

Quality Resource Guide

Managing the Patient with a Worn Dentition

Author Acknowledgements

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Educational Objectives

Following this unit of instruction, the learner should be able to:

1. Describe the etiologies for the worn dentition.
2. Identify the types of tooth wear.
3. Describe how to perform an accurate diagnostic mounting.
4. Explain the use of the diagnostic mounting in diagnosis and treatment planning.
5. Explain the difference between centric relation and maximum intercuspation.
6. Describe mutually protected occlusion.
7. Understand the proper sequence for restoring extensive wear cases.
8. Understand how to use modern materials to prevent continued wear.

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Introduction

Initial examination of a new patient occasionally reveals a severely worn dentition characterized by extensive wear and loss of tooth structure. Function and esthetics are compromised, and the prognosis for one or several teeth may be jeopardized if the problem is not corrected. The complex nature of this condition, and its multifactorial etiology, often overwhelms the general dentist with limited experience in treating such widespread tooth destruction.

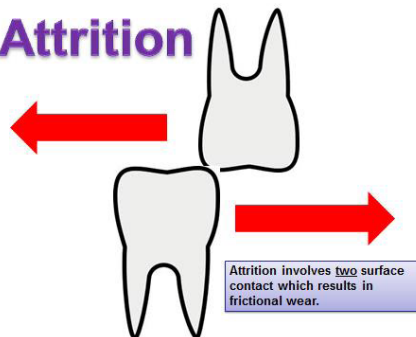
Loss of tooth structure may be a result of mechanical wear (attrition, abrasion), chemical attack (erosion, also called corrosion¹) and/or mechanical stress concentration (abfraction). Attrition is mechanical wear that occurs when opposing teeth rub against each other during mastication and/or parafunctional mandibular movements (**Figures 1-3**). This type of wear is limited to areas where teeth contact each other and results in even tooth wear with the creation of sharp wear facets. Abrasion (**Figures 4-5**) is tooth wear resulting from the friction of an exogenous material (a bolus of food, toothpaste, or an opposing ceramic crown) against tooth structure. Chemical erosion (corrosion) is the loss of tooth structure from exposure to chemicals, usually acids (**Figures 6-7**).^{2,3}

Chemical erosion can be caused by a number of different agents. The dissolution of tooth enamel requires an acidic environment. Erosion can begin at a pH of 5.5.⁴ Acid can come from gastric contents either from gastric reflux or bulimia. Regurgitation of stomach contents will normally be greater in the anterior region of the mouth due to the projectile vomitus and tongue position. The tongue will often cover the mandibular anterior teeth protecting the mandibular anterior teeth, allowing greater dissolution of the maxillary anterior teeth, especially on the lingual surfaces.^{5,6,7,8,9}

The use of commercial soft drinks and sports drinks can also add to the dissolution of enamel. An analysis of the pH of the commercial drinks reveals a low pH with the potential of causing enamel loss.^{10,11} Abrahamsen refers to the problem

Figures 1-3

Attrition



A classic example of horizontal bruxism. All teeth show wear and are flat.



Tooth structure loss is due to attrition, but the wear pattern is quite different from Figure 1. In this example there are sharp shards of enamel remaining. This is an example of vertical bruxism.

Figures 4-5

Abrasion

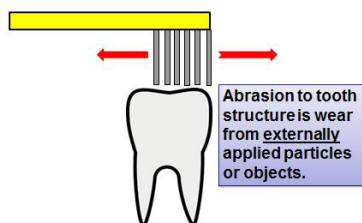
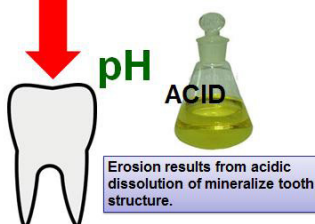


Figure 5 shows abrasion to the facial of teeth #3 and #6. Probably due to tooth brush use.

Figures 6-7

Erosion



Loss of tooth structure on the occlusal surfaces which do not contact the opposing arch.

with commercial drinks as “Coke-Swishing” and states that the loss of enamel is more prominent in the posterior of the mouth because of tongue

position. Cupping or cratering is present with the soft drink erosion and will present sharp enamel edges.²

Abfraction lesions are wedge-shaped cervical defects attributed to tooth flexure during abnormal occlusal loading. The worn dentition is often due to a combination of attrition, erosion and abfraction.¹⁻³

The clinician must identify and eliminate all etiologic factors, before restoring the dentition to proper form and function.

Often it is discovered that a patient can combine erosion, abrasion and attrition. In **Figure 8** a patient with significant tooth structure loss is seen. He had been diagnosed with gastric reflux problems and was able to communicate the history. Tooth structure loss was much greater on the patient's right side than his left (**Figure 9**).

The patient stated that he would have reflux episodes at night, and the taste would drive him to immediately brush his teeth. He was able to demonstrate that he would vigorously brush his right side, but barely touch his left side. Added erosion occurred with abrasion as he brushed his teeth with remaining gastric acids which remained in his mouth. He also related to being a right side sleeper, which allowed gastric contents to concentrate in the right side vestibule, again creating greater tooth disillusion. In **Figure 10** the patient is seen in a right side working movement. The tooth to tooth attrition contributed to the tooth loss on the right side. Thus the patient would reflect erosion, abrasion, and attrition all in the same mouth, resulting in heavy loss of tooth structure. **Figure 11** shows the left side with little loss of tooth structure in contrast to the right side.

