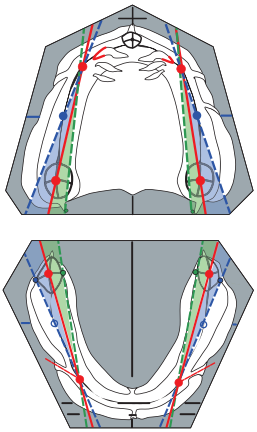
TOTAL PROSTHETICS IN FUNCTION

MODEL ANALYSIS
TOOTH SET-UP



MERZ DENTAL

CONTENT

PART I THE MODEL ANALYSIS

PART II SETTING UP THE TEETH

MERZ DENTAL

THE MODEL ANALYSIS

The model analysis is performed after mounting the model in the articulator - before applying the set-up bases. The model analysis serves to provide information on where the teeth used to be and where the replacement teeth have to be set up from a structural and prosthetic perspective. Without a carefully completed model analysis, even an experienced dental technician would lose sight of the structurally favourable areas. In order that the respective points and lines from the model analysis are easier to notice and distinguish in the course of the subsequent work steps, different colours should be used.

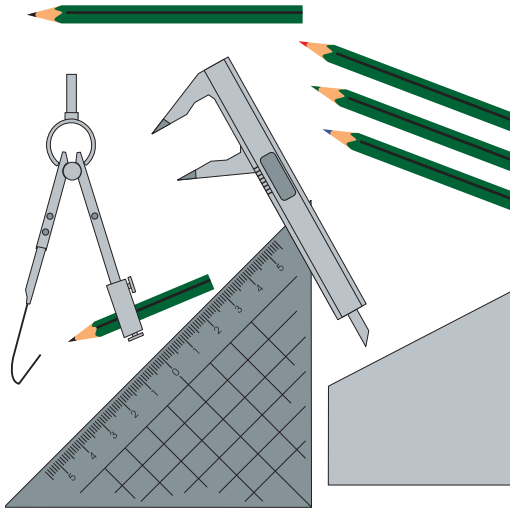
The following texts and illustrations are intended as aids for the use of the "Total prosthetics in function" method and are based on the total prosthetics concept formulated by Prof. A. Gerber and further developed by Peter Lerch, which Karl-Heinz Körholz modified for learning the work steps for the tooth set-up (Körholz, K.-H..: Totalprothetik in Funktion. Berlin: Quintessenz 1999).

The eight working steps in overview

1. Determination of the anatomic model midpoints
2. Anterior markings
3. Posterior region: Basic statics and marking the premolar positions
4. Identifying the largest masticatory unit of the mandible (first molar position)
5. Determination of the distal most loadable tooth (stop line)
6. Posterior region: Determining inner and outer corrections
7. Determining the common set-up areas between the maxilla and mandible
8. Defining the definitive set-up line

Tools required (Fig. 1)

- Pencil
- Red, green, blue coloured pencils
- Profile compass
- Set square
- Small sliding caliper
- A 22.5° angle template (e.g. cardboard)



Tools and model kit, bite registration are included in the TiF Training Kits Basic (REF 1030312) and Professional (REF 1030313), apart from the sliding caliper.

1st STEP ANATOMIC MODEL MIDPOINTS

MANDIBLE (Fig. 2)

frontal: frenulum of tongue

dorsal: Identify the midpoints of the retromolar pads by surrounding them and then halving sagittally and transversally. Then half the distance between the midpoints of the two retromolarpads.

Mark the model midpoints on the frontal and dorsal outer surfaces of the model.

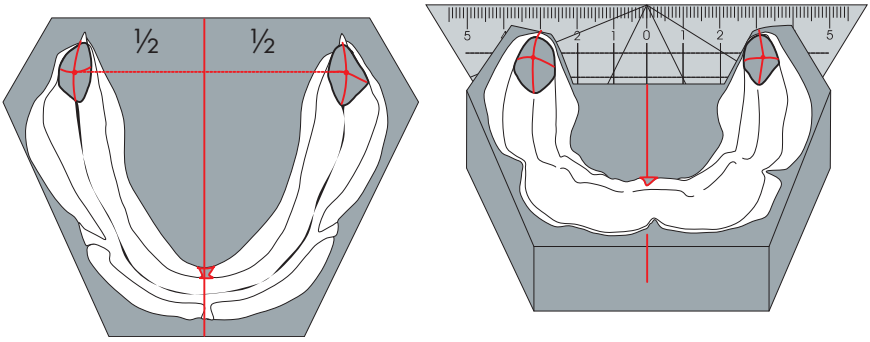


Abb. 2 Mandible - anatomic model midpoints

MAXILLA (Fig. 3)

frontal: Mark the midpoint of the incisive papilla by surrounding it and then halving it sagittally and transversally.

dorsal: Identify the midpoints of the tubers, as in the mandible.

Mark the model midpoints on the frontal and dorsal outer surfaces of the model.

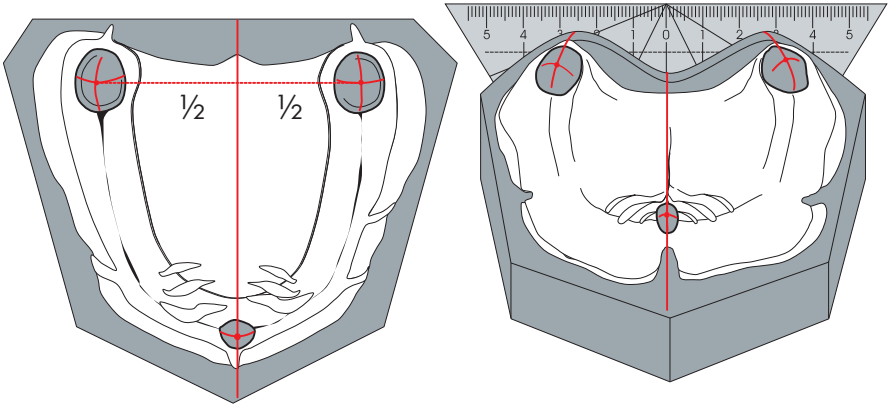


Fig. 3 Maxilla - anatomic model midpoints

2nd STEP ANTERIOR REGION

MANDIBLE (Fig. 4)

Frontal midline of the alveolar ridge and limit lines for the labial surfaces of the central incisors

The frontal midline of the alveolar ridge is marked at right angles to the anatomic model midpoint and extended to the outer surfaces of the model. A line parallel to the frontal midline of the alveolar ridge, which runs through the lowest point of the frontal mucolabial fold, is also transferred to the outer surfaces of the model.

