Re-establishing a physiologic vertical dimension for an over-closed patient

Dr Derek Mahony presents the first article of this two-part series.

The term neuromuscular occlusion has become associated with certain limited methodologies that are used to obtain a muscle-compatible occlusal relationship. In reality, there are several different approaches that can be used to determine a “neuromuscular” maxillo-mandibular relationship, even with a fully edentulous case. Within each method, however, the common basis for all muscle-oriented approaches involves first determining the resting length of the masticatory muscles.

In spite of the risks, there are some advantages associated with opening an over-closed bite. The identification can be traced back at least 60 years to an ENT physician, Dr J B Costen.1-3 Dr Costen discovered, perhaps quite by accident after referring many of his symptomatic, edentulous patients to a local dentist for new dentures, that many returned with their head and ear pain symptoms greatly relieved. His publications were positively received at the time and, in fact, what we refer to today as temporomandibular disorders (TMDs) were originally referred to as “Costen’s Syndrome.” While we know today that many TMD patients are not over-closed, over-closed patients do often exhibit some of the signs and symptoms commonly associated with TMD. Thus, although over-closure in and of itself is not pathognomonic of TMD, it should be considered as a risk factor.

The use of the patient’s own muscles to determine the vertical dimension of occlusion was already being explored in the 1940s by people like orthodontist John R Thompson.4 Sears5 introduced the concept of the “First Appliance” in the 1950s, which was designed to open the bite enough to allow the patient’s muscles to reposition the mandible. Following their lead, others5-8 have subsequently evolved the current array of neuromuscular registration methods presently in use. At the same time, several studies9-13 have demonstrated that a muscle-determined position, although similar, is not identical to centric relation.

Common signs and symptoms of over-closure When asked, over-closed patients often report symptoms such as frequent headaches, full pain of the elevator muscles and pain or stiffness in their neck muscles. Ear stuffiness, tinnitus and/or vertigo are also commonly reported. A more subtle symptom, less often reported, is frequent gastrointestinal distress in various forms that has no clear, identifiable cause. This may also be accompanied by a report of difficulty in chewing and/or swallowing. An over-closed patient will usually report several, but not all, of the following symptoms:

1. Frequent headaches with no identifiable cause
2. Ear stuffiness with no indication of ear pathology
3. Difficulty in chewing tough foods
4. Difficulty or discomfort in swallowing
5. Frequent gastrointestinal distress
6. Vertigo
7. Tinnitus
8. Persistent dull pain in masticatory elevator muscles
9. Neck pain or stiffness
10. Possible increased wear of incisor teeth

Under examination, a number of signs indicating over-closure may appear:

- A measured freeway space greater than 5mm
- EMG or visual identification of a tongue-thrust swallow
- The appearance of less than fully erupted molars
- A deep curve of Spee
- One or more posterior edentulous spaces
- Lingually tipped mandibular molars
- EMG identification of elevator muscle hyperactivity at rest of more than 2.0 microvolts average (or 2.2 microvolts RMS)
- Worn and shortened teeth (there is no scientific evidence that human teeth “grow out” in response to wear in the way that elephant’s teeth do)
- Horizontal skin creasing at corners of the mouth
- A so-called “Shimbaishi” measurement (in centric occlusion) of less than 16mm from the cemento-enamel junction of the maxillary central incisor to the cemento-enamel junction of its opposing mandibular tooth
- Long-term chronic internal derangement of the TM Joint(s)

However, patients rarely seek dental treatment for any of these objective signs. Instead, they are more likely to seek rehabilitative treatment for headache, jaw-ache, ear-ache, difficulty in chewing/swallowing or for purely aesthetic reasons.

In other cases, they are unaware of their condition, apparently due to their excellent adaptability. In the over-closed patient the “reason” for treatment, either cosmetic or functional, is often dependent more on his/her individual adaptability than on the dental condition present. While some signs simply indicate the “progress of the destruction” that a pathological maxillo-mandibular relationship fosters, other signs may indicate a successful adaptation.