Treatment Planning

When confronted with a complicated restorative challenge such as worn dentition, the clinician should return to the basics of treatment planning, beginning with the patient interview. What is the patient's chief concern? The inability to eat, tooth sensitivity and poor esthetics are common complaints of the patient with a worn dentition.

Patients provide important information. They may relate a history of bruxism, bulimia, or gastro esophageal reflux disease (GERD); though individuals with eating disorders might be unwilling to disclose these problems. Inquiring into dietary

Figure 8



Wide spread loss of tooth structure. Mandibular incisors are not affected like the maxillary and posterior teeth. The tongue will protect the mandibular incisors from stomach acid.

Figure 9



Significant tooth structure loss to the facials of the mandibular molars. Loss is due to both sleeping position and the pooling of stomach acid on one side, and the use of a tooth brush to vigorously brush the right side with stomach acid present.

Figure 10



Right working movement reveals a balanced occlusion with working, balancing and protrusive contacts. The right working movement reveals tooth loss due to attrition in addition to the erosive and abrasive habits.

Figure 11



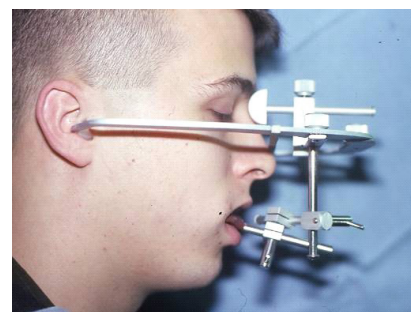
The patient's left side is not as affected by the erosive and abrasive problems.

habits may reveal behaviors such as fresh fruit mulling or the swishing of carbonated beverages, which can erode tooth surfaces.^{2,3} The patient can be asymptomatic and unaware of the presence of any of etiologic factors. Referral for medical evaluation is often indicated in such situations, which can lead to counseling for any eating disorders. Many patients will admit to poor dietary habits that can result in enamel dissolution. Referral to nutritional counseling will often benefit these patients.

A thorough review of the medical history, soft tissue examination, appropriate radiographic images, periodontal probing, and analysis of the periodontal tissues and the charting of existing dental restorations and caries lesions are always appropriate components of a comprehensive oral examination. If the dentition appears to be abnormally worn, the clinician should next evaluate the interocclusal contacts between maxillary and mandibular teeth and their contribution to the wear problem using a diagnostic mounting.

Gypsum casts made from accurate alginate impressions are sufficient for this purpose.¹² The casts should be mounted on a semi-adjustable articulator with accurate facebow and interocclusal records to properly position them in the articulator. The facebow (**Figure 12**) relates the maxillary cast to the axis of rotation of the patient's mandibular condyles, the plane of occlusion, and the Frankfort horizontal plane

Figure 12



The use of the facebow will relate the maxillary cast to the axis of rotation, the Frankfort horizontal plane and the plane of occlusion.

(or an equivalent third reference point). This allows the mounted casts to mimic the patient's occlusal relationships and mandibular movements. This mounting can be useful in identifying occlusal discrepancies and determining how to correct them.

Interocclusal records orient the mandibular cast to the maxillary cast and are made in centric relation position (CR). CR is "the relationship of the mandible to the maxilla when properly aligned condyle/disc assemblies are in the most anterior superior position against the eminentia irrespective of tooth position or vertical dimension."¹³

In contrast, maximum intercuspation (MI) is an acquired occlusal position where there is maximum contact between maxillary and mandibular teeth. CR is selected for mounting the casts because it is a physiologic, functional, and repeatable position. Methods to guide the patient into CR when making interocclusal records include: tongue positioning;¹⁴ chin point guidance;¹⁵ bilateral manipulation;¹⁶ the use of a positioning jig;¹⁷ and the use of a leaf gauge.^{18,19} After CR is obtained, the interocclusal record is made using low-resistance media such as wax, zinc oxide and eugenol, or polyvinylsiloxane bite registration material.

When occluding casts are mounted in CR, the initial occlusal contact may be on a single tooth which prevents the mandible from closing into MI without first shifting anteriorly and/or laterally. Over 90% of the population exhibit a discrepancy between CR and MI.²⁰⁻²⁴ These premature contacts or interferences can be a causative factor for excessive wear of teeth.

Occlusal Analysis

Opposing posterior teeth in an ideal occlusion are located directly over one another so that occlusal forces load them in an axial direction (Figures 13-14). The root structure of posterior teeth and the orientation of the periodontal ligaments provide excellent resistance to axial forces. Maxillary and mandibular anterior teeth meet at an angle (Figure 13) causing the maxillary anterior teeth to be loaded in a transverse direction. Consequently, anterior teeth cannot withstand heavy occlusal forces.