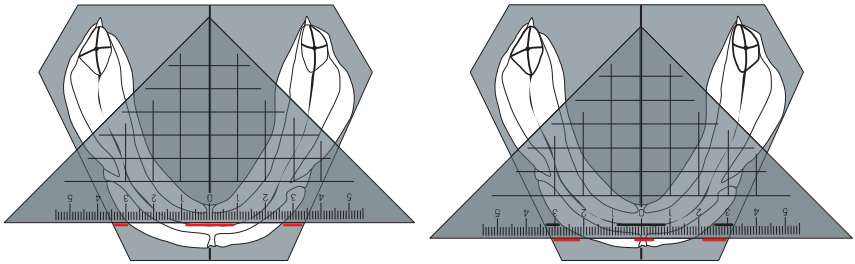


Fig. 4 Mandible - frontal midline of the alveolar ridge and labial limit for the central incisors

Using a sliding caliper (Fig. 5), the position of the labial surfaces of the central incisors is measured from the distance between the incisor guide pin and the marked mucolabial fold, and is noted on the frontal outer surface of the model. This allows the tooth set-up to be checked very precisely at any time.

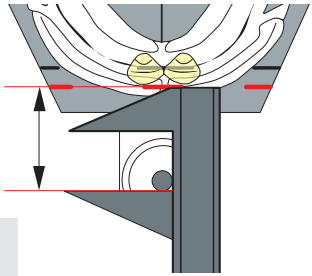


Fig. 5 Mandible - detail: labial limit for the central incisors

MAXILLA (Fig. 6)

Limit lines for the labial surfaces of the central incisors and the first large pair of palatine rugae

A line is drawn roughly 7-8 mm in front of the middle of the incisive papilla as orientation for the labial surfaces of the central incisors. The first large pair of palatine rugae is marked and points towards the canine position. The marking also serves to roughly determine the width of the set of teeth. Not all anatomic points for the model analysis can always be determined unequivocally. Sometimes the palatine rugae are difficult or impossible to identify on the model, this also applies for the buccal frenulae or the midlines of the alveolar ridge. In such cases this means inferring this "conscientiously" with sound judgement and experience.

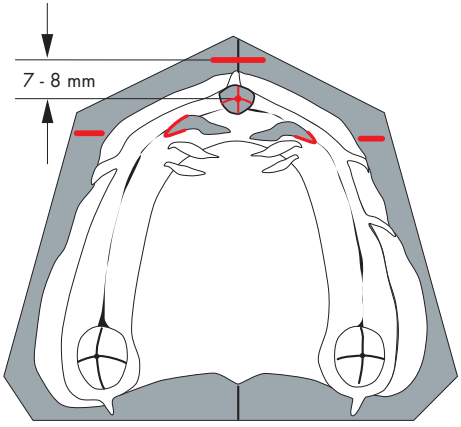


Fig. 6 Maxilla - anterior markings

3rd STEP POSTERIOR REGION BASIC STATICS

In the days of rubber dentures, it was correct and necessary to set up the posterior teeth mainly along the midline of the alveolar ridge. This is not the case for today's full dentures. Most edentulous alveolar ridges do not run straight, but are slightly curved. In practice, the line of the alveolar ridge midlines is simplified to a straight line and is used as the sole reference line for the posterior set-up. This does not take the variable atrophy of the maxillary and mandibular crest into consideration, so there is the risk that the posterior teeth are either too far buccal or too far oral and the masticatory forces are applied in an unphysiological direction. The consequences would be increased alveolar ridge atrophy, encroachment on the tongue space, as well as insufficient tongue support. This in turn leads to impairment of denture functionality, which can be extremely painful for the wearer. With a view to the physiological transmission of force and avoiding impairment of the tongue's freedom of movement and cheek support, the replacement teeth should be placed at the positions of the natural teeth, wherever possible. For this purpose, the buccal cusp areas also have to be identified, as well as those of the oral cusps and, for purely practical reasons, also the "line" of the central fossa of the replacement teeth has to be "tracked down". This important function is fulfilled by

- the basic statics,
- the outer correction,
- the inner correction.

3.1. Basic statics in the maxilla (Fig. 7)

The maxilla first premolar position is in the area of the extension of the buccal frenulae vestibular towards the alveolar ridge or slightly behind it. It is marked with a red dot on the alveolar ridge. The position of the first premolar can be found with the aid of the existing canine marking. The first premolars are roughly one premolar width behind the canine marking.

Connection lines are drawn from the maxillary first premolar positions to the respective midpoints of the tubers and are extended to the outer surfaces of the model. These two lines form the basic statics in the maxilla. They are essentially the ideal lines for the position of the load-bearing palatal cusps.

Due to the rather linear atrophy of the alveolar ridge in the area of the lost first premolars, determination of the basic statics allows the posterior teeth to be set up approximately at their original positions. Although this leads to a straight line, it is modified by the subsequent outer and inner correction. This also applies for the mandible.

3.2. Basic statics in the mandible (Fig. 8)

The mandibular first premolar position is in the area of the extension of the buccal frenulae vestibular towards the alveolar ridge or slightly behind it. It is also marked here with a red dot on the model.

Connection lines are drawn from the mandibular first premolar positions to the respective midpoints of the retromolar pads and are extended to the outer surfaces of the model. These two lines form the preliminary basic statics and essentially mark the ideal lines along where the central fossa of the mandibular posterior teeth lie. As alveolar ridge atrophy advances from the inside to the outside, the central fossa lie almost at their former positions again.

