CR position; and correction of posterior occlusion at the restored physiologic OVD. Due to the dentoskeletal malocclusion, a significant increase in OJ may be seen as OB decreases. Platforming the lingual aspect of the maxillary anterior teeth with fixed prosthodontics will be necessary (A). Therapeutic physiologic occlusion is such that IC is equal to CR in long centric.

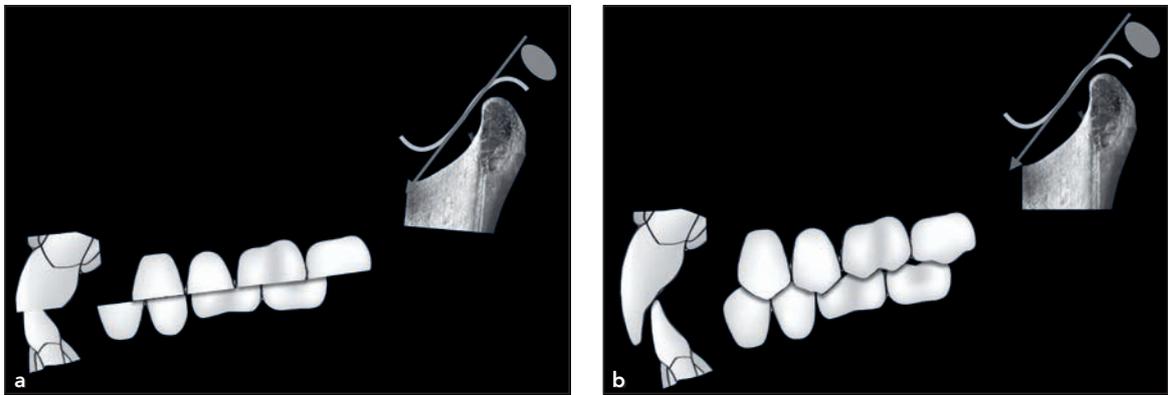


Fig 4 (a) Illustration of a potential CLI, CLId2, or CLIII malocclusion in G1 PBC with primary OT, severe retrograde wear, and concomitant loss in OVD. As a result of OVD loss, mandibular protrusion could be noted, presenting as a dental pseudo-CLIII malocclusion. (b) Treatment would involve periodontal therapy and maintenance; occlusal appliance therapy to determine therapeutic physiologic OVD, determining the CR position, and rehabilitation of the dentition at the restored physiologic OVD.

into CR (Fig 4). Regardless of malocclusion, a functional therapeutic physiologic occlusion may often result with IC equal to CR in long centric.^{16,17} Once OVD is restored, the remaining posterior dentition should be restored and periodontally stable enough to maintain the restored therapeutic OVD. In most cases, restoration of PBC malocclusions may require full-mouth

rehabilitation with fixed prosthodontics.^{1,12–15}

Cases

Case 1: G2 PBC + CLI

A 45-year-old man presented with a CLI malocclusion with a reduced, stable periodontium and

bilaterally missing mandibular first molars without replacement, and a chief complaint (CC) of missing teeth and anterior diastema that had been increasing over time. As a result, the surrounding teeth drifted into the space. The increasing anterior diastema indicated OVD loss. Treatment involved restoring the OVD, occlusal therapy with IC equal to CR,