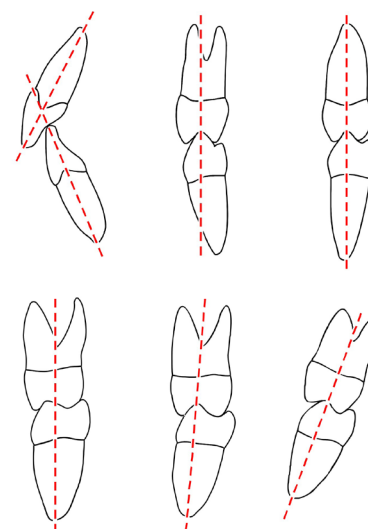
The position of the anterior teeth forward of the muscles of mastication and the TMJ (a fulcrum) creates a class III lever (Figure 15). In this configuration, the greatest occlusal forces occur on the teeth nearest the fulcrum. Therefore, occlusal forces on anterior teeth are low compared to posterior teeth. In addition, anterior teeth utilize proprioceptive indicators to prevent overloading.^{25,26}

Posterior teeth in an ideal occlusion protect the anterior teeth by bearing the heavy masticatory forces. During lateral and protrusive mandibular movements, guidance up the inclines of the anterior teeth causes maxillary and mandibular posterior teeth to separate, thus protecting posterior teeth from potentially damaging lateral forces. This anterior guidance also interrupts the contraction of the temporalis and masseter muscles preventing them from generating excessive forces.²⁶ The concept of anterior and posterior teeth protecting each other is referred to as "mutually protected occlusion".¹⁵

When the anterior teeth are missing or severely worn, the lack of anterior guidance results in continual contraction of the masticatory muscles, with accelerated occlusal wear of the posterior teeth. Without posterior tooth support, the anterior teeth cannot withstand the increased occlusal forces and will either wear or become mobile. Premature contacts in CR can destroy the class III lever relationship, causing the anterior teeth to become the occlusal stop to mandibular closure.

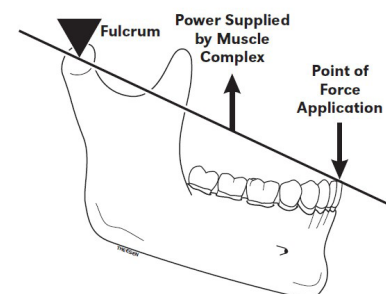
Bruxism or other parafunctional habits apply excessive forces to the teeth.^{27,28} The effects of bruxism can be observed on the diagnostic mounting. Lateral movements of the mandible during horizontal bruxism wear both maxillary and mandibular teeth very flat, creating sharp edges. The wear, without treatment, can eventually extend into the pulp chamber leading to pulpal involvement and eventual loss of teeth. A classic example of horizontal wear from bruxism is seen in Figure 1 and Figure 3.

Figures 13 and 14



Anterior teeth are not positioned to take the force of closure of the mandible. The posterior teeth will take the force of mandibular closure down the long axis of the individual teeth.

Figure 15



The ideal occlusal model will demonstrate a class III lever.

Figures 16



Horizontal attrition will wear the posterior and anterior teeth at an even rate. All teeth contact through all mandibular movements.

In contrast to the even wear on the existing teeth in **Figure 1**, we see uneven wear of the teeth in **Figure 3**, with obvious thin enamel shards which are very friable due to the thinness of the tooth, yet these delicate tooth fragments are not abraded and fractured. The two contrasting examples show the variety of wear.

Vertical Bruxism

Vertical bruxism causes excessive wear to the anterior teeth while the posterior teeth retain their natural shape. Vertical bruxism is a term used by Spear²⁷ to describe a difference in types of bruxism. Often the clinician will notice sharp areas of enamel on the teeth that are not supported by underlying tooth structure (**Figure 3**). If the patient were a horizontal bruxer, these areas would be worn flat. Instead we see the incisal edges of the maxillary anterior teeth become extremely thin and fragile while the posterior teeth often exhibit little tooth loss.

These cases can be difficult to restore as the anterior teeth continue to erupt as tooth structure is lost, but the posterior teeth remain unworn with no loss of vertical dimension of occlusion (**Figures 17-20**). This condition occurs when the initial occlusal contact during closure is on a mesial incline of a maxillary tooth (**Figure 21**).²⁴ As the mandible closes into maximum intercuspation, the premature inclined contact forces the mandible forward overloading the anterior teeth and causing wear or loosening²⁴ (**Figure 21**).

Initiating reconstructive dentistry for a patient with a worn dentition can be difficult due to the aggressive nature of the restorative process and the cost to the patient. When a patient seeks care because of pain or loss of tooth structure due to bruxism, and has the financial resources to rebuild their occlusion, the decision is easy. When a patient is unaware of any problems, and/ or has limited finances, treatment decisions are much more difficult. The dentist has the obligation to record loss of tooth structure for a patient who comes into the general practice and is conscientious about recall visits. Once the incisal edges of the anterior

Figure 17



Frontal view of vertical bruxism patient.

Figure 18



Tooth structure loss to lingual of maxillary incisors.

Figure 19



Posterior teeth show no loss of vertical. Thin areas of enamel remain, severe wear to maxillary anterior teeth while the posterior teeth retain the original occlusal height.

Figure 20



Contralateral side.

teeth or the lingual of the anterior teeth begin to show wear or wear facets, the patient needs to be informed of their problem. Classification systems, described in the literature, may aid the clinician in

Figure 21

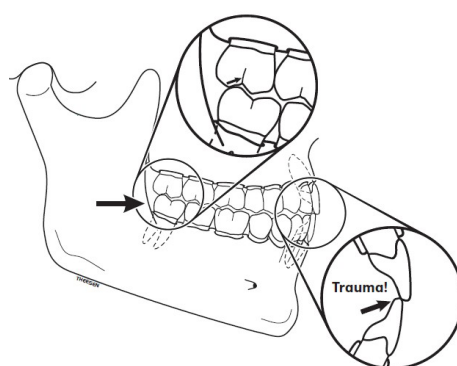


Diagram demonstrates the mechanism for vertical bruxism and the wear to the anterior teeth.

decision making as to when, or if, to intervene, with therapy. Smith and Knight²⁹, Eccles³⁰ and Lussi³¹ have developed index systems. The clinician must be able to determine etiology before beginning any preventive or interceding treatment.