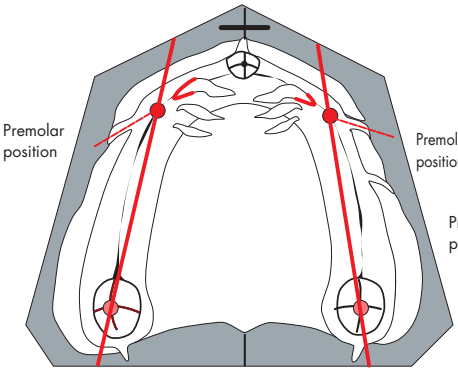


Fig. 7 Basic statics in the maxilla

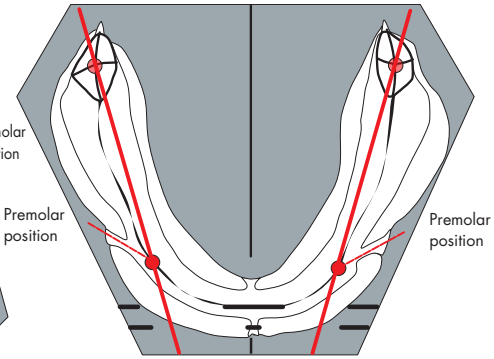


Fig. 8 Basic statics in the mandible

4th STEP IDENTIFYING THE LARGEST MASTICATORY UNIT OF THE MANDIBLE

The structural centre of the mandibular full denture usually lies in the area of the former first molar position. In turn, a tooth has to be placed at this point, which has to provide the greatest masticatory force without causing increased atrophy of the alveolar ridge. It absorbs the masticatory forces according to the direction of action of the masticatory muscles and passes them to the denture supporting area in the physiological direction. In most cases this is the first mandibular molar, if the sagittal and transversal arch relation allows this. The position of the tooth that represents the largest masticatory unit ("first molar position") can be determined very precisely using a profile compass and a set square (Fig. 9). The contour of the mandibular alveolar ridge is best drawn with a profile compass. Here it is important that it is at right angles to the alveolar ridge contour and is then "traced".

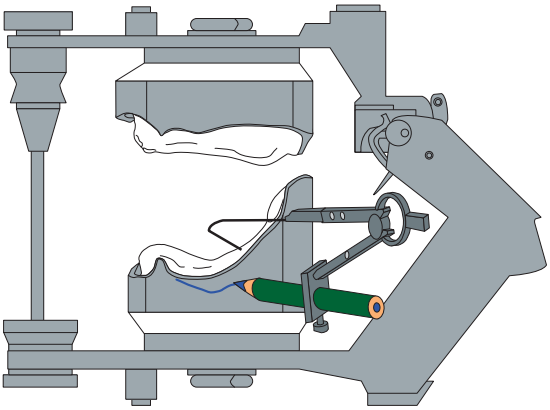


Fig. 9 Drawing the alveolar ridge contour

The lowest point of the alveolar ridge is determined with the aid of a tanget - parallel to the occlusal plane. The meeting point of these two lines denotes the position of the largest masticatory unit and is marked with a vertical line (first molar position). In addition, two vertical lines are drawn approx. 1 mm mesial and distal of this marking. They mark the functional loading area of the largest masticatory unit, i.e. the position of the centric fossa (Figs. 10, 11).

The marking of the largest masticatory unit of the mandible is transferred to the outer model edge of the maxilla, preferably using a set square (Fig. 12).

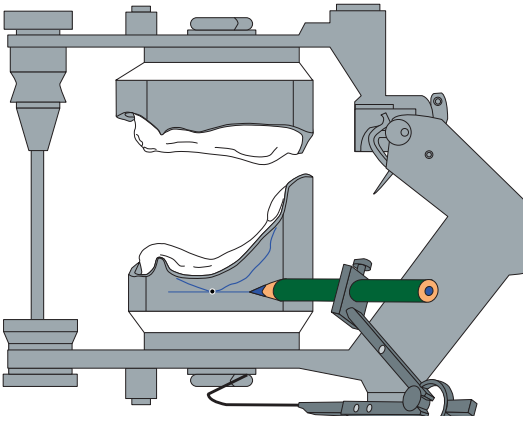


Fig. 10 Drawing a parallel to the occlusal plane

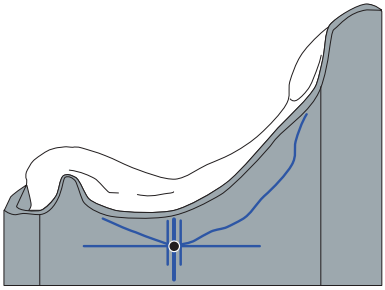


Fig. 11 Marking for the largest masticatory unit (first molar position) and its tolerance range

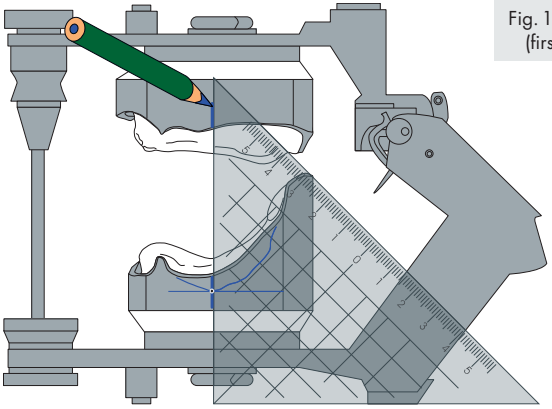


Fig. 12 Transferring the marking for the largest masticatory unit (first molar position) to the maxilla

5th STEP DETERMINATION OF THE DISTAL MOST LOADABLE TOOTH (STOP LINE)

The intersection point between the alveolar ridge contour and the marked parallel to the occlusal plane denotes the position of the largest masticatory unit. An angle template of 22.5° (Lerch, Körholz) or 25° (Stuck) is placed at this point. This is necessary to achieve approximate parallelism between the horizontal condylar inclination (HCI) and the protrusion faces of the posterior teeth. The set-up ends at the intersection point between the alveolar ridge contour and the applied angle (22.5° in this case) to avoid the mandible sliding forwards. If the contour of the alveolar ridge is so flat that an intersection point cannot be formed with the 22.5° angle template, the tooth set-up ends at the start of the retromolar pad. However, if a tooth were to be set up behind the stop line, it would stand on a more inclined area in relation to the HCI. To take up the intercuspidation position (ICP), i.e. terminal occlusion with the max. multi-point contact, the mandibular denture was then consistently pushed forwards and downwards. Gerber terms this phenomenon anterior sliding (Fig. 13).

The markings for the first molar position and the stop line are transferred to the functional ridge. This takes place perpendicular to the midpoint of the alveolar ridge (Fig. 14).