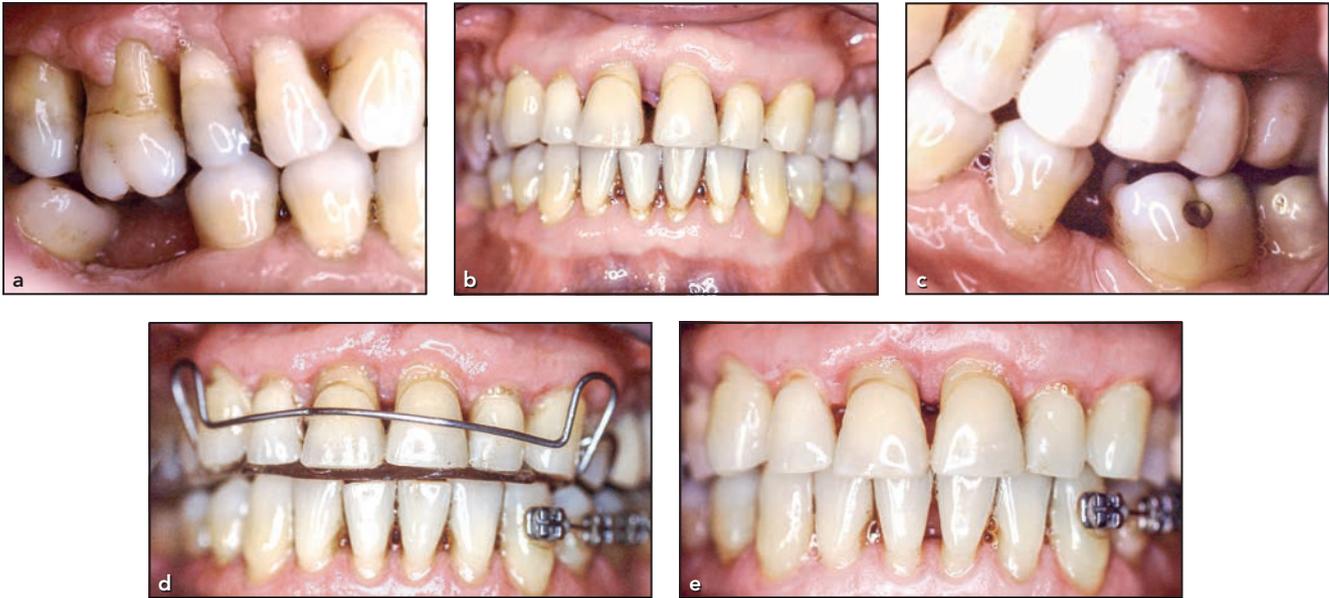


Fig 5 CLI malocclusion with G2 PBC. (a to c) Reduced yet stable periodontium, bilaterally missing 6-year molars, drifting of teeth into edentulous spaces, and increasing anterior diastema noted. (d and e) Following periodontal therapy, an anterior Hawley bite plane (BP) appliance was inserted and posterior occlusion was stabilized with orthodontics and occlusal adjustment, establishing IC equal to CR. The anterior diastema was closed using the labial bow of the BP appliance.

correction of the posterior occlusal planes, and closing the diastema (Fig 5).

Case 2: G3 PBC + CLI

A 51-year-old man presented with stage II periodontitis and a CLI malocclusion in PBC, and a CC of generalized increasing mobility and fremitus with bleeding gums. Although there was no TL, AF, or significant OVD loss, there was active periodontitis, a reduced periodontal attachment apparatus, and secondary OT. Treatment involved restoring and maintaining periodontal health, extracting nonrestorable teeth with their restorative replacements, addressing osseous defects, and periodic, 3-month periodontal maintenance (Fig 6).

Case 3: G4 PBC + CLI

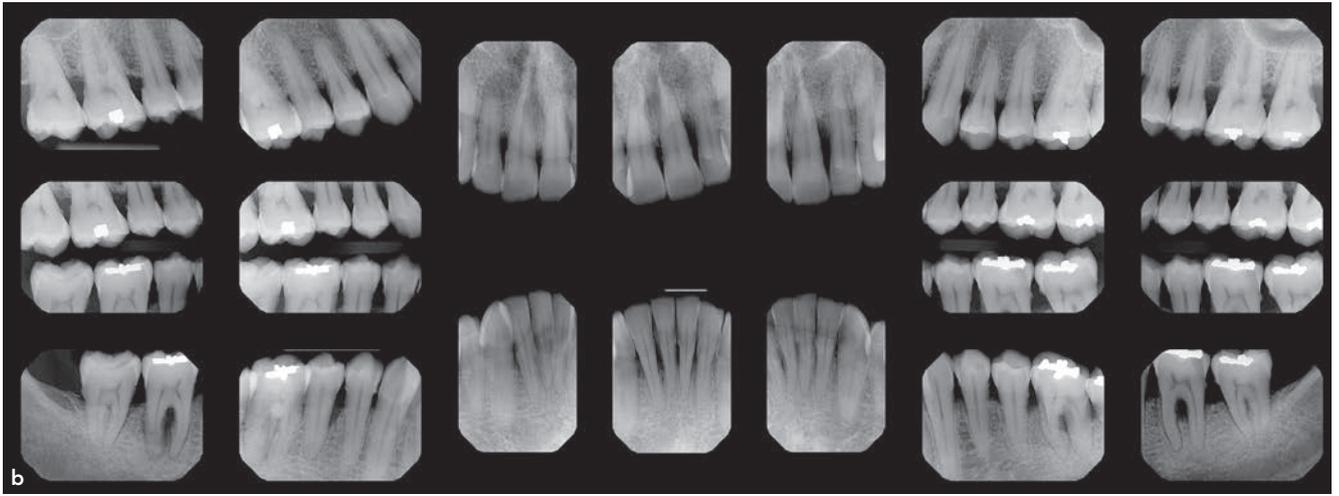
A 47-year-old woman presented with stage III periodontitis and a CLI malocclusion in PBC, with a CC of periodontal issues. Her mandibular left first molar was missing, causing the surrounding teeth to drift into the space. Additionally, the remaining posterior dentition show accelerated mesial drifting in the presence of increasing mobility and fremitus with no AF. Treatment involved extracting nonrestorable teeth, restoring and maintaining periodontal health, and correcting occlusal planes with IC equal to CR. Interproximal stripping of the dentition was necessary to reestablish interarch occlusal relationships and the OB-OJ relationship with the mandible in CR (Fig 7). Full-mouth restoration with fixed or removable

prosthodontics may be necessary to maintain a functional physiologic therapeutic occlusion.

