Occlusion
not Confusion

Notes to accompany the practical course for
General Dental Practitioners at Milton Keynes on

Thursday 29th May 2014

Brian Millar BDS, FDSRCS, PhD, FHEA
Professor, Hon Consultant in Restorative Dentistry
Specialist in Prosthodontics and Restorative Dentistry
Programme Director of M Clin Dent (Fixed & Removable Prosthodontics)

Further info: distancedentistry@kcl.ac.uk or brian.millar@kcl.ac.uk
http://www.kcl.ac.uk/distancedentistry

Fariha Hussain BChD, M Clin Dent, PGCE
Clinical Senior Lecturer, KCL
Deputy Programme Director for M Clin Dent Fixed & Removable Prosthodontics
Private Practitioner

Kings College London Dental Institute
at Guy’s, King’s and St. Thomas’ Hospitals
The objectives of the course are to cover:

- The basic principles of occlusion
- Occlusal assessment
- The occlusal positions: ICP and CR, which to use?
- When to reorganise from ICP to RCP
- When to use an articulator, how to choose one
- How to use a facebow
- When and how to record an interocclusal record (IOR)
- Obtaining CR
- Adjusting an articulator
- Lucia Jigs
- How to design occlusal changes using provisional restorations
- Making an anterior guide table
- Types of occlusal splint
- How to restore lost anterior guidance with composite

Key concept is disclusion

2 key features:
Closure into CR or close to it with all teeth touching
Anterior guidance providing posterior disclusion

The two basic principles of occlusion

1 All teeth meet simultaneously in or close to CR

2 Posterior discussion is present and is provided by the anterior guidance

This is reworked from the 4 Dawson principles:

1 All teeth meet simultaneously
2 Provide Anterior
3 Provide Posterior disclusion
4 Use CR
**Key occlusal principles:**

When restoring a dentition or providing a splint your aim should be to achieve:

1. contacts on all teeth in ICP (note initial contact on anterior teeth is slightly less than on posterior teeth to protect the anterior teeth in clenching)

2. anterior guidance, which will create posterior disclusion (ie separation of all posterior teeth during all movements away from CR/ICP)

3. Use canine guidance where possible to provide lateral guidance (part of the anterior guidance). If the canine is damaged, out of position, fragile etc then avoid canine guidance and use group function. This allows working side contacts to be present on posterior teeth during lateral excursions (buccal side of lower buccal cusps).

4. if all is well with the occlusion and ICP, then restore in ICP. So most cases where you judge the occlusion to be stable and acceptable, restore at existing height (ovd) and position (ICP) = conformative

5. if ICP is unacceptable, unavailable, unreproducible then you have to use CR. So restore in CR, or just anterior to it = reorganized.

**Occlusal Assessment**

Adverse occlusal contacts, that is anything that prevents the above features being present, should be identified. Management is beyond the scope of this chapter but should be additive where possible, ie add more anterior guidance rather than reduce posterior cusps. After all, it is often the wear on the canines that have reduced the anterior guidance resulting in less disclusion and now destructive non-working side contacts occurring. In some cases, such an interference preventing closure into CR, or close to it, should be removed with the patient’s full understanding and consent. Unopposed overerupted teeth can cause significant occlusal interferences, mandibular repositioning, an adverse ICP and damage at other sites.

Canine guidance has no advantage over group function other than for restorative convenience. The occlusion should be carefully evaluated using articulated study casts and any working and non-
working interferences carefully assessed. If occlusal interferences exist and require removal they should be carried out on duplicate articulated study casts prior to adjustment in the mouth.

Parafuncional patients should have splint therapy to reduce attritional tooth wear and treatment carefully planned to limit failure of any restorative work. Often splints also need to be used post-operatively. Deep overbites often allow early posterior disclusion allowing ease for posterior reconstructions whereas shallow overbites require more prosthetic care to maintain posterior disclusion and excursive interferences.

**The occlusal positions: ICP and CR**

You can only restore into one of two positions: ICP or CR

**Terminology of positions**
- Intercuspal position (ICP), also called centric occlusion (CO). ICP is where the teeth have maximum contact.
- Centric Relation (CR) is anywhere on the curve while the condyles are fully seated in the fossa. It is a series of positions with condyles seated at different OVDs.
- Retruded contact position (RCP) is one point in CR where the teeth first meet.

