The Need for Gnathology in Partial and Full Denture Construction

INTRODUCTION

The purpose of this paper is to briefly examine the role of gnathological principles in the construction of full and partial denture occlusal schemes. This is not a scientific study; it is a summary of clinical observations by the author over a two year period. These observations were made during Post-Graduate training at Fairleigh Dickinson University School of Dentistry.

The principles of gnathology are widely used throughout dentistry in restoring mutilated dentitions. Essentially, gnathology is the biology of the oral mechanism when observed and treated as a complex, intimately related system. The work of Stuart, Stallard, McCollum, Granger, Lucia and numerous others have documented the superior results obtainable with gnathology. The rationale for utilizing these principles to attain proper cuspal development in harmony with the stomatognathic system is seen primarily in fixed prosthodontics. However, many clinicians tend to neglect the necessity not only for proper cuspal development, but for cusps in general when restoring the partially or fully edentulous patient. By applying gnathology in these cases, the results could only be improved. In reality, these are the truly compromised cases, necessitating a multitude of procedures each requiring stringent attention to minute detail.

The work of Stuart, Stallard, and McCollum in the early 1900's defined and established the gnathological principles practiced today. Their pioneering efforts resulted in the development of a gnathological computer that readily adjusts to duplicate with precise detail the mandibular movements of each patient. The ability to locate and utilize the hinge axis is probably the single most important contribution of these researchers. To quote Lucia "The hinge axis is the greatest luxury we can utilize in oral reconstruction". Identification of the centers of rotation, coupled with pantographic tracings, enables the dentist to provide the patient with the optimum functional occlusal scheme that is protective to the supporting structures. The importance of

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occlusal development must not be minimized. Controlling the forces placed on teeth will minimize the pathological destruction consistent with improper occlusal loading. When dealing with the partially and fully edentulous patient it is of paramount importance to preserve the components of the stomatognathic system that remain. Therefore, the principles of gnathology, in conjunction with excellent denture base design are essential.

The use of cast denture bases is well documented in the dental literature. Campbell advocated the use of aluminum as early as 1939. Eventually others found gold to be an excellent denture base alloy with its excellent biocompatibility and superior casting accuracy. The use of less acrylic reduces the amount of distortion during processing, and minimizes the amount of tissue intimately in contact with it. The work of Page and Addison with mucostatic impression technique and denture bases added the final component. It was now not only possible to produce an accurate base, but the accuracy of the master model was assured. Grunewald, Lang and others have enumerated the advantages of cast mucostatic bases. Dykens alludes to the “tissue base constant” in describing the intimate relationship that must exist between the denture base and the edentulous tissue complex to achieve maximum results. The debate over which denture base material best achieves this is still unresolved. The dental literature is inconclusive at present. It is the clinical observation of this author that metal bases achieve a superior result.

If the optimum in denture construction is to be achieved, it appears that the following basic principles should be observed:
1. Location of the hinge axis and mandibular recordings must be established to develop a mutually protective occlusal scheme.
2. Utilization of mucostatic impression technique.
3. Cast Denture bases should be fabricated.

Examination of these three criteria reveals a common theme. Stringent attention must be paid to detail and function of the stomatognathic system. All three have a very intimate relationship that requires a harmonious coexistence. However, without gnathology, the other two become exercises in futility. A cast base housing improperly related teeth results in a destabilized nightmare. An accurate mucostatic impression with a well fitting base will not function effectively if destructive occlusal forces are not controlled or eliminated. Gnathology remedies this problem.

The first parameter to examine is the hinge axis. Location of the rotational centers is easily achieved with proper equipment, and is readily transferred and preserved by an accurate facebow. This provides the proper occlusal relationship of maxilla to cranial base. Proper bite registration will then give accurate maxillo-mandibular relation. Since the important movements of the mandible are from the terminal position, an inaccurate registration of the hinge axis
will negate all further work. An arbitrary facebow will not adequately relate the maxilla and so on.

It is essential to point out that employing a cast base to record mandibular occlusal records and mandibular border movements is a requirement. With proper anchorage of the pantograph to the base, a very desirable condition is set up. The excursive movements of the mandible are accurately recorded and teeth placed accordingly. Cuspal relationships are now placed in a non-interfering environment, gliding past each other and minimizing base destabilization. This degree of accuracy cannot be achieved with an arbitrary facebow transfer. This would result in either the necessity of utilizing monoplane teeth, or extensive occlusal adjustment, greatly compromising cusp function and efficiency. Monoplane teeth are simply an excuse for laziness not employing the state of the art in dental science in conjunction with years of knowledge incorporated into gnathology. The use of monoplane teeth exert a destructive influence on the mandible by negating its ability to achieve a proper centric obtainable with cusps. However, the same result would be seen with cusps if proper mandibular recordings are not used. The ability to develop custom occlusal schemes through full waxing and casting of posterior denture teeth provides the optimum in results.

The remaining two parameters deserve brief mention. Mucostatic impressions, as pointed out by Page, require the use of a free flowing material that captures the tissue at rest. The tray itself should not load the tissue in any manner. The resulting master model is duplicated and a refractory model made. The materials used to gain an accurate result must be consistent with the guidelines established by the manufacturer of the alloy. A well-fitting, stable, retentive base is the only acceptable goal. One final note; processing of the tooth/ridge substitutes should be accomplished independent of the cast base and luted to it as a separate procedure. This will minimize any distortion of the metal base secondary to acrylic shrinkage. Both of these topics could be widely expounded on needing further research to deliver satisfactory answers.

**SUMMARY**

The results obtainable in partial and full denture prosthetics can be greatly enhanced by utilizing proven techniques. Among these, gnathology, coupled with cast bases and mucostatic impression technique represent the state of the art. This translates into a happier, healthier patient, and a satisfied doctor.
REFERENCES


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