1. Freeway space > 5mm (if pain level is low, it is an adaptation, otherwise it is not)
2. Tongue thrust swallow (if full arch tongue thrust, usually a successful compensation)
3. The appearance of less than fully erupted molars (tongue inhibition of natural eruption)
4. A deep curve of Spee (often associated with one or more missing molars or a deep anterior overbite with retroclined upper incisors)
5. One or more posterior edentulous spaces (leads to deep curve of Spee)
6. Lingually tipped posterior teeth (tongue thrust during swallowing, restricted maxillary arch)
7. Hyperactivity of elevator muscles at “rest,” (an adaptation, successful if no elevator muscle pain)
8. Worn/short teeth, abstractions (ground off) (not a successful adaptation)
9. Skin creasing at corners of mouth (may appear as an aesthetic problem only, not an adaptation)
10. Saliva weeping at corners of mouth (an aesthetic and functional problem, not an adaptation)
11. CEJ (cemento-enamel junction) to CEJ in C.O. < 16mm. (less than the normal adaptive range)
12. Internal derangement(s) of the TMJ (if no degeneration, may be a successful adaptation)

Maxillo-mandibular bite relationships

Centric Occlusion (CO = habitual) The maxillo-mandibular position of maximum intercuspsation is most often the dental treatment position, primarily by default. This is of necessity whenever single tooth preparations or small restorations are involved, since they must fit within the patient’s existing occlusal scheme.
It is only at times of major reconstructive, orthodontic and/or surgical treatments that the option of opening a bite or establishing a new maxillo-mandibular relationship may present itself. However, many clinicians still prefer to “play it safe” and retain the existing habitual (CO) maxillo-mandibular relationship, even during major rehabilitative procedures.

By definition, the use of centric occlusion as a treatment position excludes re-establishing a proper vertical dimension in an over-closed patient’s. However, if the patient’s condition is actively deteriorating this may not be a safe option at all, as the continued physiologic breakdown may lead to failed dentistry and/or a flare up of craniofacial pain.

Centric Relation (CR)
The concept of centric relation has a very long history and was originally devised, at least in part, to accommodate the use of articulators during prosthodontic treatment.

Although we now know that the jaw doesn’t function like a hinge, originally it was convenient to make that assumption when using articulators to make prostheses. Today, one clear difference between centric relation procedures and strictly muscle-oriented methodologies is the priority given by CR methods to evaluating the function of the temporomandibular joints. Typically, centric relation operators give first priority to establishing stable joint function, while muscle-oriented (neuromuscular) approaches tend to focus almost exclusively on muscle comfort.

Consequently, a variety of methods have evolved to capture and establish a muscle-related centric position, while maintaining favorable joint function.

Requirements of proper Neuromuscular Occlusion (NMO)
The first step in all approaches to NMO requires inducing relaxation in the masticatory musculature, however, there is no rational excuse for not evaluating TM joint function prior to beginning the process. This can be accomplished quickly and easily with Joint Vibration Analysis (JVA see Fig 1), or with more expensive and invasive imaging such as MRI. Muscle relaxation can be aided by Ultra-Low Frequency TENS (ULF-TENS, see Fig 2), an Aqualizer, soft music or any other technique that reduces the resting hyperactivity of the masticatory muscles. Surface electromyography (see Fig 5) is useful for making a quantitative determination whether relaxation has occurred or whether resting muscle hyperactivity still exists. Needles and/or fine wire electrodes not only make relaxation less likely, they record a more localised signal that is less representative of overall muscle activity.

There are several methods currently used for selecting the treatment vertical. Each has its own rationale and advantages, but all of them benefit from objective diagnostic aids to ensure the best compromise between optimum joint, muscle, and tooth function.

- The TScan range is distributed in the UK by Indent Systems. For further information please contact Indent Systems on 01952 562800, email mike@indentsys.co.uk or visit www.indentsys.com

* The second part of this article will appear in issue 14

**About the author**

Dr Derek Mahony  Specialist Orthodontist BDS(Syd) MBChB(Edin) MOrth RCS(Conv)/FDSRCS(Eng) MOrth RCS(Edin)/FDSRCS(Edin) FDSOrth RCSP(Glas) FDSOrth RCS(Eng) MOrth RCS Conv FrCSI RCSP(Glas) FDSOrth RCSP(Glas) FDSOrth RCSP(Glas)

Dentist BDS(Syd) MScOrth(Lon) MCDS FDS(HK) FRCD(Can) IBO FICD FICD MOrth RCS(Eng) MOrth RCS(Edin)/FDSRCS(Eng) MOrth RCSP(FD) FDSOrth RCSP(Glas) FDSOrth RCSP(Glas) MOrth RCS Conv FrCSI RCSP(Glas) FDSOrth RCSP(Glas) FDSOrth RCSP(Glas)

49 Botany Street Randwick NSW 2031 Sydney, Australia

www.derekmahony.com

Telephone 01932 582900 www.indentsystems.com mike@indentsys.co.uk

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**Fig 2** Bio-TENS,* a ULF-TENS unit used for muscle relaxation of the masticatory and/or a flair up of craniofacial pain.

**Fig 3** BioEMG II* for monitoring rest position and testing muscle function against the new bite registration.

**Fig 1** BioEMG II* for monitoring rest position and testing muscle function against the

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