Other tooth contact positions (incisal edge-to-edge position and lateral positions) are encountered during physiological movements such as mastication, and also during pathological movements, eg. bruxism.

**Movements**
There are two particular mandibular movements to consider:
1. In the vertical plane, opening and closing, from maximum opening to tooth contact involving hinge and translation movements of the condyle.
2. Movements made while the teeth maintain contact:
   - a slide from RCP into ICP
   - lateral excursions, left and right
   - anterior protrusive movement into, and beyond, the edge-to-edge position

Anterior (protrusive), retrusive (from ICP to RCP) and lateral movements made while maintaining tooth contact are guided by the anterior anatomic determinants (the teeth) and the posterior anatomic determinants (the two TMJ’s and adjacent tissues).
When to reorganise

If you do not have and ICP, or don’t like it then use the only other position: CR
Restorative care can be either *conformative*, working within existing occlusal relationships, eg
the placement of a simple composite occlusal restoration, or *reorganised* where the occlusal
relationship is to be intentionally changed: examples are crowning canines and recreating canine
guidance from a previous group function case, use of Dahl restorations to enable occlusal
adaptation to take place.

Accept or change the existing occlusion?

The decision to be conformative or reorganised crops up in many aspects of dentistry. In ethetics
when required to restore an anterior tooth the clinican needs to decide if the new restoration should
be made to match the existing teeth (conformative) which may involve compromising esthetics or
going for the reorganised approach of smile design, changing the overall esthetics of the smile zone.

Similarly in restorative dentistry there are many times that the existing occlusion is accepted and a
new restoration designed to fit in. However, there are situations where it is preferable to take the
opportunity to reorganise the occlusion: where ICP is flawed, missing, compromised, unstable, too
far from CR or un reproducible. If the clinician has checked both ICP and CR and is uncomfortable
restoring to the current ICP then RCP/CR should be considered. It may not always be possible or
desirable to convert the patient back into CR.

An example of a patient who cannot be restored in CR.
When to use an articulator

When changing occlusal position, either intentionally or unintentionally (eg multiple restorations)
When changing OVD
When changing anterior guidance
When providing a Michigan splint
If in doubt

Which articulator?

Today we will be looking at the Denar 330 and Denar Slidematic Facebow from Prestige Dental, UK. This is a well-built comprehensive device but costly.

Today we will use the Bioart 4000GKT which has been in service at KCL for over 10 years as a robust reliable low cost device. It is based on the low cost Bioart 4000. We at KCL (formerly GKT) modified this, added some features such as magnetic plates and simplified it for undergraduate and postgraduate use. It has recently been replaced by the more upmarket Bioart 4000S. This is used with the Bioart facebow. Today we will use the standard facebow but I recommend the Bioart professional facebow which you can also use today if you wish.

If you wish to use a Bioart, I recommend contacting Panadent, UK for a Bioart 4000S with Professional Facebow.

If you use a different system you will easily be able to apply skills learnt today to your facebow and articulator.

How to use a facebow

Use a simple one. We will teach this on the course and you can use it several times today.
You can also watch the video on U-tube.

When and how to record an interocclusal record (IOR)

Articulation of casts requires good quality and accurate casts without voids on the occlusal surfaces and a facebow record. The clinician needs to select an occlusal position to articulate the upper and lower casts. If work is to be carried out using the patients existing intercuspal position (conformative approach) then the existing intercuspal position is used. Is an interocclusal record (IOR) required or is the interdigitation obvious to your technician?

If the interdigitation is not obvious then an interocclusal record is required to mount the casts in the correct intercuspal position. This will depend on the number and position of the remaining teeth as well as their occlusal form (how much tooth wear is there?). If a record is required then it should be recorded at the same vertical dimension at which the patient is to be restored.

In the case of study casts the articulation would be made at the patient’s existing occlusal vertical height. So the occlusal record, taken in ICP, should be as close to zero thickness as possible. This can
be achieved with a thin layer of hard wax or a hard-setting polyvinylsiloxane occlusal registration material, such as Futar D Occlusion.
The IOR needs to be rigid enough to permit accurate location of the casts into it. Occlusal registration silicones are fast-set (1 minute), easy to use and do not require the use of wax, wax-knives and heat. The polyvinylsiloxane occlusal registration materials have also been shown to be suitable for RCP records. With the currently available materials which set to a rigid consistency the distortion is reduced, cast relocation is simple and they can be made at zero occlusal separation. If a wax is used then it should be of a hard-set variety (eg. Moyco hard wax).