Case 4: G4 PBC + CLId2

A 56-year-old man presented with stage IV periodontitis and a CLId2 malocclusion in PBC, with a CC of esthetic concerns. He had multiple missing teeth, a deep OB, OVD loss, and conformational treatment in collapse. Treatment involved extracting nonrestorable teeth, restoring and maintaining periodontal health, correcting occlusal planes with IC equal to CR, restoring OVD, and replacing missing teeth (Fig 8). The patient refused any orthognathic corrective surgery. Due to the deep CLId2 malocclusion, altering the OVD would retrude the mandible into CR,

Fig 6 (a) Clinical and (b) radiographic views of a CLI malocclusion with G3 PBC and stage II periodontitis. Although TL was not noted, there is generalized moderate to severe attachment loss, increased mobility/fremitus, no AF, and no significant loss in OVD.



which may improve the OB but often detrimentally increases the OJ. Restoration of such cases could necessitate full-mouth restoration with fixed or removable prosthodontics.

Conclusions

PBC is a clinical syndrome with multiple, often pathologic etiologic factors. In developing a multidisciplinary treatment plan to treat PBC, the adequate diagnosis and analysis of each individual patient is required. Although not all PBC cases require treatment, early intervention and careful maintenance of these patients can prevent the onset and

progression of periodontitis and may allow for the preservation of a stable, functional, physiologic malocclusion. First and foremost, the foundation of all treatment must be the health of the periodontal attachment, free of inflammation. The decision to intervene with treatment should be based on the following parameters:

- Can the patient chew adequately?
- Is the patient esthetically satisfied?
- Does the patient have a phonetic pattern?
- Is the patient in good periodontal health?

- Is the patient free of active dental caries?
- Is the patient free of subjective and objective TMD symptoms?
- Is there a negative occlusal sense present?
- Does the patient have a parafunctional habit pattern (bruxism)?

When treatment is needed, the availability of restorative space should be evaluated, and the decision to restore OVD should be tested using reversible treatment modalities. Additionally, assessing the occlusal pattern, amount of centric slip, and AF presence should be done before engaging in



Fig 7 CLI malocclusion with G4 PBC and stage III periodontitis. (a to c) The patient presented with TL, secondary OT, and mesial tipping in posterior dentition without AF or significant loss in OVD. (d to f) Following periodontal therapy and extraction of nonrestorable teeth, orthodontic appliances were used to correct dental/occlusal discrepancies. Interproximal stripping was necessary to retract teeth and reestablish functional arch form. Treatment and photos provided by Dr Jonathan Korostoff (Philadelphia, Pennsylvania, USA).