Wear facets due to bruxism can begin to show in the teenage years. After growth is completed, use of an occlusal guard may be necessary to prevent progressive tooth wear. The patient needs to be made aware of their bruxism habit and the need to use the guard. Both the dentist and the patient need to be aware of known risk factors that may increase bruxism. Smoking, caffeine consumption, heavy alcohol drinking, type A personality – anxiety, sleep disorders such as snoring and sleep apnea, psychotropic medication, and antidepressants have been documented to increase bruxism activity.²⁵

Construction of an orthotic appliance for patients who demonstrate wear will aid in preventing further destruction of their teeth.³² Continued evaluation and documentation over the years will alert the general practitioner to changes in the amount of wear for the patient. If concerns are present for either the patient or the dentist, a mounting of accurate gypsum casts and evaluation of the occlusal contacts are warranted. A clinical decision can be made to equilibrate the patient to try and prevent further wear.

Figure 22



Diagnostic mounting demonstrates premature contacts on inclines instead of flat surfaces or fossas. Occlusal stability is not possible.

Figure 23



Posterior contacts in CR on inclines. The contact between the first and second molars has been opened due to occlusal pressure pressing the second molar to the distal.

Figure 24



The casts in maximum intercuspation. The distance or slide from centric relation to maximum intercuspation is over 4mm.

Figure 25



An ideal occlusion is waxed in the centric relation position.

It is common for a gross premature contact to be present in patients with a worn dentition (Figure 22). This type of contact is often difficult to detect in a routine examination, and may go unnoticed by both the patient and the restoring dentist. Only a diagnostic mounting in CR will reveal the contact.

Figure 22 reveals the first contact between cuspids, there is significant interocclusal space between the maxillary incisors and the mandibular incisors. Many dentists feel CR is not a functional position. In the mounting shown, wear facets exist in the CR position, demonstrating continued function in the CR position. Figure 23 reveals CR contact on the inclines for the same patient. Repeated contact on the mesiobuccal cusp marginal ridge (Figure 23), has driven the maxillary second molar to the distal and opened the interproximal contacts between the first and second molars.

In order to restore the mouth to normal function, the premature contact must be located, identified, and corrected. Correction may entail extensive reconstruction with artificial crowns.

A common thought for a dental practitioner observing the wear of teeth is to make the assumption that the patient has lost vertical dimension of occlusion. As the teeth wear, the supporting bone and tissues will continue to erupt with the tooth as it wears. The result is a worn dentition but no loss of vertical.^{33, 34, 35}

Using a diagnostic mounting and wax up, the clinician can determine if it is possible to transfer the mandibular forces of closure back to the posterior teeth. If the attempted wax up reveals that there is such a discrepancy in the interocclusal relationship that a stable occlusion is not possible, an orthodontic consultation is required. A trial restoration can be completed using provisional restorations that restore the occlusion to a mutually protected scheme. The final outcome can be predicted for the patient by the use of durable well-constructed provisional restorations. The authors recommend the use of indirect provisionals with methymethacrylate resin (Figure 27).³⁶

Figure 26



The patient is placed on an orthotic appliance to mimic the new occlusal relationship between the maxilla and the mandible.

Figure 27



Individual provisional restorations made from the ideal wax up. Individual provisionals will be predictable.

Figure 28



Facial view of the final restorations. Restorations are pure zirconia. The final restorations mimic the provisionals.

Figure 29



Facial view at nine-year recall. With posterior stability, and anterior guidance, this case of a vertical bruxism patient shows no wear, chipping or tooth movement nine years after completion of the case.

Treatment Sequence

Figures 22-28 show the treatment sequence for the patient shown in **Figures 17-20**. **Figure 29** shows the nine year recall for this patient. Treatment for the patient with a worn dentition must be completed in a logical sequence in order to achieve a successful outcome. The case must first be evaluated using a diagnostic mounting and initial occlusal stability must be achieved by removing all interferences in CR. This can be achieved through equilibration of the mounted casts; the goal being to develop stable occlusal stops on the posterior teeth. Any contacts on sloping surfaces that might force the mandible anteriorly or laterally during closure should be eliminated.³⁷ Once adjustments are shown to be appropriate on the casts, they may be duplicated in the patient's mouth.

Once equilibrated, CR should coincide with MI. **Figure 24** shows the anterior teeth in maximum intercuspation. Following equilibration and the changing of mesial slope contacts to a stable flat contact (creating a stable posterior occlusion), the anterior teeth are no longer the stopping force for the closure of the mandible. Equilibration of a patient with a significant posterior-anterior shift, and contact on the functional cusps may not lend itself to an easy equilibration. The diagnostic mounting will aid in the analysis of the ability to equilibrate and the possible prognosis of the equilibrated case.