If a significant number of teeth are missing it will be necessary to construct a wax rim on an acrylic baseplate for stability. This can used along with wax or silicone to record the occlusal position (more likely to be RCP).

If teeth are out of occlusion due to an “open bite” or following tooth preparation then an IOR with a different thickness may be needed. You can simply apply more silicone registration material to those teeth.

If the intercuspal position (ICP) is non-existent (eg. where there has been extensive tooth wear) or unfavourable a decision may be made to study the dentition or restore the teeth in the retruded contact position (RCP). In this case you would need to record the RCP again using silicone or wax.

There are two steps to recording an RCP record, both of which can be difficult: getting the patient into the retruded contact position and then recording it

Lucia Jigs

The traditional Lucia jig is a useful concept but suffers from being removable. Nowadays the bonded equivalent has the benefit of providing prevention, esthetic improvement and occlusal correction through rapid repositioning of the mandible by the patient into CR

Obtaining CR
Determining the retruded contact position
With digital pressure on the mandible demonstrate the retruded contact position. Get the patient into the retruded arc of closure (centric relation) and allow the mandible to close gradually. The most widely used method is the Dawson technique. See the articles by Wise for details.

This technique is suitable for the easier cases where the patient does not resist the distal movement of the mandible too much. Where difficulty is encountered the teeth can be separated with a cotton wool roll, or tongue spatula, for at least 5 minutes. Then the manipulation is carried out as before.

When resistance is still present then an anterior acrylic jig is fabricated intra-orally by applying Palavit-G or Duralay to the vaselined palatal aspect of the upper incisors. This is usually called a Lucia jig after its inventor. The jig is shaped by hand to form an inclined plane while care is taken not to allow the exothermic reaction to cause discomfort to the patient.
If the patient still resists the distal manipulation of the mandible then an occlusal splint is fabricated in the laboratory and worn at night until the next appointment. A Michigan splint (stabilization splint) is ideal for this. It should not be removed on the day of the appointment until the RCP record has been obtained.

You can restore anterior teeth on upper palatal and lower incisal surfaces with composite to create a Lucia jig effect.

**Custom Made Incisal Guidance Table**

1. Articulate the models to be copied. These could be a copy of the existing dentition and occlusion, a provisional bridge or diagnostic wax-up. Ensure centric latch is ‘off’.
2. Set the incisal pin on the articulator to the centre of the incisal guidance table.
3. Apply a thin layer of Vaseline or other separating medium to incisal guidance table and to tip of the incisal pin.
4. Mix acrylic resin eg Duralay/Trim to a dough consistency and place on the centre of the incisal guidance table. Mould by hand then bring the pin into contact.
5. Move articulator through all eccentric movements; keep doing this until Duralay has set. Adjust or reline if necessary.
6. Remove pre-op/diagnostic model and re-articulate with working model.

**Types of articulator**

- Arcon/non-arcon
- Non-adjustable/semi/fully
- With/without facebow

**How to use an articulator**

Learn to use a simple facebow eg Bioart Professional. Technician will do the rest in terms of setting it up and using it for diagnostic waxing, etc. You can examine casts on it.

**Adjusting an articulator**

Unlikely you will need to adjust posterior determinants. Programming is possible but difficult. Stick to average values:

- Conylar Track angle 30°
- Bennett Angle for Progressive side shift 15°

**Making an anterior guide table**

In acrylic to replicate anterior determinants from one cast to another. Today we will look at this using putty.
Types of occlusal splint

For acute episodes of pain the full coverage soft splint may have a place but otherwise does little more than provide a placebo effect. This however is not to be undervalued.

Full coverage acrylic stabilisation splints (SS) to correct the occlusion, according to the features listed above, are of great value. They can be used to provide relief from TMD, headaches, muscle pain as well as protect restorations. They can be easily converted into repositioning splints for more advanced therapies such as disk recapture.

Michigan Splint    Tanner Appliance

SS are usually upper (Michigan Splint) but in a class 3 occlusion it is easier to make a lower (Tanner Appliance), see figures above.

