neo.lign

Full teeth

Curriculum

Modern Prosthetics

choose natural beauty

powered by
visio.lign

Preface

The working group „Prothetik (prosthetics)“ has been dealing with the design of teeth and occlusal surfaces since 1997. We have been involved in development projects of prefabricated and individual anterior and posterior teeth.

The experience and results acquired during numerous years of training and lecturing activities have been incorporated into methods and concepts for efficient fabrication of dental restorations and individual prosthetics.

We consider it our task to optimize methods and processes in daily laboratory routines and to convey practicerelated techniques based on common theories and concepts. The working group „Prothetik“ intends to be a communicator between users, customers and manufacturers of products and services in the dental sector in order to improve quality, efficiency and individuality in the fabrication of dental restorations.

The curriculum „Modern Prosthetics“ is the basis of our methods and concepts. It also serves to support the user in his daily work.

In this context, we would like to thank bredent (company) which enabled us to integrate our experience and know-how into the development of the new visio.lign veneering technique, which includes anterior and posterior veneers and denture teeth as well.

Frankfurt, February 2011

Patrik Guttenbacher

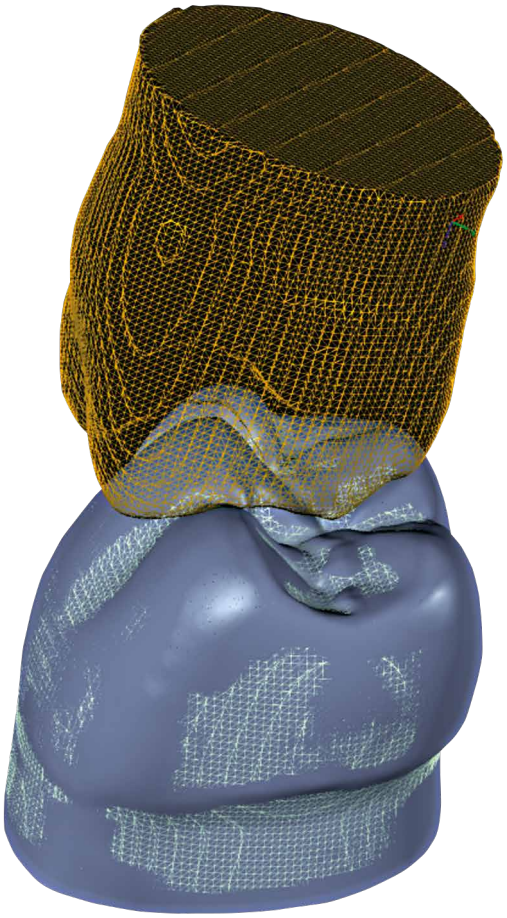
Christian Rohrbach

Hans Joachim Dörner

Content

page

1. Introduction



Customer orientation, flexibility and cost pressure are the challenges, which all dental laboratories are confronted with. To meet them, various methods and techniques are employed to fabricate functional dental restorations; frequently, the question comes up whether these methods are still up-to-date.

Moreover, dental technicians are required to take different occlusion concepts and theories into account. This is an aspect of customer orientation.

The target of this manual is to give you an overview of current occlusion concepts and their historical development. The manual includes the latest insight and results of dental prosthetics to provide recommendations for efficient and low-cost fabrication of high-quality dental restorations.

The curriculum "Modern Prosthetics" is also intended to serve as a guideline for future development projects of new occlusal designs, which should also be used for automatically generated suggestions of occlusal surfaces in dental CAD systems to reduce the existing complexity.

Reliability and reduction of time that are gained contribute to increasing the quality in the dental laboratory and provide necessary options for individual and esthetic prosthetics.

2. The occlusion concepts

2.1 Relevance of occlusion concepts

Naturally, all of us have heard about occlusion concepts before; after all, the term is frequently used in dental laboratories. In many cases it is assumed that the term is based on undisputable principles established by nature and that there might be correct and incorrect occlusion concepts.

