Comprehensive Occlusal Concepts in Clinical Practice
To understand the reasoning and general purpose of entering into any therapy that may change or modify a patient’s occlusal scheme, it is important to first realize that most signs and symptoms of occlusal causation occur mainly in individuals who demonstrate some degree of parafunctional activity. That is to say, a sign such as attrition rarely occurs from normal mastication (Belser and Hannam, 1985; MacDonald and Hannam, 1984; Moss et al., 1987; Silvestri, Cohen, and Connolly, 1980).

INTRODUCTORY DISCUSSION OF PARAFUNCTIONAL WEAR

Almost no one spends sufficient time with their teeth in contact during normal chewing function to cause observable wear patterns. These common wear patterns come from those times of clenching and or bruxing during either nocturnal or diurnal time frames. The potential etiologies of these activities will be discussed in chapter 2.

Of course, there are exceptions to the statement that parafunctional habits are the overriding, most common cause of signs and symptoms of occlusal disease. Conditions such as iatrogenic changes or dual bites, where a patient holds his or her teeth in a position other than some
acquired closing pattern, could be considered additional causes of signs of occlusal disease (Attanasio, 1991; Kampe, 1987).

It is also essential for the modern dental clinician to understand that there exists a clear clinical ability to reduce muscle activity during these parafunctionally destructive times, but no clear evidence exists that the clinician can reduce or stop the actual parafunctional habits. The total body of evidence indicates that by providing a physiologic occlusion, a therapist can realistically reduce the muscle activity during bruxing and clenching. The therapist can greatly reduce the results of a destructive habit, realizing that the habit itself remains; only the muscle activity is reduced (Ash, 2006; Baba, 1991; Geering, 1974).

Most of this text will further explain this basic concept and help the reader develop understanding and learn multiple techniques proven to achieve the physiologic occlusion mentioned above. It is necessary first to master the ability to recognize and then categorize all the potential signs and symptoms that make up any given disease (Lytle, 1990, 2001a, 2001b). As in all scientific methodologies utilized in medical and dental practices, there are accepted protocols. These protocols are summarized by detailed examination, varying diagnostic procedures, and treatment planning opportunities when and where appropriate.

**RATIONALE FOR COMPREHENSIVE OCCLUSAL EXAMINATION**

Obviously, dental examinations must be comprehensive and thorough. But they must be more than a detailed collection of data. The examination is usually performed after any emergencies or other compelling issues have been addressed. Once the patient’s perceived chief complaints or concerns have been addressed, the doctor-patient relationship is more likely to lead to an engaged patient ready to interact with the dentist during the comprehensive clinical examination.

It should be mentioned at this time that there is evidence that pain is not a reliable indicator of the presence of occlusal disease. Epidemiological studies have consistently shown that in large groups of subjects, those with malocclusion have no more pain than those with more ideal occlusal schemes (Kampe, Hannerz, Strom, 1991; Okeson, 1981; Wadhwa and Kapila, 2008). Many clinicians have observed this phenomenon in their own practices, sometimes observing patients with horrible malocclusions who have almost no symptoms. They present with no complaints of pain or discomfort. When these same patients also have no signs, it is then apparent that they spend very little time in parafunctional activity. This is further rationale for a comprehensive occlusal examination to carefully list any present signs and symptoms, as they are a strong indicator of the history of what has taken place on the dentition.
Introduction to Occlusal Disease and Rationale for Occlusal Therapy

**Table 1.1. Categories of parafunctional activity.**

<table>
<thead>
<tr>
<th>TYPE 1: Almost No Parafunction</th>
<th>No evidence of wear, mobility, tooth migration, muscle soreness, fractures, cracks, craze lines, or abfractive lesions</th>
</tr>
</thead>
<tbody>
<tr>
<td>TYPE 2: Moderate Parafunction</td>
<td>Evidence of slight wear, mobility, tooth migration, muscle soreness, fractures, cracks, craze lines, or abfractive lesions</td>
</tr>
<tr>
<td>TYPE 3: Destructive Parafunction</td>
<td>Evidence of excessive wear, mobility, tooth migration, muscle soreness, fractures, cracks, craze lines, or abfractive lesions</td>
</tr>
</tbody>
</table>

**CATEGORIES OF PARAFUNCTIONAL ACTIVITY**

After a comprehensive occlusal examination, the clinician should be able to classify a given patient in one of the three categories outlined in table 1.1 (Lytle 1990, 2001a, 2001b).