Partial coverage splints can have their place but must be closely monitored as tooth intrusion can occur. We will make an anterior flat bite platform today as it works well in a bruxist. Be very wary of posterior partial splints (pivot appliance) as they can cause severe damage (see figure below)

Posterior intrusion caused by prolonged wearing of a partial posterior splint.  An example of a simple anti-snoring anterior repositioning splint.
Occlusal contacts on restorations:

Check **posterior** restorations for contacts:
keep centric stops,
never load non-functional cusps,
avoid non-working side interferences (NWSIs) which are:
   - LILB lingual incline of lower buccal cusps
   - BFIUP buccal facing incline of upper palatal cusps
Identify anterior slides, usually upper teeth mesial surfaces, such as overerupted posterior teeth. These deflect mandible forwards out of CR.

Check **anterior** restorations for contacts:
keep light centric stops,
confirm anterior guidance:
   - protrusive contacts on all incisors equally
   - lateral guidance on canines (see 3 above)

Use this image in the seminar to discuss **good**, **bad** and **other** occlusal contacts
Notes on current TMD therapies.

As TMD is actually a group of conditions that results in TMJ joint pain (arthralgia) and pain in the associated muscles (myofascial pain) it is not surprising that there is no clear best treatment. It is linked to TMJ pathology including internal derangement manifesting as joint pain and clicks.

For some patients there is a peripheral cause of the pain, eg clenching habits or direct trauma following overopening (eg an excessive yawn, third molar surgery) while in others there may be altered central nervous system processing of the pain. Psychosocial stressors are a factor in TMD pain.

Treatment for TMD remains elusive and many procedures have been attempted but without universal agreement or success. Many treatment protocols have their enthusiasts which claim to have case-based evidence but there is no clear independent evidence to follow.

For many patients an explanation of the condition, its likely cause and outcome will help. Early intervention if required usually involves analgesics, massage and a soft occlusal splint. The benefits of this is uncertain and it may be that the patients self-heals in time anyway. At King’s, the next line of treatment is the provision of a stabilisation splint (SS), usually in the upper arch (Michigan splint).

Examples of treatment advocated by some for TMD treatment are:

1 Manipulation of the occlusion

This Cochrane review concludes, like so many such rigorous reviews, that there is a lack of evidence to support or refute the use of a stabilisation splint (SS), so no clear benefit. However the same authors in a similar paper in J Dent Ed state that the use of a SS for myofacial pain many be beneficial for reducing the severity of the pain compared with no treatment.

This review makes it clear that there is no evidence to support the use of electromyography, kinesiographics, posturographics, etc in the treatment of TMDS, MFPDS. Many clinicians already know this but there are enthusiasts often trained by LVI who support such therapies.

Note: occlusal reduction to treat TMD is not recommended in the UK. Additive treatment has a place, eg where anterior guidance (and posterior disclusion) has been lost.
2 Direct intervention of the TMJ

This paper supports the use of HA injections into the joint but most papers looking at steroid injections report no clear benefits.

Review of surgical procedures.

Reviews the risks associated with third molar extraction and damage to the TMJ.

3 Medication

A good overall review of TMD and MPS. Recommends analgesics for the initial treatment but can consider: NSAIDs, steroids, muscle relaxants, opiates, tricyclic antidepressants in longer-term although evidence is weak.

The evidence is lacking for the long-term use eg Tramadol, Adjunctive medication such as antidepressants can also be used.

Pathophysiology and pharmacologic control of osseous mandibular condylar resorption. [Review] Gunson MJ. Arnett GW. Milam SB.
Review on condylar resorption by osteoclast often activated by trauma, hormone imbalance or inflammatory changes such as arthritis. Pharmacological treatment includes NSAIDs, omega-3 fatty acids, cytokine inhibitors, antioxidants and tetracyclines.

4 Alternative therapies


Some benefits found


Stresses need for technique, training and accurate doses. In general, the use of botox into masseter in bruxists looks promising.

Sidebottom


Showed a significant reduction in pain 79% patients report a reduction in pain of at least 25% and the mean was a 57% reduction in pain.


Small study with injections into Lateral pterygoid showing elimination of clicks

Further info on our blended learning courses from KCL and how to get an M Clin Dent Prosthodontics from KCL, a Russell group dental institute while studying online, with face to face training. Please see website or contact distancedentistry@kcl.ac.uk or Brian.Millar@kcl.ac.uk