Advanced restorative techniques and the full mouth reconstruction: part two – occlusal concepts

In the second part of the series on advanced restorative techniques, **Dr Paul Tipton** focuses on occlusal concepts

Most advanced restorative dentistry techniques have changed little over the last 20-30 years, including that of the full mouth reconstruction. However, the impact of new dental materials, such as titanium and zirconia, has had a major influence on aesthetic dentistry and implantology during this time period. As a result, the profession may have an over-reliance on new materials rather than tried and tested techniques. Some fundamental techniques are just as relevant today as they were when I started my Masters degree in conservative dentistry at the Eastman Dental Hospital in 1987.

During the course of this series of articles on advanced restorative techniques, some old techniques will be revisited in light of today's aesthetic and restorative requirements and some newer concepts will be discussed in greater detail whilst dealing with the overall topic of full mouth reconstruction. This article discuses the topic of occlusion and occlusal concepts.

Gnathology

Stallard first coined the term gnathology in 1924, defining it as the science that relates to the anatomy, histology, physiology and pathology of the masticatory system. McCollum formed the Gnathological Society in 1926 and is credited with the discovery of the first positive method of locating the transverse horizontal axis and transferring the recording to an articulator using a facebow.

Stuart became associated with the Gnathological Society early and published the classic 'Research Report' with McCollum in 1955. Their observations led to the development of the principles of mandibular movements, transverse horizontal axis, maxillomandibular relationships, and an arcon-style articulator that was designed to accept the transfer of these occlusal records. The goal was to truly capture maxillomandibular relationships that accurately reproduced border jaw movements and which would then allow the technician to produce the most stable, functional and aesthetic occlusal form for indirect cast restorations. The registration of the horizontal and sagittal movements of patients was believed to allow the maximum cusp height-fossae depth with proper placement of ridges and grooves to enhance stability, function and aesthetics.

Fundamentals of gnathology

The fundamentals of gnathology include the concepts of retruded axis position (centric relation), anterior guidance, occlusal vertical dimension, the intercuspal design, and the relationship of the determinants of mandibular movements recorded using complex instrumentation to the occlusion in fixed prosthodontics. This has evolved into the five principles of occlusion I embrace today:

1. RCP = ICP around RAP
2. Mutually protected occlusion
3. Anterior guidance
4. No non-working side interferences
5. Posterior stability.

The early gnathologists studied the recorded tracings made during mandibular movements. When the mandible travels forward along the sagittal plane it is considered a protrusive excursion or protrusion. Therefore, retrusion is the movement toward the posterior; and it is the most retruded physiologic relation of the mandible to the maxilla to and from which the individual can make lateral movements that initially defined retruded axis position (RAP) or centric relation (CR) to the gnathologist. Further investigations led the gnathologists to believe that mandibular (condylar) movements are governed by the three axes of rotation.

The concept of retruded axis position evolved into a three-dimensional position, resulting in its description as the rearmost, uppermost, and midmost (RUM) position of the condyles in the glenoid fossa. More recently, with the input of anatomists and physiologists, the concept has also included a bone braced position slightly anterior to the RUM position. Whilst there can be discussions between groups as to the exact definition of RAP, it is generally accepted as a muscular relaxed, reproducible and braced position that is an area not a pinpoint and can only be achieved with relaxed musculature.

Placing the condyles with the correct position and having immediate disclusion (canine guidance and incisor guidance) upon movement away from that position, with no vertical or horizontal deflective contacts is fundamental to gnathology. Tooth wear is considered pathological in gnathology and one of its fundamental concepts is trying to advance a dentition with minimal wear.

Figure 1: Full face pre-op view

Figure 2: ICP

Figure 3: Upper arch pre-op

Figure 4: Facebow recording

Alternative occlusal concepts: Pankey Mann Schuyler

As gnathology was evolving, several competing occlusal concepts and permutations were theorised, such as the Pankey Mann Schuyler (PMS) theory of occlusion. The Pankey Mann Schuyler concepts evolved out of an initial study group headed by LD Pankey on the east coast of America. Nomenclature was different and included centre relation (CR) instead of retruded axis position (RAP); centre related occlusion (CRO) instead of retruded contact position (RCP) and centric occlusion (CO) instead of inter-cuspal position (ICP). Beyron, following his observations on Australian Aborgines, suggested that uniform tooth contact and resultant wear on several teeth in lateral occlusion was a positive and inevitable outcome. As a modification of canine guidance, the Pankey Mann Schuyler philosophy in complete full mouth reconstruction was to have simultaneous contacts of the canine and posterior teeth in the laterotrusive (working) excursion, known as group function, and only anterior teeth contact in the protrusive excursive movement.