**ENGAGING THE PATIENT IN THE COMPREHENSIVE OCCLUSAL EXAM**

It must be stated clearly now that it cannot be simply left up to the patient to say whether he or she has a parafunctional habit or not. Consistently, the literature suggests that these activities occur either during sleep or at times of stress (Campillo et al., 2008; Glaros et al., 2000; Kevij, Mehulic, and Dundjer, 2007; Wood, 1987). Either way, the patient is generally not aware of these occurrences. It can become quite instructive and helpful for patients to discover the destructive effects of their own habits as the process of co-discovery occurs.

If the clinician asks open-ended questions for the patient to ponder as the patient is shown the results of heretofore-unrealized habits, the patient may discover the destructive effects during the interactive exam process or realize the relationship after the exam. Commonly, patients realize they have been “chewing up their own dentition.” This discovery helps the patient accept recommended phase I treatment such as occlusal splint therapy.

**RATIONALE FOR OCCLUSAL THERAPY**

The various signs that are detected during a routine yet thorough occlusal exam are usually repeatable and measurable, and they are the best indicators of occlusal disease. It is appropriate for the comprehensive dentist to perform this type of examination prior to determining the category of parafunction present in the patient’s history and prior to treatment planning. The dentist only has a scientific basis for providing definitive occlusal therapy when the patient has clinical signs of occlusal disease (Clark et al.,
Unless there exists a need to change the acquired occlusion because of orthodontic or restorative requirements, there is little literature-based support for therapies such as occlusal equilibration. Even when signs and symptoms do exist, it is important for the clinician to prove that these signs are directly related to occlusal factors. Only if there is evidence of occlusal instability or parafunction should the clinician attempt to modify the occlusion. When there is no evidence, the clinician should leave the patient with his or her wonderfully adapted and acquired occlusal scheme.

Some discussion is needed at this time about the literature involved with noncarious cervical lesions (Braem, Lambrecht, and Vanherle, 1982; Dejak, Mlotkowski, and Romanowicz, 2005; Grippo, 1991; Grippo and Simring, 1995; Kuroe et al., 2001; Lee and Eakle, 1996; Madani and Ahmadian-Yazdi, 2005; Pegoraro et al., 2005; Pintado et al., 2000; Spranger, 1995; Winter and Allen, 2005). It is common for clinicians to assume that these wedge-shaped lesions have an occlusal traumatic etiology. Even though there exists some conflicting literature, it has yet to be scientifically proven that abfraction solely occurs as a result of occlusal trauma. More likely, it is a result of a multifactorial phenomenon of trauma, lack of buccal bone, prominence of the root, and some tooth brushing and tooth paste abuse. The clinician has little choice but to include all of these possibilities in thinking about what to do with a dentition that has some abfractive lesions. When these lesions are present and there is evidence of occlusal trauma, the clinician should remove occlusal trauma as one of the possible etiologic factors.

If root prominence exists, orthodontics could be helpful. There may be a rationale for gingival grafting to protect the root with attached gingival. This is just one example of the complexity and sophistication needed to accurately define the cause and effect of many so-called multifactorial conditions in dentistry and medicine.