The mere observation of other persons and their dentures allows to determine that teeth in natural dentitions are in occlusion with two opposing teeth (antagonist teeth). There are clearly fewer cases of occlusion with a single opposing tooth. If advance and lateral movements are made under tooth contact until edge to edge bite is achieved, it can be recognized that either only individual teeth, entire groups of teeth or almost all teeth are in contact whereas the remaining teeth are not in contact. Different types and combinations of such tooth relationships may be found in natural dentitions.

In order to discover the principles of mandibular movements and occlusion and even to exceed nature, classifications were made, theories were formulated and corresponding occlusion concepts were established. They had become necessary since problems during the fabrication of dental restorations had been encountered again and again in the 18th and 19th centuries, which could damage the masticatory apparatus. In view of the growing relevance of the anatomy and physiology, a basis had been created for the scientific research into tooth relationships and mandibular movements.

The term eugnathic is used to describe the ideal tooth relationships in a perfectly functioning masticatory apparatus, whereas dysgnathic is used for tooth relationships in imperfect or inadequately functioning masticatory apparatuses. The classification of the English orthodontist Angle, who divided the occlusion types into scissors bite (normal bite, class I), deep bite (overbite, protrusion, class II), crossbite (mandibular prognathism, class III) and subgroups. An association of dentists in the USA, which was named Gnathologic Society, committed themselves to the scientific research into tooth relationships and mandibular movements. In their efforts they used studies of Bonwill, Gysi and others and developed their own theories and concepts. Some universities, however, came to results that differed considerably from those of the Gnathologic Society.

2.2 Occlusion concepts in static occlusion

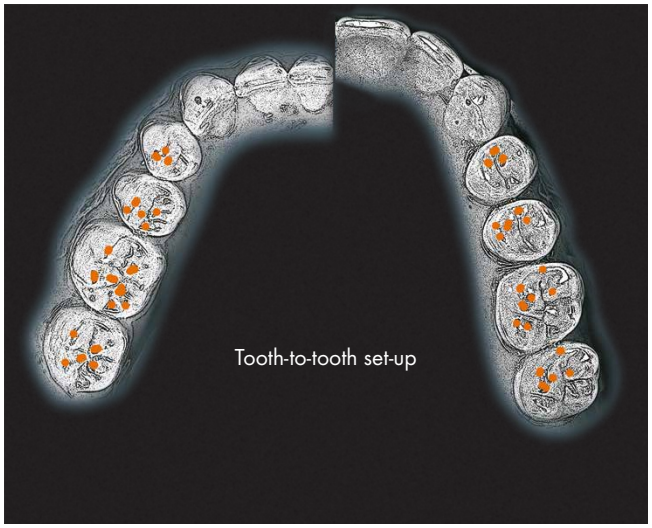
(intercuspation, occlusal relation or in centric relation)

If natural rows of teeth are looked at from the side or the front, various interdigitation types both in the sagittal or in the transversal direction are obtained in static occlusion.

The tooth-to-two-teeth concept was developed from the tooth relationship most frequently found in the natural dentition (with one main and one secondary antagonist) for intercuspation in the sagittal direction. Payne developed a wax-up technique to present ideal distribution of the contact points on the occlusal surfaces. As a result, the periodontium is loaded centrically and the masticatory system will not be damaged by improper stress.

In some patients distoclusion with a width up to half of a premolar was found; in these cases each tooth rests only on a single antagonist. Consequently, the tooth-to-tooth concept was developed; Thomas invented a wax-up technique with tooth moulds for this concept. The

ideal occlusal distribution of contact points ensured perfect loading of the periodontium.



Both concepts provide for defined, idealized occlusal contact points in intercuspation or centric relation. The design of occlusals by Payne and Thomas could be used for crown and bridge restorations.

In the transversal direction, single interdigitation or double interdigitation can be found. Double interdigitation is the "normal" natural type of interdigitation, in which the working cusps of lower and upper teeth come into contact with the recesses and marginal ridges of the antagonist teeth (in static occlusion). Since this natural intercuspation is "normal", there is no common term for it.
In the case of single interdigitation, only one cusp of a pair of teeth comes into contact with the fossae or marginal ridges of the antagonist teeth. It is extremely rare in natural dentitions, however, it offers some advantages when setting up full dentures. According to Hiltebrandt the lower working cusps bite into the upper fossae; according to Gerber the upper working cusps bite into the lower fossae and, according to Hofmann, the size of the jaw base is the decisive factor for the type of interdigitation. Pound uses the term "lingualized occlusion" for the simple interdigitation, in which only the palatal upper cusps come into contact with the lower fossae.