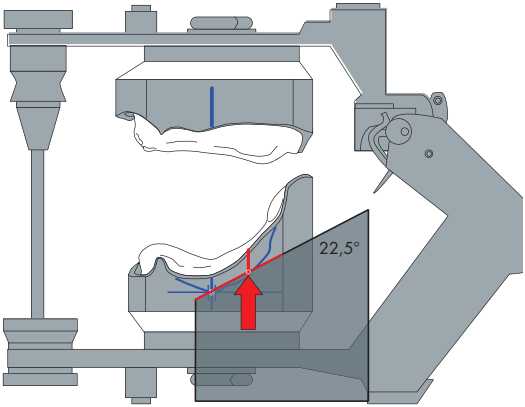


Fig. 13 Identifying the stop line with a 22.5° angle template

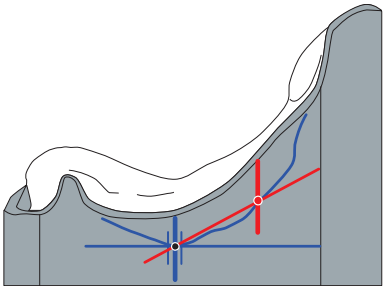


Fig. 14 Stop line

6th STEP OUTER AND INNER CORRECTIONS (Fig. 15)

The maxillary and mandibular dental arches must be aligned with one another. Even during the model analysis, it has to be considered here whether canine-premolar guidance or balanced occlusion (minimum requirement is the "three-point contact") is to be achieved. Generally it is the case that the teeth must not be set too far towards buccal or oral, such that the patient neither bites into the cheek nor on the tongue and the masticatory forces can be absorbed according to the pulling direction of the masticatory muscles.

The function of the **outer corrections** entails locating the common structural and dynamic set-up area, avoiding crossbite set-ups and ensuring cheek support. The function of the **inner corrections** entails creating the maximum possible space for the tongue, the most unimpaired phonetics and also locating the common structural and dynamic set-up area.

The maxillary and mandibular dental arches must be aligned with one another.

if teeth are positioned too far towards buccal or oral, the patient bites

- into the cheek,
- onto the tongue.

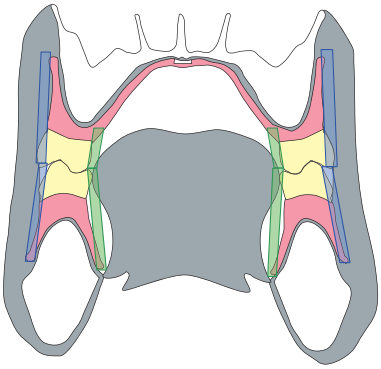


Fig. 15 Cheek support and freedom of tongue movement

6.1. Mandible (Fig. 16, 17)

Outer correction

The contour of the outer correction depends on the space identified from the stop line (distal-most loadable tooth). It defines the vestibular position of the lower buccal cusp.

If there is sufficient space to place a second molar or premolar, it passes through the first premolar position and the buccal limit of the retromolar pad. However, this constricts the tongue space, as this outer correction line extends very close to the basic statics and the teeth may, under certain circumstances, be set far into the lingual space (Fig. 16).

If, according to the stop line, it has been established that no tooth can be placed behind the position of the largest masticatory unit, then the outer correction passes through the first premolar position, but now through the marking point for the largest masticatory unit, the first molar position
(Fig. 17).

Inner correction

It passes from the first premolar position to the lingual limit of the retromolar pad; the line is drawn to the outer surfaces of the model. To ensure sufficient freedom of tongue movement, the inner correction in the maxilla describes the maximum lingual position of the central fossa.

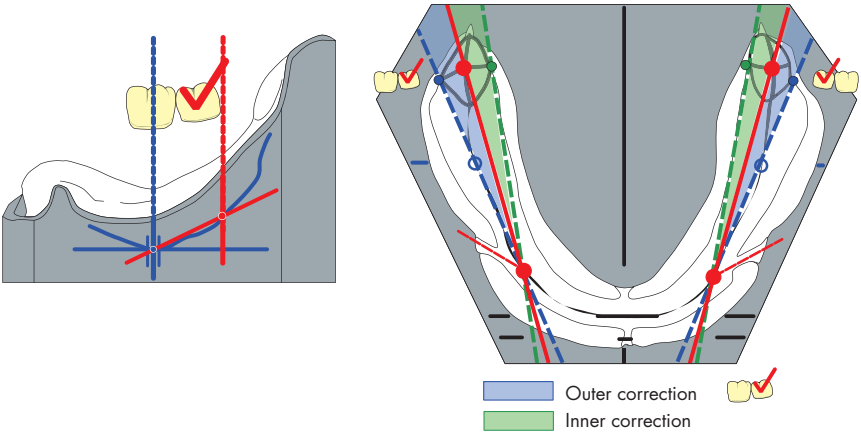


Fig. 16 Mandible - inner and outer correction given sufficient space for a second molar or premolar

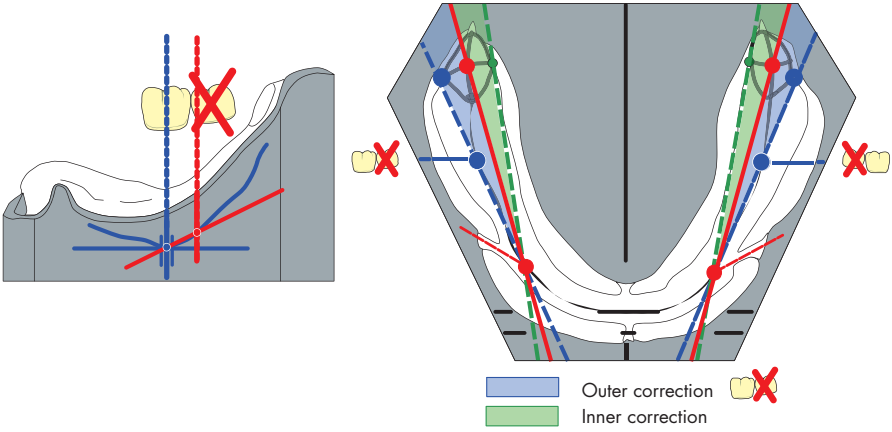


Fig. 17 Mandible - inner and outer correction given restricted space conditions; the decision was made against placing a second molar or premolar.

6.2. Maxilla (Fig. 18, 19)

Outer correction

The outer correction in the maxilla marks the contact area of the upper buccal cusps. Should they exceed the marking of the outer correction, they have to be placed out of contact in order to avoid levering or tipping of the denture.
Two techniques are possible for identifying the maxillary outer correction:

Lingualized occlusion according to Prof. Gerber (Fig. 18)

According to the recommendation of Prof. Gerber, who restricted the exclusive structural function of the maxillary teeth to the palatal cusps, the outer correction passes through the first premolar position and through the first molar position transferred from the mandible (largest masticatory unit). The line is also marked on the outer surfaces of the model. This outer correction offers the greatest scope towards vestibular and is therefore the most favourable alternative for the masticatory function and the freedom of tongue movement, as well as cheek support. This particularly applies for canine/premolar guidance. However, only a slender antagonistic support area is available during laterotrusion.