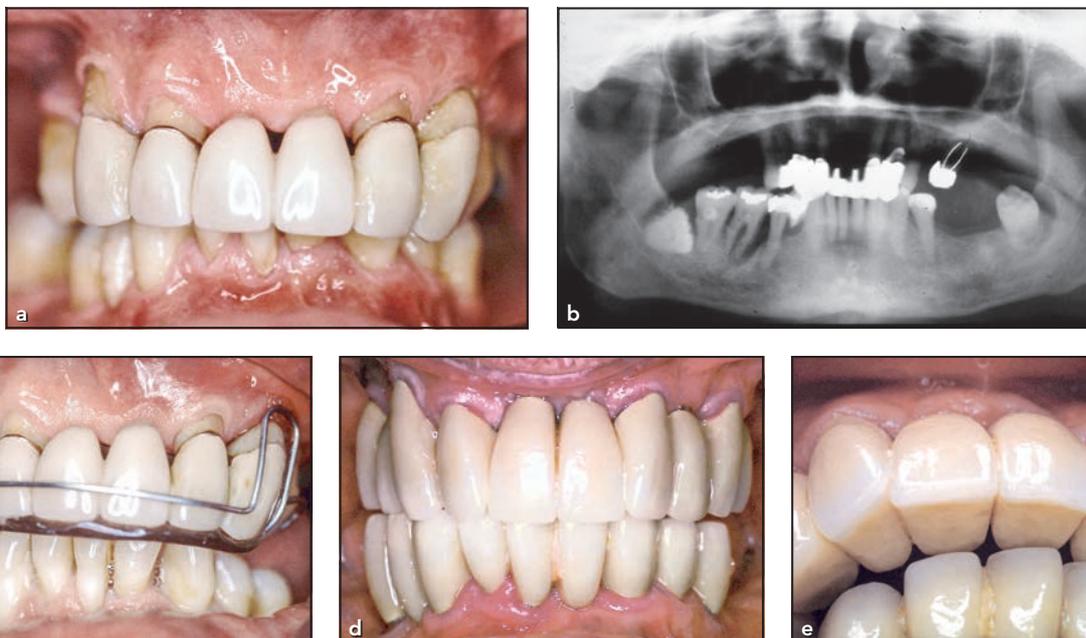


Fig 8 CLII d2 malocclusion with G4 PBC and stage IV periodontitis. (a and b) The patient presented with conformative occlusion with TL, secondary OT, no AF, and loss in OVD. (c) Following periodontal therapy, an anterior Hawley BP appliance was inserted to evaluate OVD and CR position. Due to the skeletal discrepancy, OB decreased and the OJ increased significantly. (d and e) Restoring a stable therapeutic physiologic occlusion required full fixed prosthodontics with an anterior lingual platform and IC equal to CR in long centric.

Table 2 Example Evaluation Form to Record Clinical Findings

	Periodontitis stage			
	I	II	III	IV
PBC grade	1	2	3	4
Angle class	I	IId1	IId2	III
AF	Y	N		
Increased mobility/fremitus	Y	N		
OT	1 degree	2 degrees	1–2 degrees	
OVD loss	Y	N		

PBC = posterior bite collapse; AF = anterior flaring; OT = occlusal trauma; OVD = occlusal vertical dimension; Y = yes; N = no.

treatment. Table 2 demonstrates an example of a means to record clinical findings. The therapeutic goal for intervention should be such that the dentition is able to function within the masticatory form and the functional demands for each patient; in everyday practice, clinicians deal with a statistically insignificant number—one—and never know where this one patient may fall within the average. Above all, multidisciplinary care in treating PBC should be accepted by the patient with the understanding that a functional, physiologic, therapeutic occlusion may not be achieved without comprehensive integration of treatment and extensive fixed prosthodontics.

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References

- Amsterdam M, Abrams L: Periodontal prosthesis. In: Goldman H, Cohen DW (eds). *Periodontal Therapy*, ed 3. St Louis: Mosby, 1964:762–813.
- Rosenberg ES. Posterior bite collapse, part 1: Pathologic occlusion. *Compendium* 1988;9:207–218.
- Granger ER (ed). *Biomechanics*. In: *Practical Procedures in Oral Rehabilitation*. Philadelphia: Lippincott, 1952:16–18.
- Nakamura SS, Donatelli D, Rosenberg ES. Posterior bite collapse and diagnostic grading for periodontitis. *Int J Periodontics Restorative Dent* 2021; 41:61–69.
- Shifman A, Laufer BZ, Chweidan H. Posterior bite collapse—revisited. *J Oral Rehabilitation* 1998;25:376–385.
- Chasens AI. Controversies in occlusion. *Dent Clin North Am* 1990;34:111–123.
- Rosenberg ES, Simons J, Gualini F. Clinical aspects and treatment of posterior bite collapse due to accelerated wear. *Int J Periodontics Restorative Dent* 1987;1:67–82.
- Turner KA, Missirlian DM. Restoration of the extremely worn dentition. *J Prosthetic Dent* 1984;52:467–474.
- Harper RP. Clinical indications for altering vertical dimension of occlusion. Functional and biologic consideration for reconstruction of the dental occlusion. *Quintessence Int* 2000;31:280–282.
- Chapple ILC, Mealey BL, Van Dyke TE, et al. Periodontal health and gingival diseases and conditions on an intact and a reduced periodontium: Consensus report of workgroup 1 of the 2017 World Workshop on the Classification of Periodontal and Peri-implant Diseases and Conditions. *J Periodontol* 2018;89(suppl 1):s74–s84.
- Tonetti MS, Greenwell H, Kornman KS. Staging and grading of periodontitis: Framework and proposal of a new classification and case definition. *J Clinical Periodontol* 2018;89(suppl 1):s159–s172.
- Amsterdam M. Periodontal prosthesis: Twenty-five years in retrospect. *Alpha Omegan* 1974;67:8–52.
- Rosenberg ES, Lever B. Posterior bite collapse, part II: Occlusal therapy. *Compendium* 1988;9:258–278.
- Kastenbaum F. Case report: Treatment of posterior bite collapse with secondary occlusal traumatism. *Penn Dent J (Phila)* 1977;79:39–42.
- Jensen-Doray PG. Case report: Comprehensive treatment of a patient with posterior bite collapse. *Compend Contin Educ Dent* 1984;5:826–838.
- Celenza F. The centric position: Replacement and character. *J Prosthetic Dent* 1973;30(4 Pt. 2):591–598.
- Schulyer CH. Freedom in centric. *Dent Clin North Am* 1969;13:681–686.

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