2.3 Occlusion concepts in dynamic occlusion

(for mandibular excursion movements)

2.3.1 Balanced occlusion

(fully balanced occlusion, bilateral balanced occlusion)

At the beginning of the 20th century, the term of balanced occlusion became established. The spherical theory by Monson, Spee's curve and Bonwill's three-point theory of occlusal balance formed the basis. Studies in patients with physiologically abraded teeth confirmed the occurrence of balanced occlusion in the human masticatory organ. Since the type of fixation and design of dental restorations always needed to be adapted to the residual teeth, the big challenge in this period was to fabricate full dentures, which were fixed in a stable position in the mouth and didn't have to be removed for eating.

Balanced occlusion describes simultaneous contact on all sides of all facets and incisal edges during mandibular excursion movements. The development of corresponding articulators and registration systems to measure joint data and for facebow transfer was advanced. Since a dental restoration, which is fabricated whilst ensuring balanced occlusion, may easily cause problems during excursion movements (if the tooth relations in the articulator are not identical with those found in the mouth), the fabrication of fixed restorations in balanced occlusion becomes very complex and difficult. In the field of full dentures, balanced occlusion ensures stable support of the denture

and protects the denture base by providing tooth contacts to avoid sliding during movements without masticatory stress, that is not during chewing since the rows of teeth do not have balanced contact during chewing due to the food bolus.

Among others, the proper set-up of teeth is responsible for retention of the denture during chewing, which can be achieved using various setup options. Later on, Gerber described that each individual denture tooth had to be set up in a way to ensure autonomous functional stability in order to prevent the denture from being loosened in the event of pressure by the food bolus on a pair of teeth.

Balance contacts which protect the joint, also called ortho balances, can protect the jaw joints. Balanced occlusion was supported by Gysi, Mc Collum, Schröder, Häupl, Gerber, Böttger and others.

Since in full dentures all teeth are set up on a common denture base, a minimum requirement for the balanced occlusion could be defined; a three-point contact with one contact each on the working side, the balance side and the anterior region for lateral movements and for protrusive movements on the central incisors and on the last molar must be accomplished.

2.3.2 Group guidance

(unilateral or unilateral balanced occlusion)

In the case of group guidance, the canines, premolars and the first molar come into contact during mandibular lateral movement on the laterotrusion side (working side). Group guidance is found in dentition exhibiting functional abrasion (physiological abrasion patterns) which is frequently encountered in persons with a scissors bite. When fabricating fixed restorations, group guidance must be restored for such patients. For this purpose, a facebow transfer and "programming" of the articulator using individual patient data are required.

In 1929 Schuyler provided the fundamentals for a group-guided occlusion concept with guidance on the working side of canine and posterior teeth. In 1960s the concept was supported by Pankey, Mann, Posselt, Ramfjord, Ash and others. It became known as freedom-in-centric or wide-centric or long-centric concept; by grinding natural teeth or by using restorative measures, tooth guidance of up to 1 mm from intercuspation towards the central relation (in sagittal and transversal direction) could be achieved without changing the vertical dimension. Sliding into the centric relation by interfering contacts is avoided. Within group-guided occlusion, the long centric concept can be employed with the "Schuyler Teller".

2.3.3 Anterior- and canine-guided occlusion

2.3.3. Anterior- and canine-guided occlusion
If - intentionally or unintentionally – sliding contacts are made in case of anteriorcanine-guidance, all posterior teeth will immediately disclude during protrusive and laterotrusive movements in the natural dentition. During mastication, however, no sliding movements will occur on the teeth. The term "guidance" is not to be understood as slide guidance but as "control guidance" of the neuromuscular system which controls the movement of the mandible. Starting from the tooth contacts in intercuspation, the receptors in the tissue of the anterior and canine teeth initiate a muscle program to guide the mandible in a way to avoid any slide contact. As a result, teeth and gingiva (tissue) are protected against excessive stress. Anterior-canine guidance is frequently found in persons with a deep bite (closed bite).