Balancing (Fig. 19)

If the upper buccal cusps are brought into contact during laterotrusion, this line runs along the straight vestibular limit of the alveolar ridge to the mucolabial fold. All the teeth that extend beyond this outer correction line then have to be placed out of contact. This line is also marked on the outer surfaces of the model.

Inner correction

It passes from the first premolar position to the so-called pterygomandibular fold; this line is drawn to the outer surfaces of the model. The inner correction marks the palatal limit for the position of the central fossa.

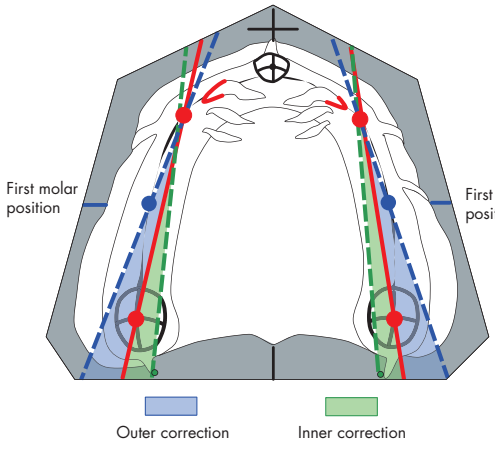


Fig. 18 Maxilla - inner and outer correction according to Prof. Gerber

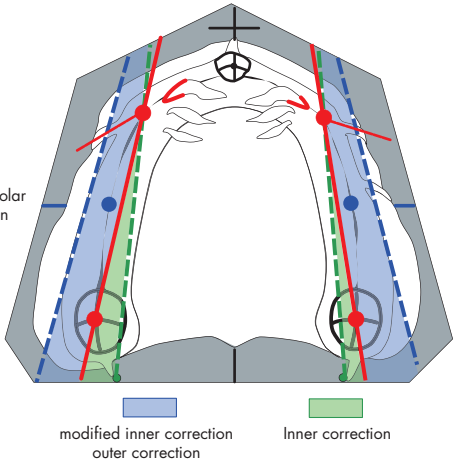


Fig. 19 Maxilla - inner correction with modified outer correction to achieve balance

7th STEP DETERMINING THE COMMON SET-UP AREAS BETWEEN THE MAXILLA AND MANDIBLE

As a result of the model analysis, twelve lines are transferred frontally and dorsally to the outer surface of the model respectively. The frontal lines (basic statics, outer and inner correction) remain how and where they are (Fig. 20).

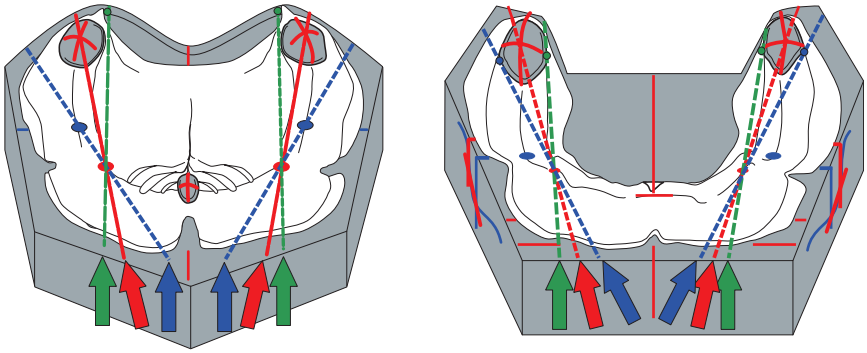


Fig. 20 Frontal markings of the basic statics, inner and outer corrections

To define the definitive dorsal set-up lines, the models placed in the articulator have to be viewed from behind (Fig. 21). This is a procedure lasting just a few seconds. On the one hand, it serves to achieve structurally favourable alignment of the maxillary and mandibular posterior dental arches, and to support the cheek and allow freedom of tongue movement, on the other.

The common dorsal basic static lines are defined by averaging the maxillary and mandibular left and right basic statics lines in order to be able to evenly distribute the load on the alveolar ridges, as follows:

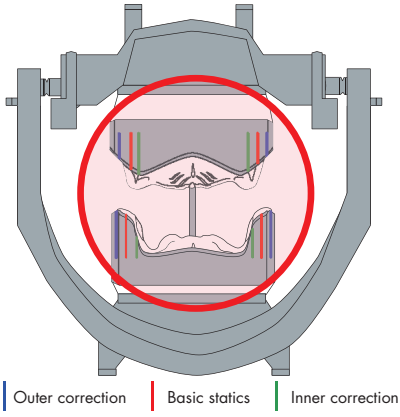


Fig. 21 Dorsal markings of the basic statics, inner and outer corrections

7.1. Common basic statics

The distances between the maxillary and mandibular basic statics are halved on the left and on the right side (Fig. 22) and a line is drawn from the top to the bottom (or vice versa). Averaging/halving the basic statics distances result into the common basic statics, which are best marked with a small notch for placing a rubber band. The markings on the frontal outer surfaces of the model remain as fixed points.

The common basic statics in the maxilla represent the ideal line for the position of the palatal cusps; in the mandible it defines the ideal line of the central fossa. It therefore takes the differing atrophy of the jaws into consideration. The maxilla is subject to atrophy from the outside to the inside, the mandible to atrophy from the inside to the outside. The replacement teeth are then set approximately at the original positions of the natural teeth.

7.2. Common outer and inner correction

The line that lies closest to the basic statics previously determined is always essential for the common area of the dorsal outer correction (Fig. 23) and dorsal inner correction (Fig. 24).

Outer correction (Fig. 23)
This line is the vestibular limit of the maxillary and mandibular buccal cusps respectively. If it is exceeded in the maxilla, the cusps have to be placed out of contact in order to avoid levering or tipping of the denture.

Inner correction (Fig. 24)
It limits the position of the palatal cusps in the maxilla; in the mandible it marks the maximum lingual line of the central fossa in order not to restrict the tongue.