Schuyler further suggested that incisal guidance without freedom of movement from a centric related occlusion (CRO) to a more anterior tooth intercuspation (CO) will 'lock-in' the posterior occlusion (long centric).

The incisal guidance, along with 'long centric', is determined by the distance from transverse horizontal axis-centric relation and the normal freedom of movement in the envelope of function. This method requires that the incisal guidance be established and the mandibular posterior buccal cusps be placed to a height measured along the occlusal plane as dictated by the curve of Monson. The maxillary posterior teeth are developed after the completion of the mandibular restorations as dictated by a wax functionally generated path record. The definitive restorations are equilibrated into a centric relation position with mandibular buccal cusps onto a flattened fossae-marginal ridge contact with 'freedom in centric' anterior guidance and group function in laterotrusive (working) excursion.

Deflective contacts

Though 90% of natural dentitions have a deflective occlusal contact or an occlusal 'prematurity' between centric related occlusion (CRO) and centric occlusion (CO), it is usually

Figure 5: Upper cast front view

Figure 6: Upper cast right-hand view

Figure 7: Upper cast left-hand view

Figure 8: Lower study cast

Figure 9: Diagnostic waxing front view

Figure 10: Diagnostic waxing right-hand view

in the form of a slide that has both a vertical and horizontal component occurring in all three planes. According to Ash and Ramfjord, the horizontal 'long centric', from centric related occlusion to centric occlusion, should be incorporated into a restoration by means of a post restorative occlusal adjustment.

Dawson illustrates the 'freedom in centric' concept within the lingual concavity of the maxillary anterior teeth. He redefines long centric as 'freedom to close the mandible either into centric relation or slightly anterior to it without varying the vertical dimension at the anterior teeth'. Additionally, long centric accommodated changes in head position and postural closure (Mohl position).

Gnathology versus PMS

Gnathologists believe that once the condyles are positioned in retruded axis position (centric relation), any movement out of this position should disocclude the posterior segment, thus nullifying any horizontal cusp-fossae area contact.