Stuard and Stallard found out that achieving balanced occlusion requires considerable effort in the articulator and resulted in interfering contacts in the mouth in almost all cases. They turned away from balanced occlusion and in 1960 they described the organic occlusion or protective occlusion, which is known as anterior-canine-guided occlusion today. In this concept, the central incisors ensure guidance during protrusive movement, the canines during lateral movement and the anterior teeth during lateroprotrusion.

In 1982 Slavicek described the sequential lateral guidance with canine dominance in which during lateral movement first tooth no. 6, then tooth no. 5 and tooth no. 4 disclude and finally only tooth no. 3 provides guidance. This is accomplished by setting up or waxing up starting from tooth no. 6. In the articulator tooth no. 5 discludes tooth no. 6, tooth no. 4 and tooth no. 2 discludes tooth no. 5 and tooth no. 3 discludes tooth no. 4 immediately. Due to the mobility of the tooth (periodontium), however, sequential slide guidance occurs in the mouth. Owing to the resilience of the denture base, sequential lateroprotrusive guidance in the articulator is frequently unwillingly transformed into pure group guidance in the mouth.

In 1976 Gausch advanced the concept of anterior-canine guidance for full dentures and – already in its name – he points out that the neuromuscular control of the paths of the mandible is influenced by the anterior and canine teeth. If the patient performs a sliding movement on the anterior or canine teeth, the receptors in the mucosa "inform" about the risk of "loosening" of the denture. The neuromuscular program is changed and forces the denture wearer to perform masticatory movements that are performed by patients with natural teeth. Gausch recommends canine guidance of 55° and anterior guidance of 40°.

Grunert advanced the concept of anterior-canine guidance. The inclination of the anterior teeth is parallel to the determined condylar path inclination, the canine teeth are set up at an angle of 5° and the occlusion plane has an angle of 10° to the axisorbital plane. In centric, the lower posterior teeth only have contact in lingualized occlusion.

The supporters of the occlusion concepts without balance contacts assume that – in balanced occlusion – the protection mechanism against loosening of the dentures will induce patients to perform "unnatural" masticatory movements which will then cause damage to the denture base all the more.

To improve reliable retention of anterior-canine-guided full dentures, some concepts suggest to use the first premolar for canine guidance. From a static point of view, it features a better position on the ridge and avoids tilting of the denture in case of undesired slide contacts. The future will show whether the efforts to use the term "premolar guidance" for this type of "anterior-canine guidance with tooth no. 4" will be successful.
Gutowski also abandoned the concept of balanced occlusion and in 1986 he described the set-up of an anterior-canine guidance, in which the premolar teeth also provide guidance but not necessarily. In his concept, the anterior teeth are set up at an angle that is 8° above the condylar path inclination.

2.3.4 Lingualized occlusion

A set-up in lingualized occlusion can be realized in the occlusion concepts of balanced occlusion, group guidance of anterior-canine-guided occlusion and in the "pure" centric setup concept. Accordingly, the opposite of lingualized occlusion is "normal", double contact of lower and upper working cusps in the fossae and marginal ridges of the antagonist teeth.

The fact that contacts on buccal cusps may affect the retention of the denture was already known for these "non-lingualized" concepts. Gysi and Fischer described a setup of teeth at an angle of 10° above the interalveolar line and solved the problem later on by grinding the buccal cusps in the maxilla. This set-up can only be simplified considerably by positioning the buccal cusps out of contact as it is demonstrated in the Pound technique.

The term lingualized occlusion describes a set-up of teeth in which the palatal cusps (in the English-speaking world also called "lingual") have contact in the fossae of the lower teeth in a tooth-to-tooth relationship.

In German-speaking countries the term "lingualized occlusion" was accepted in the fields of dentistry and dental technology only at the end of the 90s. The original meaning of the German term "lingualisiert" was derived from "lingual occlusion", which describes teeth that are positioned "more lingually".