A diagnostic wax-up is completed on the mounting to reestablish a stable occlusal scheme (*i.e.* anterior guidance and cusp-fossa, or cusp-marginal ridge, occlusal contacts on the posterior teeth) (**Figure 25**). This enables the posterior teeth to bear the forces of mandibular closure and restores the class III lever advantage to the anterior teeth. An occlusal scheme separating the posterior occlusion by 1mm when the cuspids are in lateral contact is the preferred relationship. Keeping the incisal guidance shallow for patients with a bruxism habit will aid in reducing the force on the anterior teeth during lateral movements of the mandible.³⁷

Duplicating the diagnostic wax-up can assist the clinician in fabricating provisional restorations. Placing these provisional restorations allows the patient and the clinician to assess the proposed occlusion and view the esthetics prior to the fabrication of final restorations.³⁶ The provisional restorations should reflect the desired esthetic result, the change in the occlusal scheme, and should be individualized to allow normal tissue contacts allowing normal home care, including flossing. Care should be taken to ensure that the mandible is able to move throughout its entire envelope of function without interferences.¹⁶

The occlusal vertical dimension, or Vertical Dimension of Occlusion (VDO), may be opened at this time, if necessary. A change in the VDO must be undertaken with care. A change can be tested with the use of an orthotic appliance (removable overlay splint) at the new VDO, followed by building provisional restorations at that position (**Figures 26 and 27**). This allows the patient to evaluate the new VDO for function and comfort. The length of time for the patient to use the orthotic appliance is a clinical decision by the restoring dentist. Spear recommends evaluation of the appliance in 4-8 weeks.²⁷ The main criteria is the comfort of the patient. Some clinicians prefer to move directly to provisional restorations, and do not feel there is a need for the orthotic or testing an increased VDO.¹⁶ Because the orthotic is a conservative and reversible procedure, the authors recommend its use.

If the patient is able to function normally with the provisional restorations, replacement with definitive restorations will predictably result in a favorable outcome. The provisionals will provide the clinician with information regarding optimal occlusal contacts. The dentist and the patient can observe esthetic form for the anterior teeth. Are they too long? Are they too wide? Is there a need for diastemas? The disocclusion of the posterior teeth can be observed and worked out in the provisional restoration. Once the esthetic and functional desires of the patient and restoring dentist are satisfied, restoration can begin.

The clinician may need to consider endodontics and post/cores in order to have sufficient tooth substructure to retain an artificial crown. Crown lengthening may also be an option if there is sufficient bone to support the teeth after the procedure is completed. If crown lengthening is indicated, the authors will normally wait three months prior to beginning final restorations.

Attempting to complete all final restorations at the same time can be overwhelming. The authors feel a reasonable alternative is to divide the treatment into segments. First, fabricate permanent restorations for the anterior teeth to restore anterior guidance. Then complete the posterior restorations, doing both upper and lower teeth on one side of the mouth at one time. If desired, all teeth can be restored at once, but a clinical remount will be required to insure stable contacts and excursive movements.

Since the VDO and all excursive movements have been worked out using provisional restorations, there is no need to lute the final restorations with temporary cement. Provisional restorations are easy to remove with an instrument pressed into the resin. The provisional restorations flex under stress, breaking the cement seal and allowing removal. Well-done final restorations will have smooth margins making it difficult to use an instrument to remove them. Final restorations will not flex, and will resist removal. It has been the authors' experience that temporarily cemented final restorations often cannot be removed. Since the provisionals have already been tested, there is no reason to temporally cement the final restorations.

Despite achieving perfect cuspid guided disclusion with a full-mouth rehabilitation, parafunctional behavior will probably persist for the bruxism patient, making the use of a nighttime protective appliance mandatory. The continued parafunctional activity can destroy even the most meticulously restored dentition.¹⁶

Knowledge of materials used for the reconstruction is important. The use of strong materials will aid in preventing the loss of restorations over time due to

Figure 30



Maximum intercuspation.

Figure 31



Laterotrusion working movement is natural tooth structure against a metal ramp.

Figure 32



Figure 33



Completed full mouth restoration in porcelain fused to metal. Lateral movements will be porcelain to porcelain contact.

continued attrition.⁴¹ Providing occlusal contact on metal or zirconia will aid in preventing restoration fracture or loss. There is risk of restoration fracture if the patient has a heavy bruxism habit. The patient shown in **Figures 30-33** has a metal ramp on the maxillary cuspid occluding against an unrestored mandibular cuspid. This ramp will help with the anterior guidance and aid in preventing fracture of the anterior restorations. The patient in **Figures 34-38** was restored with pure zirconia restorations. This patient had a full-mouth rehabilitation with porcelain contacts on the cuspids. Lateral movements are controlled by the porcelain-to-porcelain contact of the anterior teeth.

Using zirconia frameworks will allow the pure zirconia to make all occlusal contacts. This will prevent the show of metal for the severe bruxing patient. Sailer has shown that zirconia ceramic restorations have a similar survival rate to metal ceramic fixed partial dentures.

Figure 37 shows the computer graphic for developing zirconia over the incisal edge. **Figure 38** shows the zirconia substructure used with zirconia over the incisal edge to prevent continued wear and possible fracture of the new restoration.

Horizontal Bruxism

Horizontal bruxism patients are diagnosed by the observation of little to no posterior to anterior shift from CR to MI. These patients will have teeth which display significant horizontal wear on all teeth, both anterior and posterior. Diagnosis is made by the presence of equal wear to all teeth, flat incisors, no areas of thin enamel projections present.

Figure 34



Preoperative for a zirconia rehabilitation.

Figures 35 & 36

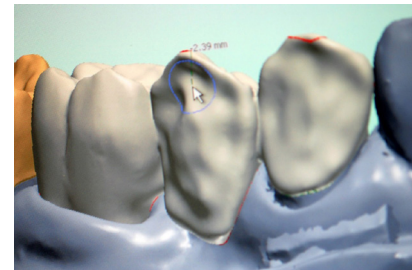


Occlusal view of completed zirconia restorations, implant restorations are porcelain fused to metal.