Figure 11: Diagnostic waxing left-hand view

Figure 12: Lower wax-up

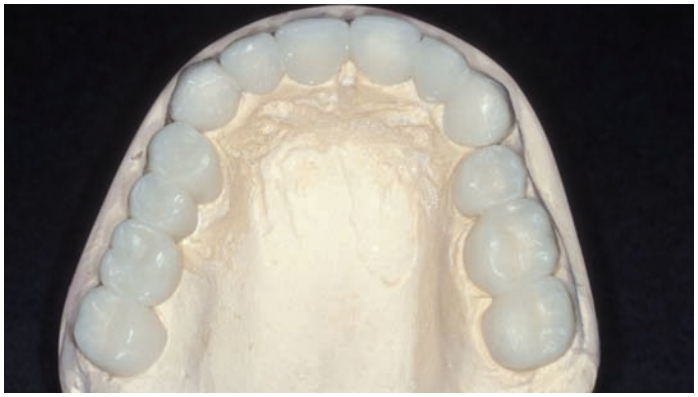

Figure 13: Prototypes types upper arch

Figure 14: Prototypes lower arch

Figure 15: Upper prep guide

Figure 16: Lower prep guide

Figure 17: Upper right restoration on fully adjustable articulator

Figure 18: Upper left restoration on fully adjustable articulator

Figure 19: Anterior crowns front view

Figure 20: Anterior crowns right hand view

Figure 21: Anterior crowns left hand view

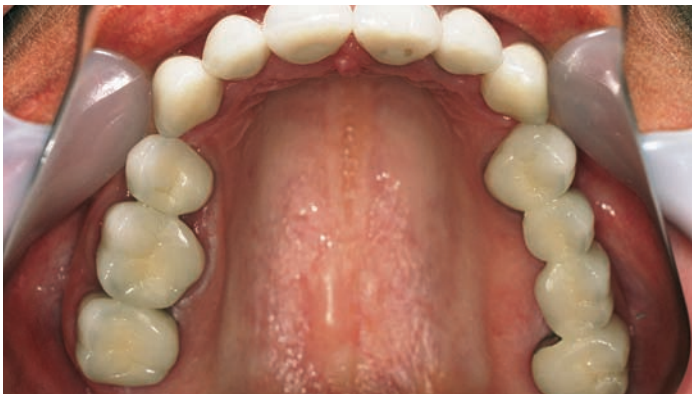

Figure 22: Upper arch occlusal view

Figure 23: Upper right quadrant with palatal ramps

Figure 24: Upper left quadrant with palatal ramps

This belief, combined with the immediate anterior disocclusion, forms the basis of a mutually protected occlusion and limits tooth wear. The PMS occlusal scheme, however, encourages multiple occlusal contacts during lateral movements (group function or wide centre) and during protrusive movements (long centric). This may have the effect of increasing tooth wear. It is, therefore, logical that the PMS occlusal scheme recommends that occlusal wear is physiological, not pathological as suggested by gnathologists. The task of adjusting maximum intercuspation contacts in two different positions on an articulator may result in a lack of precision in both positions. However, the masticatory system has the ability to adapt to various influences and though, in the author's opinion, the concept of gnathology will produce stable long-term results, some patients may require more freedom in their occlusion and the PMS concepts are not to be dismissed in these patients. Indeed, some PMS concepts such as waxing-up the curve of Spee and Monson prior to occlusal rehabilitation are incorporated into every day occlusal practice.

Figure 25: Intercuspal position with no anterior contacts

Figure 26: Upper anteriors

Figure 27: Upper anteriors final view

Figure 28: Lower anteriors final view

Figure 29: Full face final view

Case study

Patient A was referred to me for a full mouth reconstruction and aesthetic improvements to her smile (Figures 1-3). Initial impressions, facebow and jaw registration were taken for mounted study models (Figure 4). The study models showed the degree of over-eruption of her anterior segments and disturbances to the occlusal plane (Figures 5-8).

Initial diagnostic waxing (Figures 9-12), prototypes (Figures 13 and 14) and prep guides (Figures 15 and 16) were completed using a lower curve of Spee of a 4" radius (anatomical average as recommended by the PMS techniques).

Initial prototypes were placed with large palatal ramps on the upper anterior teeth to allow anterior tooth contacts and thus an immediate disclusion style of occlusal scheme as recommended in the gnathological approach.

During the course of the initial preparation and prototypes and after a period of stabilisation, the patient was struggling to come to terms with the palatal ramps from a speech and comfort point of view.

The decision was made to change the occlusal scheme to a PMS 'freedom in centric' style approach where initial guidance in both left and right lateral excursions came from posterior teeth until such time as the canines contacted and then took over as canine guidance. In

protrusion, a similar long centric was established on posterior teeth so that in protrusive movements the initial guidance was from the posterior teeth until such time as the incisors touched and then took over the further smooth protrusive movements. This was achieved by using a fully adjustable articulator to complete the restorations (Figures 17 and 18).

Conclusions

The definitive anterior crowns were made of Procera all ceramic (Nobel Biocare) (Figures 19-21). The posteriors were constructed of traditional porcelain fused to metal with large flat areas on the palatal cusps for the establishment of both 'long and wide centric' (Figures 22-24) as in the new intercuspal position there were no anterior contacts (Figure 25) due to loss of the palatal ramps. The final aesthetic result can be seen in Figures 26 to 29.

Occlusion and the various occlusal concepts have caused – and continue to cause – debate. Whilst the author has been trained throughout his career in the concepts of gnathology, there is the recognition that other occlusal concepts, such as PMS and bilateral balance, may have a part to play in treatment of some patients.

During the rest of this series, the principles of gnathology will be used in the treatment of the partial or full mouth reconstruction.

The next article will deal with the topic of treatment of the severe wear case from both a diagnostic and treatment perspective. PD

Acknowledgements

For the writing of this article on advanced restorative techniques, the author would like to thank the following people for their help:

- Dr Ibrahim Hussain, BDS, M. Med.Sci.Implantology – implant surgeon
- Dr Andrew Watson, BDS, MSc, specialist in endodontics
- Mr Bradley Moore – dental technician, ADS Laboratory, Harrogate.

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