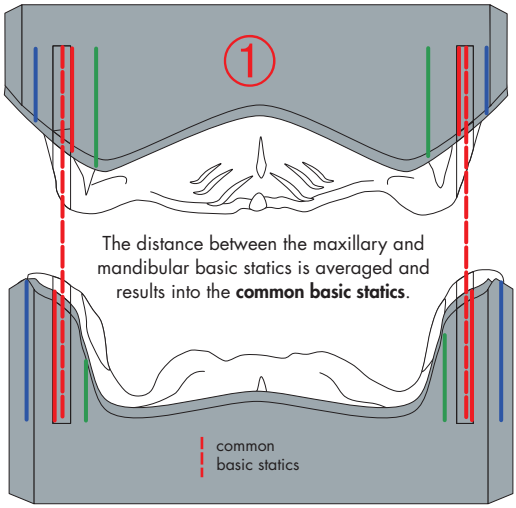


Fig. 22 Defining the common basic statics by averaging

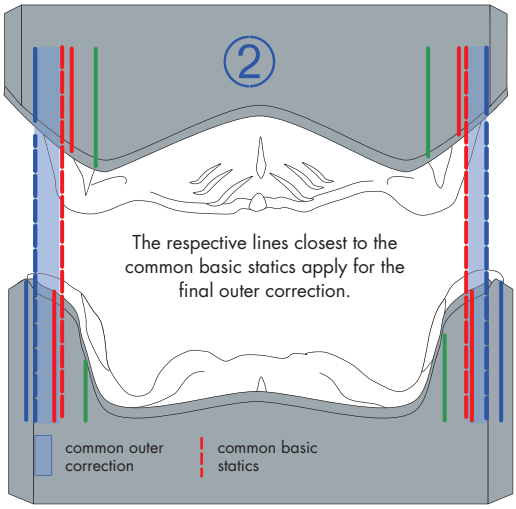


Fig. 23 Identifying the final outer correction

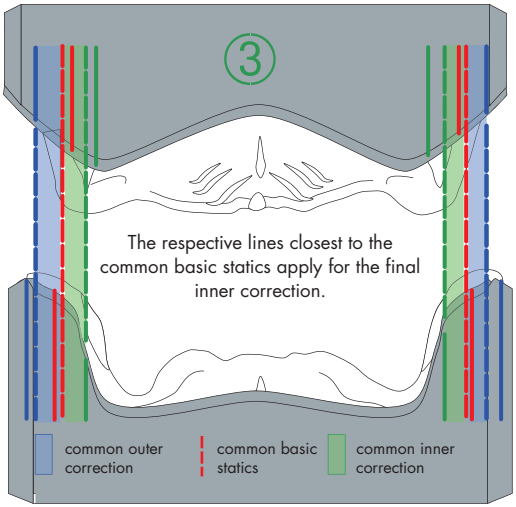


Fig. 24 Defining the final inner correction

8th STEP DEFINING THE DEFINITIVE SET-UP LINE

Ideally, the outer and inner corrections for the maxilla and mandible are symmetrical to each other, the positional stability is ensured without problems. However, this is rarely the case for patients who have been treated with full dentures over a long period. The lowest common denominator has to be found for the areas, as described in the 7th work step of the model analysis. The distance between the maxillary and mandibular basic statics is averaged by halving. This applies in the same way for the outer and inner corrections. The common basic statics associated with the respective first premolar positions can be used here as the definitive set-up line in the sense of a main static reference line, but it takes the differing (transversal) atrophy of both jaws into consideration.
Reference is made to the detail figure (Fig. 25) to illustrate this.

Furthermore, there is now the possibility of deciding to undertake a shift in the definitive se-tup line towards buccal or oral within the common set-up area. However, it must be taken into account that an area (e.g. the common outer correction) increases, but another area (e.g. the common inner correction) decreases.
The decision-making criteria

- asymmetry in the contour of the alveolar ridges
- freedom of tongue movement
- cheek support
- positional stability and
- balanced occlusion or canine-premolar guidance.

Figure 26 shows the situation in which the upper basic statics (= ideal line for the transversal position of the maxillary palatal cusp) lies outside the common set-up area.
This clearly illustrates the importance of determining the common basic statics and the common outer and inner correction, because, with the exception of extreme situations, a common area can be defined for use in supporting the maxillary and mandibular denture. If only one jaw were to be selected as a static reference area, e.g. in the form of the alveolar ridge midlines, firstly a crossbite set-up would probably be necessary, and secondly the transversal resilience of more atrophied jaws would not be taken into account sufficiently. Nevertheless, often only while setting up the posterior teeth can it be ascertained from which tooth onwards the buccal cusps exceed the common outer correction and have to be placed out of contact to avoid tilting moments.

Figure 27 shows an extreme situation, almost indicative of crossbite. Here it has to be assumed that there is no contact during extrusion movements from the second premolar onwards. With regard to preserving freedom of tongue movement, only premolars would be placed in the mandible, the maxillary posterior teeth only have contact with their palatal cusps.

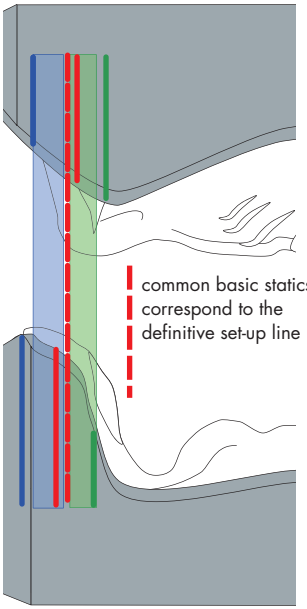


Fig. 25 1st case - Definitive set-up line

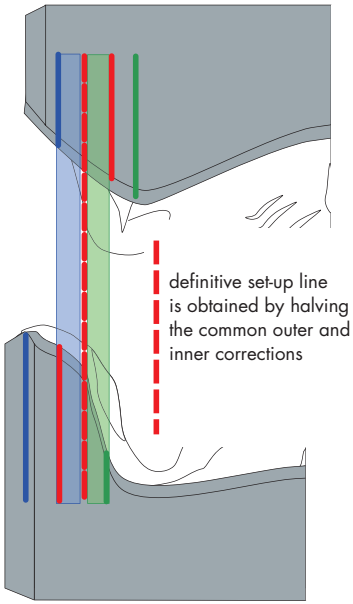


Fig. 26 2rd case - Definitive set-up line

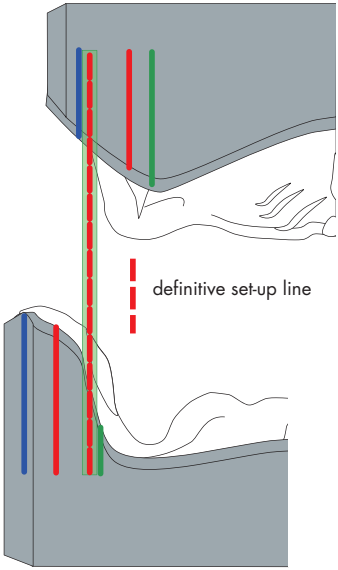


Fig. 27 3rd case - Definitive set-up line

PART II SETTING UP THE TEETH

Following the model analysis, defining and marking the static set-up lines on the outer surfaces of the model, the wax set-up is carried out. The following brief description of the procedure is also based on the book quoted 'Total prosthetics in function' from Karl-Heinz Körholz (Quintessenz Verlag, Berlin 1999).