Occlusal view of full zirconia reconstruction. All surfaces which touch have pure zirconia.

Figure 37



Crowns are designed to allow the placement of feldspathic porcelain on the facial while keeping the contacting surfaces in pure zirconia.

Figure 38



Milled zirconia substructure shows the use of zirconia over the incisal edge to prevent fracture of porcelain in a patient with continued bruxism.

Be careful when reconstructing a patient with horizontal bruxism. Even with perfect occlusion and anterior guidance, these patients will continue to exert excessive forces on their teeth. **Figure 41** shows the dislodgement of a maxillary lateral incisor after seven years of service in the mouth. These patients must be made aware of their problem and the need for long term care. The authors observe the patients with vertical bruxism show little continued wear and problems over the years.

Horizontal bruxism patients are probably the most difficult to treat and maintain. **Figure 42** shows a periodontist that was maintained with a guard for over 20 years. He decided he wanted

the teeth crowned for esthetics and because he was uncomfortable due to sensitivity. As a periodontist he was impeccable with his hygiene and demands for perfection.

Lithium disilicate crowns were selected for the restoration. He desired the crowns to include the bicusps to correct a rotated bicuspid and have maximum esthetics.

The cast in **Figure 43** shows the cupping and loss of tooth structure. Little posterior wear is present.

Conservative preps were done for the lithium disilicate crowns. A final impression was made, and provisional crowns were fabricated using the indirect technique from a wax up. One of the benefits of individual provisionals is the ability of the patient to clean and floss the units. It allows the patient to observe esthetics, and determine if the contours are proper for their needs. It also allows the clinician to evaluate lingual contours, if the clinician has violated the functional movements of the patient, the lingual contour and be corrected.

The new provisionals were too long and the lingual contour too steep and the patient dislodged all of the provisionals within 24 hours. The incisal edge was shortened and the lingual contour was modified to allow more movement. Contact with the mandibular incisors was preserved. The patient was able to wear the new recontoured provisionals without incident, demonstrating to the clinician that new crowns mimicking the provisionals would be satisfactory.

An impression was made of the provisionals in place as a guide for the dental laboratory technician. The provisional crowns were scanned and used as a guide. The scan mimicked the length of the provisional and the lingual anatomy. The patient was very pleased with the final esthetics. The lithium disilicate crowns were bonded into place. An alginate impression was made of the maxillary and mandibular teeth, mounted and a guard was fabricated for the long-term maintenance.

Figure 39



An example of true horizontal bruxism. All teeth both anterior and posterior are worn flat.

Figure 40



All maxillary teeth restored with zirconia crowns, anterior six are restored with cast gold post and cores.

Figure 41



At seven years, a lateral incisor is dislodged.

Figure 42



Figure 43



All maxillary teeth restored with zirconia crowns, anterior six are restored with cast gold post and cores.

Figure 44



Figure 45



Figure 46



A two-year postoperative photo shows little change (**Figure 47**). The four-year recall (**Figure 48**) shows changes to the cervical tissues, both the teeth and the gingiva. Abfraction lesions and gingival recession are present. The etiology of abfraction lesions is disputed, with a variety of opinions.⁴⁷⁻⁴⁹ There is no evidence that the lesions are caused by occlusal forces or abrasive factors. It is left to the clinician to decide the cause and how to treat it.

Since the patient is a 70 year old periodontist and is under the care of another board certified periodontist. Both are convinced that the lesions are due to changes in oral hygiene and that the patient has become more aggressive in his brushing.

Figure 47



Figure 48



Maintenance

Regular recalls for wear patients are mandatory. Communication between the patient and the dentist is essential for long-term survival of the restoration. Routine radiographs to detect caries or loss of supporting bone are necessary. The continued use of a protective orthotic appliance is critical to prevent the destructive forces of bruxism. Photographs on an annual basis are helpful. The photos can help to reveal changes to restoration integrity and periodontal attachments. Patients must understand that the dentist has restored the patient's mouth to an optimal occlusion and continued long-term care is necessary.

If the clinician has diagnosed that erosion is part of the etiology contributing to loss of tooth structure, the patient will need to be concerned with the avoidance of contact of the teeth with acids.⁵⁰ This includes acidic drinks, misuse of medications which may be acidic in nature, and occupational exposure to acidic vapors and fluids. All contributing systemic diseases must be treated, including GERD, bulimia, regurgitation and rumination. If possible, salivary hypofunction must be treated. For the gastric reflux patient, they must learn not to brush right after a regurgitation episode. The acid from the regurgitation will remain in the mouth, and brushing the teeth with the residual acid will accelerate the tooth structure loss. The use of bicarbonate of soda as a rinse after an acid attack will reduce the pH of the

oral fluids and reduce the risk of additional tooth structure loss.⁵¹

The use of fluoride therapy, in the form of a varnish, a mouthwash, a topical gel or dentifrice will aid in the prevention of erosion.⁵¹ The use of a toothpaste containing casein/calcium phosphate can aid in reducing the extent of tooth erosion.⁵²

Conclusion

The severely worn dentition is generally a result of multiple factors. Contributing etiologies must first be identified and eliminated. Only then should the teeth be restored to proper form and function. A diagnostic mounting helps the clinician identify premature occlusal contacts and determine the best way to eliminate them. It is also an invaluable tool when planning the restorative phase of treatment. A stable occlusal scheme is developed in a diagnostic wax-up, which can serve as a guide for the final restorations. Attention to detail during the initial evaluation, treatment planning, and treatment sequencing phases can turn a complicated restorative challenge into a manageable restorative case.