Around 1950 Earl Pount published his technique, which he had already developed in the 1930s. His theories were not taught at universities for a long time. He recommends to set up teeth in lingualized occlusion in which only the palatal cusps of the upper teeth rest in the lower fossae and tooth no. 6 has two supporting contacts. The buccal cusps are out of contact. Pound suggests group

guidance for lateral movement, that is without balance contacts, and only to support the anterior teeth and the last molar during protrusion. For set-ups in lingualized occlusion Payne recommends to place all palatal cusp tips with point-to-point contact into the central fissure of the lower teeth and to maintain balanced occlusion during any excursion movements.

Gerber cleverly combines the biomechanical aspects of Gysi with balanced occlusion and the physiological views of Hildebrandt with an occlusion field and developed the condylar principle in his condylar theory published in 1962, which creates "polyvalent occlusals according to the mortar and pestle principle and disclusion of the buccal cusps". In his approach the palatal cusps of the molars and the second premolars are in the mesial fossae of the opposing teeth. The first premolars are set up according to the reverse condylar principle and the buccal cusps of the lower teeth are in the mesial fossae of the upper teeth. The possibility of disclusion of the buccal cusps corresponds to Pound's principle of lingualized occlusion.

When developing the "New Technique" set-up concept, Stuck was inspired by Pound. Balance occlusion with buccal disclusion (corresponds to lingualized occlusion) according to Gerber is abandoned in favor of intermediary guidance paths which do not entail any excursion movements and have a length of just 1 mm. The occlusion concept tends towards centric set-up with occlusion field according to Hildebrandt, which is changed into canine guidance on the first premolar in the articulator. This will enable "pure" centric set-up in lingualized occlusion in the patient.

2.3.5 Centric set-up

Before 1887 denture teeth were set up evenly in full dentures. In these "level" set-ups all cusps came into contact with an unspecified occlusion level. Consideration of lower excursion movements during the fabrication of dentures was not an issue yet. The centric set-ups emerged from the "level" set-ups. After recording the bite in central occlusion, the posterior teeth were set up parallel to the occlusion plane. Balanced occlusion could not be achieved with this approach but is also not considered necessary in these theories. Correct relation of the mandible to the maxilla is of utmost significance for any set-up system. Incorrect positions may cause loosening of the denture and damage the ridges.

2.3.6 Physiological occlusion

Based on these results, End described the concept of physiological occlusion in 1994, which reproduces only the occlusion found in the patient's mouth. The teeth come into contact just for a short time and point contact is achieved in physiological centric and they do not slide in via "slide guidance" across the tooth surfaces. This type of occlusion is found in natural dentition and can be partly rediscovered in the variety of all other occlusion concepts. As a result, only natural tooth moulds (shapes) and a set-up in centric occlusion are required. Guidance on the working side, balance side and in the front does not have to be checked. Since the mandibular movements are controlled by the central nervous system and guided by muscles, which has already been pointed out by Hildebrandt, full dentures do not require any tooth shapes, which differ from the natural dentition, and set-up theories. The success of the previous set-up concepts depends on proper determination and setting up in centric occlusion (relation).

2.4 General summary

Occlusion concept	for laterotrusion (lateral movement)	for protrusion (advance movement)	in intercuspation position (occlusal relation)
Anterior-canine guidance	Antagonist contact tooth no. 3, remaining teeth disclude	Contacts on tooth no. 1, remaining teeth disclude	Contact points in habitual intercuspation position or centric
Group guidance	Contacts – teeth no. 3, 4, 5, 6 remaining teeth disclude	Contacts – teeth no. 1, 2, 3 remaining teeth disclude	Patter of contact points according to Payne or Polz, Thomas, Gerber, End, etc.
Balanced occlusion	Contacts on laterotrusive side: teeth no. 1 to 7 (at least no. 6 and 1) Medi-otrusive side: teeth no. 4 to 7 (at least no. 6) – remaining teeth disclude	Contacts on teeth no. 1 to 7 (at least no. 1 and 7) on both sides	Depending on static occlusi-on concept selected in tooth-to-tooth. tooth-to-two teeth, single (lingualized) or double occlusion

The idealized occlusal distribution of contacts in intercuspation position are always described for the eugnathic dentition (Angle class I occlusion). Since perfect conditions are hardly found in natural dentitions owing to shifted, missing, twisted or tilted teeth, the dental technician needs to ensure stable support of the working cusps by shifting the positions of the fossae and marginal ridge contacts to more suitable areas. In this effort, the knowledge of the classification of contact points into the transversal (A, B, C contacts) and sagittal (stopper and balance contacts) is very helpful. To ensure stable occlusal support of a tooth, at least three contact points are required, which should preferably be aligned as ABC contacts and are located on the mesial and distal cusp segments.