GENERAL PRINCIPLES OF THE TOOTH SET-UP

Setting up the mandibular anterior teeth can be undertaken in three ways:

- on the patient, this also applies for the maxillary anteriors
- after the maxillary anterior teeth according to the dentist's aesthetic requirements with the aid of the bite template
- before the maxillary anterior teeth according to averaged aspects, insofar as cosmetic and phonetic information is not available.

The mandibular posterior teeth are set-up before those in the maxilla. It is generally recommended to place the teeth in pairs, as this makes (self) checking far easier. The risk of one side of the jaw "hanging", which ultimately represents the "positional setting" for the opposing jaw, is minimised.

Articulators, model mounting and tools

This method of tooth set-up can be applied independently of a particular articulator system. Suitable articulators include Artex, Artist, Atomic, Balance, Contact, Condylator, Dentatus, Finess A-C, Handy II M, Protar, Rational, SAM, Simplex 2000 and Stratos 200.

The model can be mounted according to the occlusal plane, ideally with a thin, round elastic thread or rubber sewing thread, a maxillary model positioner specific to the articulator or with the aid of a face bow.

Setting up full dentures according to 'Total prosthetics in function' requires no expensive tools, no calottes, set-up benches etc., but very simple and useful utensils:

- thin, round elastic thread or rubber sewing thread
- four burrs or similar
- two approx. 10 cm long wire ends (only for integral®)
- set square
- small sliding caliper
- 9° angle template (e.g. cardboard) for integral® of sizes S, L and M or a 6° angle template for integral® size XS and all artegral® sizes (TiF angle template REF 1090390).

Static lines

The definitive set-up line (common, final basic statics) represents an ideal line, which takes the differing atrophies of the alveolar ridges into account. In the mandible it marks the ideal line of the central fossa, with the exception of the mandibular first premolar. In the maxilla it marks the ideal position of the palatal cusps, in this case with the exception of the first premolar.

The common, definitive outer correction defines the vestibular limit of the maxillary and mandibular buccal cusps. If they are exceeded in the maxilla, the cusps on the vestibular line have to be placed out of contact in order to avoid levering or tipping of the denture. At this point a reminder is given about the contour of the outer correction for both variants. In the case of a Gerber-oriented se-tup, the maxillary outer correction passes through the premolar and first molar positions. However, if the aim is to balance the dentures, the contact area for the maxillary buccal cusps has to be expanded further. For this reason it runs along the straight section of the (lateral) buccal alveolar ridge in this case.

The common, definitive inner correction limits the maximum lingual line of the central fossa in order not to restrict the tongue. Accordingly, the mylohyoid line (linea mylohyoidea) can be taken for lingual checking of the mandibular posterior teeth, on the one hand, and also the Pound line, on the other. In order to ensure sufficient free space for the tongue, the posterior teeth may touch this line, but not exceed it lingually.
In the maxilla, the definitive inner correction marks the position of the palatial cusps - this is also absolutely necessary to ensure sufficient tongue space.

The procedure described as follows relates to an averaged, static set-up, assuming no relevant information is available on the bite templates, order slip etc.

MANDIBULAR SET-UP

The posterior set-up starts with the mandible; the variants stated above apply for the anterior teeth.

Mandibular central incisors

Their basal surfaces are above the midline of the alveolar ridge, for an averaged cosmetic and phonetic set-up the labial areas extend at maximum to the middle of the labial mucolabial fold (Fig. 28). Once the maximum position of the labial areas has been measured during the model analysis and noted on the front side of the model, this value can be set and checked with the aid of a sliding caliper. This applies in the same way for the position of the basal areas above the midline of the alveolar ridge. The imprecise location by eye is no longer necessary, the result of checking is therefore far more precise and easier to understand. This labial limitation is important to avoid levering of the denture while biting with the anterior teeth. Viewed from labial, the incisal surfaces lie on the level of the occlusal plane (Fig. 29). From an approximal perspective, all the incisal edges of the central incisors point to the maxillary mucolabial fold (Fig. 30).

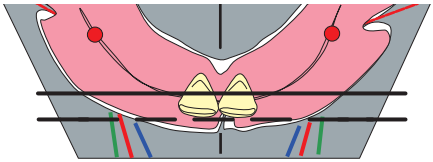


Fig. 28

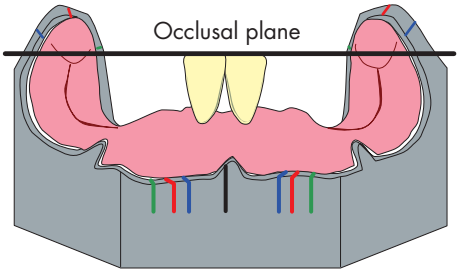


Fig. 29

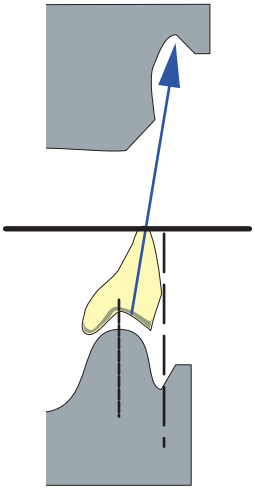


Fig. 30

Mandibular lateral incisors

Their set-up is undertaken in a similar way as with the central incisors. Their basal surfaces too are above the midline of the alveolar ridge, for an averaged cosmetic and phonetic set-up the labial areas also extend at maximum to the middle of the labial mucolabial fold (Fig. 31). The occlusal plane is the vertical specification for the position of the incisal edges from the labial view, as applicable to the same extent for the central incisors (Fig. 32). Attention has to be paid in the approximal view that the tooth neck protrudes slightly more labially than is the case with the central incisors (Fig. 33).