Patients who are diagnosed with vertical bruxism and be restored to normal function and can assume that the restorations will last a life time. Patients with horizontal bruxism will continue to exert excessive forces on their teeth despite reconstructive efforts to achieve posterior stability and anterior guidance.

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References

- Grippe JO, Simring M, Schreiner S. Attrition, abrasion, corrosion and abfraction revisited. A new perspective on tooth surface lesions. *J Am Dent Assoc*, 2004; 135:1109-18.
- Abrahamsen TC. The worn dentition—pathognomonic patterns of abrasion and erosion. *Int Dent J*, 2005; 55(Suppl 1):268-76.
- Verrett RG. Analyzing the Etiology of an Extremely Worn Dentition. *J Prosthet Dent*, 2001; 10:224-233.
- Gudmundsson K, Kristleifsson G, Theodors A, Holbrook WP. Tooth erosion, gastroesophageal reflux, and salivary buffer capacity. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 1995; 79:185-9.
- Wang GR, Zhang H, Wang ZG. Relationship between dental erosion and respiratory symptoms in patients with gastro-esophageal reflux disease. *Journal of Dentistry* 2010;10:892-898.
- Lussi A (ed): Dental Erosion. Monogr Oral Sci. Basel, Karger, 2006, vol 20, pp1-8.
- Kelleher M, Bishop K. The aetiology and clinical appearance of tooth wear. *Eur J Prosthodont Restor Dent* 1997 Dec;5(4): 157-160.
- Bassiouny M: Clinical features and differential diagnosis of erosion lesions: Systemic etiologies. *Gen Dent* 2010;58(3) :244-255.
- Ali D, Brown R Rodriguez L Moody E, Nasr M. Dental erosion caused by silent gastroesophageal disease. *JADA* 2002; 133(6):734-737.
- Jain P, Nihill P, Sobkowski J, Agustin. Commercial soft drinks: pH and in vitro dissolution of enamel. *General Dentistry*, 2007, 55(2):151-154.
- von Fraunhofer JA, Rogers MM. Effects of sports drinks and other beverages on dental Enamel. *Gen Dent* 2005; 53:28-31.
- Rudd KD, Morrow RM, Bange AA. Accurate alginate impressions *J Prosthet Dent* 1969;22L:294-300.
- Glossary of Prosthodontic Terms. *J Prosthet Dent* 2005; 94:10-92.
- Schuyler CH. Intraoral method of establishing maxillomandibular relation. *J Am Dent Assoc*, 1932;19:1013-1021.
- Stuart C. In: Gnathologic Tooth Preparation. Quintessence Publishing Co., Chicago. 1985 p. 53.
- Dawson P. Functional Occlusion From TMJ to Smile Design. 2007; Mosby Elsevier Publications, Philadelphia, Pa.
- Lucia VO. Centric relation, theory and practice. *J Prosthet Dent*, 1960; 10:849.
- Long JH Jr. Location of the terminal hinge axis by intraoral means. *J Prosthet Dent* 23:11;1970.
- Fenlon MR, Woelfel JB. Condylar position recorded using leaf gauges and specific closure forces. *Int J Prosthodont* 1993;6:402-408.
- Rugh JD, Harlan J. Nocturnal bruxism and temporomandibular disorders. In: Jankovic J, Tolosa E (eds). *A Textbook of Occlusion*. Chicago: Quintessence, 1988:249-261.
- Posselt U. Studies in the mobility of the human mandible. *Acta Odontol Scan*, 1952; 10:19-35.
- Hodge L, Mahan P. A study of mandibular movement from centric occlusion to maximum intercuspation. *J Prosthet Dent*, 1967; 18:19-30.
- Rieder C. The prevalence and magnitude of mandibular displacement in a survey population. *J Prosthet Dent* 1978;39:324-329.
- Neff, PA. TMJ Occlusion and Function. Georgetown University Publication 1975. P50.
- Lavigne G, Khoury S, Abe S, Yamaguchi Y, and Raphael K. Bruxism physiology and pathology: an overview for clinicians. *J Oral Rehab* 2008 35:476-494.
- Williamson EH. Anterior Guidance: Its effect on electromyographic activity of the temporal and masseter muscles. *J Prosthet Dent* 1983;49:816-21.
- Spear, FM. Occlusal Considerations for Complex Restorative Therapy. In: McNeill C (ed). *Science and Practice of Occlusion* Chicago: Quintessence, 1997; 437-456.
- Attanasio, R. An overview of bruxism and its management. *Dent Clin North Am* 1997;2:229-241.
- Smith BG, Knight JK. An index for measuring the wear of teeth. *Brit Dent j*. 1984 23:156(12);435-8.
- Eccles JD. Dental erosion of nonindustrial origin. A clinical survey and classification. *J Prost Dent* 1979 42;(6):649-53.
- Lussi A. Dental erosion clinical diagnosis and case history taking. *Eur J Oral Sci* 1996;104(2):191-8.
- Wilkinson T., Hansson TL, McNeill C, Marcel T. A comparison of the success of 24 hour occlusal splint therapy versus nocturnal occlusal splint therapy in reducing craniomandibular disorders. *J Craniomandib Disord Facial Oral pain* 1992;6:64-70.
- Turner KA, Missirlian DM. Restoration of the extremely worn dentition. *J Prosthet Dent*, 1984; 52:467-474
- Berry DC, Poole DF. Attrition: Possible mechanisms of compensation. *J Oral Rehabil* 2:1 1975.
- Johansson A, Johansson A-K, Omar R, Carlsson G. Rehabilitation of the worn dentition. *J Oral Rehab* 2008; 35: 548-566.
- Hansen PA, Sigler E, and Husemann RH. Making Predictable Multiple Single Unit provisional Restorations. *J Prost Dent* 2009;102:260-263.
- Lucia VO, Modern Gnathological Concepts – Updated, Quintessence Pub Co., 1984, p99-104.
- Misch C. In Contemporary Implant Dentistry, Published by Mosby Elsevier, St. Louis, Missouri. p110.
- Dawson PE. Temporomandibular joint pain-dysfunction problems can be solved. *J Prosthet Dent*, 1973;29:100-112.
- Koyano K, Tsukiyama R, Ichiki R and Kuwata T, Assessment of bruxism in the clinic. *J Oral Rehab* 2008, 35:495-508.
- Johansson A, Johansson AK, Omar R, Carlsson GE. Rehabilitation of the worn dentition. *J Oral Rehabil*, 2008; 35:548-566.
- Sailer et.al., Randomized controlled clinical trial of zirconia ceramic and metal ceramic fixed dental prostheses: *Int J Prost Dec* 2009.
- Pelaez, J et.al., A four year prospective clinical evaluation of zirconia and metal ceramic posterior fixed dental prosthesis. *Int J Prost* 2012;24:451-458.
- A study on the in vitro wear of the natural tooth structure by opposing zirconia or dental porcelain. *J Adv Prosthodontics* 2010;2:111-115.
- Wear evaluation of the human enamel opposing different & T-ZP dental ceramics and other porcelains. *Journal of Dentistry* 2012.
- Mitov, G et.al., Wear behavior of dental Y-TZP ceramic against natural enamel after different finishing procedures. *Dental Materials* 2012 28;p909.
- Bartlett DW, Shah P. A critical review of non-carious cervical (wear) lesions and the role of abfraction, erosion, and abrasion. *J Dent Res* 2006 Apr;85(4):306-12.
- Nascimento MM, et al., Abfraction lesions: etiology, diagnosis, and treatment options. *Clin Cosmet Investig Dent* 2016;8:79-87.
- Levrini L, Benedetto GD, Raspanti M., Dental wear: A scanning Electron Microscope Study. *Biomed Res Int* 2014; 2014 340425
- Ren YF. Dental Erosion: Etiology, Diagnosis and Prevention. April 2011, published by Academy of Dental Therapeutics and Stomatology.
- Lagerweij MD, Buchalla W, Kohnke S, Becker K, Lennon AM, Attin T. Prevention of erosion and abrasion by a high fluoride concentration gel applied at high frequencies. *Caries Res*. 2006;40(2):148-53.
- Panich M, Poolthong S. The effect of casein phosphopeptide amorphous calcium phosphate and a cola soft drink on in vitro enamel hardness., *J Am Dent Assoc*. 2009 Apr;140(4):455-460.