THE COMPREHENSIVE OCCLUSAL EXAMINATION

A comprehensive occlusal examination must include but not necessarily be limited to the following components:

- Occlusal analysis (described below)
- Muscle palpation (described in chapter 6)
- Range of motion (described below)
- Joint sounds (described below)
- Joint palpation (described below)
- Articulated study casts (described below)
- CR (centric relation) analysis (described below)
- Digital imaging (described below)
**Occlusal Analysis**

Marking the teeth with appropriate ribbons after drying them with tissue paper folded on a Miller Forceps allows the clinician to identify what parts of the teeth touch during arc of closure as well as excursive movements. These markings indicate which occlusal surfaces can touch during patient instruction but not necessarily what the patient actually does during parafunctional movements. The clinician must look for actual evidence during the rest of the exam to correlate these markings with recordable signs such as wear or mobility. This process can be another learning moment for the patient, when both the patient and the dentist see and feel these contacts. The patient can feel them by rubbing the teeth together, and the clinician can feel them by placing slight pressure on the tooth in question with a finger while the patient rubs the teeth together.

Two different-colored ribbons (red and black) should be utilized to differentiate closure markings from excursive markings. Excursive movements are marked first with red, and then closure movements are marked with black. This is further described in chapter 10, which covers the details of equilibration. It will become easy for the clinician to identify working, balancing, and protrusive markings and understand the potential damaging effects from these excursive interferences.

The mechanism of micro trauma during parafunctional repetition of these contacts, both on the teeth and joint apparatus, is discussed in chapter 10. Suffice it to say at this time that the major causes of joint deterioration occur as a result of external trauma (a blow to the face or jaw) and secondarily by micro trauma. Thus, it is important to identify evidence of micro trauma, look for facial scarring that may be evidence of external trauma, and listen carefully for a history of trauma.

**Range of Motion**

Any of several types of devices can be used to measure the patient’s total opening and lateral movements. It is important to note if the movements are pain free and if they can be done smoothly or with difficulty. The movement measurements are compared to averages such as 40 mm in opening and 10 mm in lateral directions. Do not simply measure but also analyze the potential cause and effect of any alteration in movement or form of movement. When a patient has limited movement to one side or demonstrates a deviation to one side upon opening, the clinician should determine which of the following causes pertain to this particular patient:

- Muscle spasm or tightness that interferes with normal movement
- Disc derangement, which can block normal movement
- Arthritic or adhesive stickiness of joint and joint tissue
- Fracture of condylar structures
- Tumor
- Degenerative disease
- Neurological etiology
- Avoidance of a particular tooth interference
- Normal movement because of developmental or birth defect of the joint apparatus
- A normal effect because of irregular condylar inclinations of right and left eminences

**Joint Sounds**

Either with a stethoscope or Doppler, the clinician can determine whether the crepitus sounds occur on excursive movement, on direct rotation, or both. This differentiation is helpful in evaluating whether the joint breakdown is an early or late type. There is evidence that most joint changes begin out on the lateral pole and may work themselves medially toward the medial pole. During excursive movements, the so-called joint loading takes place in areas other than the medial pole. Only during actual rotation does the loading take place in and around the medial pole. Through deductive reasoning, the clinician can conclude that, if crepitus is heard during rotation, the problem is more serious than if it is only heard on excursive movement.

**Joint Palpation**

Place gentle pressure on the area that demonstrates a slight depression as the patient opens, indicating the departure forward of the condyle and its lateral pole. Upon this pressure, the patient may feel tenderness if there has been damage to the lateral pole or there is inflammation of the retrodischal tissues available for investigation by this same palpation.

**Articulated Study Casts**

The carefully and accurately made casts are mounted with a face bow and the very best beginning bite record available on the examination visit. A common error is to call this record a “centric relation record.” It is often simply the bite du jour. The patient’s muscle and joint condition may make it difficult, if not an insurmountable problem, to find the centric relation arc of closure until there has been therapy such as occlusal bite splint therapy. The longer the author has been in practice, the more the author has learned to rely on bite splint therapy to verify the centric relation arc of closure.