Since all teeth are set up on a common denture base, proper distribution of the contact points – depending on the occlusion concept – can provide adequate stability of the denture with clearly fewer occlusal contacts.

As a matter of fact, the development of occlusion concepts has not been completed since the latest results found at dental universities/colleges will continuously be integrated into the occlusion concepts. Generally, all occlusion concepts mentioned in this compendium can be assigned to an existing theory since they were frequently only slightly changed or can be considered to be further developments.

3. Use & development

3.1 Development of prefabricated teeth and occlusal surfaces

Today daily work routines require fast and reliable handling when setting up teeth and – if possible – universal teeth and a minimum amount of functional grinding. However, we should not be tempted to believe that functional restorations can be fabricated without the need for grinding or remounting. In the authors' opinion, the challenge lies in finding a good compromise between the range of functions, complex handling and caserelated reworking.

Based on the current experience and the products tested, each assortment of teeth should include one anatomical posterior tooth with multifunctional occlusal surface type, which can be found in the opposing quadrants and hence be identical, if the occlusion concepts mentioned before can be applied.

The resistance to abrasion of the tooth material that is used is an essential factor; insufficient resistance to abrasion may result in shortened vertical dimension (lower bite) and endanger proper function of the denture.

To ensure perfect handling for the user and case-specific selection and use of the available prefabricated teeth, a customer- and market-specific training program is very advantageous. It can be used to fulfill the request for time-saving and reliable fabrication of dental restorations in a better manner.

3.2 Implant prosthetics

The stability of a denture is an essential aspect especially in the field of implant prosthetics. In addition to the demand for maximum size of the denture base and avoiding damage to the soft tissue, existing theories and static concepts must be applied as appropriate.

Each artificial tooth must be set up in a way to ensure autonomous functional stability, which is based on strictly applied analysis of static. Special attention must be paid to chewing dynamics! If these criteria are not considered, premature loss of the implants may result.

3.3 Summary and outlook

The results and findings of the occlusion concepts enable the dental user to fabricate functional restorations more easily.
The standard concepts are logical. Despite all results and findings, each patient case needs to be solved individually to guarantee a successful result. Further development of anterior and posterior teeth in recent years contributed to achieving success. Multifunctional surfaces have been created which can be adapted to the respective occlusion concept. As a result, full dentures have gained new significance.

Thanks to the development of new articulators featuring optimized determination of data, patient-specific prosthetic restorations can be fabricated if consequent use is ensured.

The "Arbeitskreis Prothetik" has set itself the task to convey knowledge about modern materials, manufacturing methods and equipment (e.g. articulators) and to develop them further.

To apply established occlusion concepts to individual cases, special set-up instructions are prepared and methods are optimized.

In order to achieve this goal, we want to cooperate with dental clinics at universities/colleges, the dental industry and interested technicians/dentists. Our working group is preparing a comprehensive program of courses and lectures.

neo.lign
Full teeth

choose natural beauty

Photos:
Christian Rohrbach, MDT, BdH Frankfurt
Hans Joachim Dörner, MDT, BdH Frankfurt
Jörg Bressen, MDT, Recklinghausen
Authors:
Patrik Guttenbacher, MDT, Karlsruhe,
Totalprothetik Masterpak
Christian Rohrbach, MDT, BdH Frankfurt
Hans Joachim Dörner, MDT, BdH Frankfurt

bredent group

000226GB-20210927

bredent GmbH & Co. KG · Weissenhorner Str. 2 · 89250 Senden · Germany · T: +49 7309 872-441 · F: +49 7309 872-444 · www.visio-lign.com · @: info@bredent.com