POST-TEST

Internet Users: This page is intended to assist you in fast and accurate testing when completing the “Online Exam.” We suggest reviewing the questions and then circling your answers on this page prior to completing the online exam.

(2.0 CE Credit Contact Hour) Please circle the correct answer. 70% equals passing grade.

1. **Observing loss of tooth structure where there is no occlusal contact possible for the patient will lead the practitioner to look for:**
 - a. attrition
 - b. abrasion
 - c. severe bruxism
 - d. chemical erosion
2. **The first step in treatment planning for a patient with a worn dentition is to:**
 - a. do a diagnostic mounting.
 - b. obtain full mouth radiographs.
 - c. access the patient's chief complaint.
 - d. evaluate periodontal pocket depths.
3. **In order to fully evaluate the interocclusal contacts, the dentist may want to evaluate a diagnostic mounting. The best position to evaluate the contacts is:**
 - a. centric occlusion
 - b. maximum intercuspation
 - c. centric relation
 - d. protrusion
4. **The use of a facebow will provide the dentist with:**
 - a. a good interocclusal relationship
 - b. the relationship between the maxillary cast and the points of rotation.
 - c. a method to evaluate the smile line to a line parallel to the eyes.
 - d. an excellent method to mount the mandibular cast to the maxillary cast.
5. **The most efficient method to load maxillary posterior teeth is to allow the mandibular cusp to contact a:**
 - a. mesial incline
 - b. distal incline
 - c. flat non-incline area
 - d. marginal ridge
6. **The best occlusal scheme to prevent wear and to give the patient a comfortable interocclusal relationship is:**
 - a. balanced occlusion
 - b. mutual protected occlusion
 - c. group function occlusion
7. **Once the ideal occlusion has been obtained for the patient, the muscles of mastication will relax and any bruxism wear will cease.**
 - a. True
 - b. False
8. **Following an equilibration of the patient's natural teeth, it is possible to gain horizontal space for restoration of anterior teeth.**
 - a. True
 - b. False
9. **Patients displaying excessive wear have basically equilibrated themselves into a centric relation position and an occlusal evaluation is not necessary.**
 - a. True
 - b. False
10. **The best way to evaluate if an increase in the vertical dimension of occlusion will be comfortable for the patient is to:**
 - a. construct an orthotic appliance at a new VDO and then provisional restorations at the VDO.
 - b. provide analgesics to the patient during therapy.
 - c. create new restorations from soft, malleable material.
 - d. Creating a new VDO with new restorations is never a problem.

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