**CR Analysis**

One group of objectives is to evaluate the hinge movement, status of the joint and accompanying tissues, and the relative input of the muscles of
mastication (degree of ease or difficulty) while finding the centric relation arc of closure. There is common acceptance that the centric relation arc of closure involves a seated and braced medial pole, a relaxed musculature, and a comfortable joint during hinge motion, even during joint loading. Please note the details of this procedure in chapter 4.

**Digital Imaging**

Digital photography, digital radiography, and various uses of CAT scan and CAD CAM technology are now not only commonplace but have become the standard of excellence in diagnostics and communication between patient, technician, and specialist. Throughout this text, uses and examples of these technologies will be illustrated. Clearly, patient education has been enhanced and restorative results have been made much more predictable by advanced digital technologies. Digital photography can enhance evaluation of the face, asymmetries, and dentition. Many diagnostic decisions are improved by analyzing the smile, lips at rest, profile, and extreme smile to determine the possible amount of lip movement. Chapter 8 details which views are critical and how to do the esthetic evaluation.

**SAMPLE OCCLUSAL EXAMINATION FORM**

The following occlusal examination form (figs. 1.1 a and b) is used by several visiting faculty of the Pankey Institute.

**THE PATIENT’S UNDERSTANDING**

After engaging the patient in co-discovery and collecting this kind of data, it is important to make sure the patient has an increased understanding of their own condition. This author likes to think that multiple potential “learning moments” can occur during the examination process. Throughout this book, there are examples of the clinician creating these “magical” learning moments. One frequently used technique is active listening during the comprehensive examination. By asking patients to clarify their understanding of each last completed step, the clinician stimulates extended dialogue. Oftentimes, the exam process takes an hour or more with conversation taking more of this time than data collection. The wise clinician makes time in the day’s schedule for an extended appointment.

A definitive decision tree occurs as the clinician approaches the next step of diagnosis. Does the bulk of evidence for this particular patient weigh in more as an occlusal-muscle condition or as some related pathology or other condition of the temporomandibular joint apparatus? It is helpful for the patient to demonstrate where the pain occurs. Does the patient point with one finger to the joint? Or does the patient rub several
### M. TEMPOROMANDIBULAR JOINT SYMPTOMS:

<table>
<thead>
<tr>
<th>Negative</th>
<th>Acute</th>
<th>Episodic</th>
<th>Chronic</th>
<th>Trauma</th>
<th>Ear Ringing</th>
</tr>
</thead>
</table>

- Hypomobility
- Chronic Subluxation
- Spontaneous Dislocation
- Swallowing Discomfort

### N. MAXIMUM OPENING (AT MIDLINE)

<table>
<thead>
<tr>
<th>Normal</th>
<th>Acute</th>
<th>Painful</th>
</tr>
</thead>
</table>

- Wide Range
- Normal Range
- Reduced Joint Space
- Increased Joint Space

### O. MANDIBULAR DEFLECTION ON OPENING:

<table>
<thead>
<tr>
<th>None</th>
<th>To Right - Then Left</th>
<th>To Left - Then Right</th>
</tr>
</thead>
</table>

- Immediate
- Normal Range
- Wide Range

### P. TEMPOROMANDIBULAR JOINT NOISE WITH MOVEMENT:

<table>
<thead>
<tr>
<th>Negative</th>
<th>Vertical Opening</th>
<th>Lateral Movement</th>
</tr>
</thead>
</table>

- Crepitus
- Clicking
- Popping

### Q. TEMPOROMANDIBULAR JOINT RADIOGRAPHS:

<table>
<thead>
<tr>
<th>Concentric</th>
<th>Reduced Joint Space</th>
<th>Flattened Condyle</th>
</tr>
</thead>
</table>

- Condylar Protrusion
- Fossa Irregularities
- Osteoporosis

### R. TEMPOROMANDIBULAR JOINT PALPATION:

<table>
<thead>
<tr>
<th>Negative</th>
<th>Lateral Pterygoid (A)</th>
<th>Anterior Temporal (C)</th>
</tr>
</thead>
</table>

- Medial Pterygoid (B)
- Posterior Temporal (C)

### S. MUSCULAR PALPATION:

<table>
<thead>
<tr>
<th>Negative</th>
<th>Lateral Pterygoid (A)</th>
<th>Hyperplastic Condyle</th>
</tr>
</thead>
</table>

- Posterior Temporal (C)
- Superficial Masseter (F)

### T. HEADACHES AND NECKACHES:

<table>
<thead>
<tr>
<th>Negative</th>
<th>Mild</th>
<th>Moderate</th>
<th>Severe</th>
</tr>
</thead>
</table>

- Very Restricted
- Painful
- Chronic

### U. OCCLUSAL HABITS

<table>
<thead>
<tr>
<th>Negative</th>
<th>Severe</th>
</tr>
</thead>
</table>

- Patient Aware
- Bruxism (Gnashing)

### V. EMOTIONAL STRESS LEVEL:

<table>
<thead>
<tr>
<th>Negative</th>
<th>Probable</th>
<th>Questionable</th>
<th>Severe</th>
</tr>
</thead>
</table>

- Sleep Loss
- Fatigue
- Irritability

### W. POSSIBLE TREATMENT SEQUENCE:

<table>
<thead>
<tr>
<th>None</th>
<th>Preventive Counseling</th>
<th>Limited Ocular Adjustment</th>
</tr>
</thead>
</table>

- Occlusal Coping
- Occlusal Equilibration
- Occlusal Reconstruction

- Drug Therapy
- Vapocoolant
- Muscle Exercises

### Figs. 1.1a and 1.1b. Occlusal examination form (Courtesy of Dr. Steve Hart and Dr. Carl Rieder).
A. MISSING TEETH:

PATIENT _______________________________________
AGE ________
DATE ___________

Without Tenderness
Some Discomfort
Pain in R.C.P.

B. FIRST CONTACT IN RETRUSED CONTACT POSITION (CENTRIC RELATION):

- Repeatable
- Without Tenderness
- Questionable
- Some Discomfort
- Undeterminable
- Pain in R.C.P.

C. MANDIBULAR DISPLACEMENT (FROM RCP TO IP AT MIDLINE):

- Anterior
- Vertical

D. MANDIBULAR EXCURSIVE MOVEMENTS FROM INTERCUSPAL POSITION:

LATERAL GUIDANCE (WORKING)

- Right
- Left

BALANCING INTERFERENCES (NON-WORKING)

- None (Right Side)
- None (Left Side)

- Light (1)
- Moderate (2)
- Heavy (3)
- Severe (3)

F. ABNORMAL WEAR AND TOOTH FRACTURE:

- None
- Light (1)
- Moderate (2)
- Severe (3)
- Opposing Porcelain (4)
- Fractured Filling (5)
- Fractured Cusp (6)
- Split Tooth (7)

G. WIDENED PERIODONTAL SPACE:

- None
- Light (1)
- Moderate (2)
- Severe (3)
- Uniform (4)
- Hour-Glass (5)
- Occlusal Flaring (6)

H. ALVEOLAR BONE LOSS:

- None
- Light (1)
- Moderate (2)
- Severe (3)
- Very Severe (4)
- Lamina Dura (5)
- Horizontal (6)
- Vertical (7)
- Infra Bony (8)
- Furcation (9)

I. MISCELLANEOUS RESPONSE:

- None
- Hypercementosis (1)
- Osteosclerosis (2)
- Root Resorption (3)
- Pulpal Calcification (4)
- Exostosis (5)
- Cervical Erosion (6)
- Gingival Recession (7)
- Percussion Sensitivity (8)
- Thermal Sensitivity (9)

(b) OCCLUSAL-TMJ EXAMINATION

Figs. 1.1a and 1.1b. Continued
fingers over a sore muscle area? The former likely indicates the condition originates in the joint, and the latter in the occlusal-muscle condition.

REFERENCES