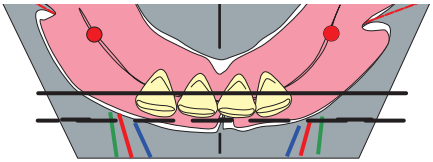


Fig. 31

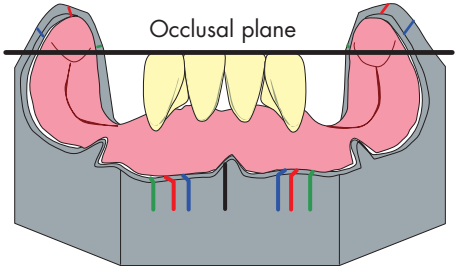


Fig. 32

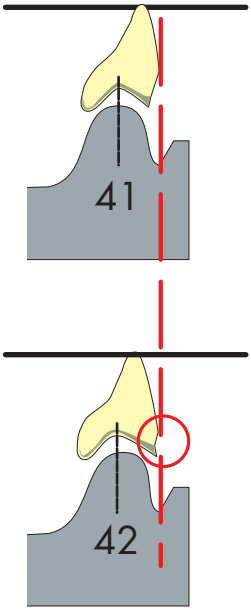


Fig. 33

Mandibular canines

The basal surfaces of the canines stand slightly in front of the midline of the alveolar ridge (Fig. 34). The labial surfaces are inclined lingually (Fig. 35), which is easy to check in the approximal view. The canine tips protrude the occlusal plane by approx. 1 mm (Fig. 36). The distal incisal edges are aligned to the buccal limit of the retromolar pad (retromolar triangle), alignment to the definitive set-up line is ideal (Fig. 37).

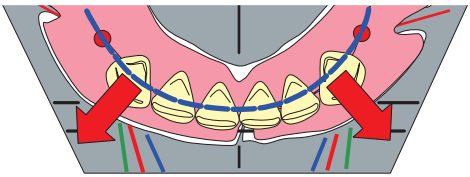


Fig. 34

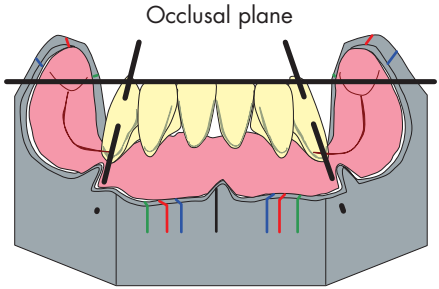


Fig. 35

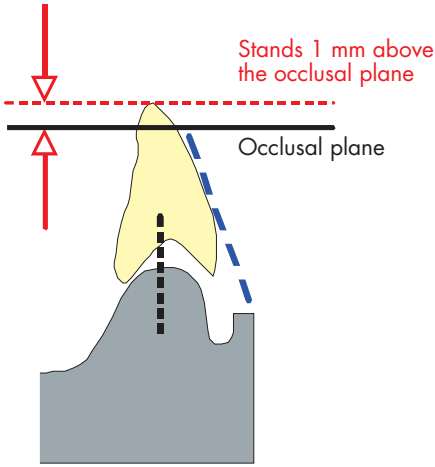


Fig. 36

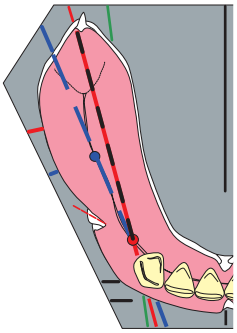


Fig. 37

A harmonious, semicircular anterior or incisal edge arch should be strived for when setting up on training and phantom models that usually have an even frontal alveolar ridge arch. Individualisation can be achieved by slight rotation and inclination. These irregularities are not uncommon for patient set-ups based on static phonetic and aesthetic information.

Mandibular first premolars

Given correct tooth selection, the mandibular first molars are placed without gaps immediately behind the canines on the "first premolar position" (Fig. 38). Like the canines, they are inclined slightly lingual so their buccal faces lie along a line (Fig. 39). Viewed from buccal, the first premolars are (almost) perpendicular to the occlusal plane and also protrude it by approx. 1 mm (Fig. 40). From an occlusal view, the definitive set-up line runs between the buccal cusp and the "central fossa" of the first premolar, which is known not to have any mesio-distal continuous fissure. This is important statically, as the central fossa of the first premolars is not in the middle of the occlusal surface (Fig. 38).

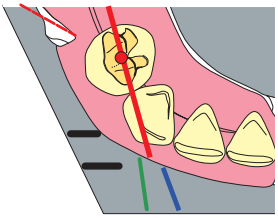


Fig. 38

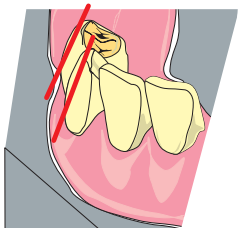


Fig. 39

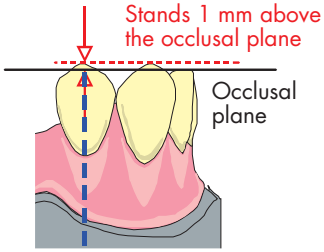


Fig. 40

Mandibular second premolars

The same criteria apply in principle for the second premolars as for the first. The buccal face lies on a line with that of the first premolar. The tooth is perpendicular to the occlusal plane. The essential differences are: The central fossa lies exactly on the contour of the definitive set-up line (Fig. 41). The buccal cusp tips lie exactly on the height of the occlusal plane such that the set-up rubber covers the buccal tip. This means that the second premolars are approx. 1 mm lower and therefore stand more towards the alveolar ridge than the first premolars (Fig. 42). The especially pronounced and notably mesio-lingual cusps of the second premolars are higher than the lingual cusps of the first premolars – this results in a step set-up in association with the molars. According to Peter Lerch, this is particularly important for protrusive support (Fig. 43).

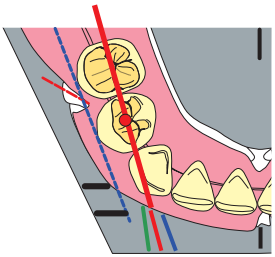


Fig. 41

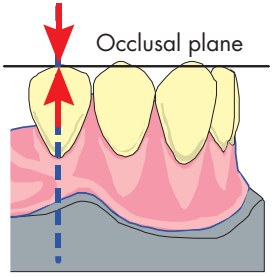


Fig. 42

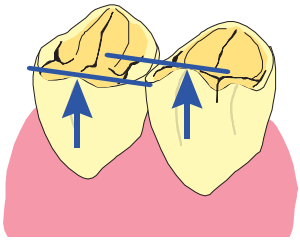


Fig. 43

Mandibular first molars

The mandibular first molars are structurally and functionally the most important teeth of the set-up. It is not without good reason that they are known as the largest masticatory unit or masticatory centres. Their position is determined as the "six position" during the model analysis already. The definitive set-up line has to pass through the centric fossa of the mandibular first molars (Fig. 44).

The mandibular first molar is at the "six position", during the model analysis the limit line was defined for the last tooth to be set up. It may very pertinently be termed the "stop line". To check the spatial conditions, the molar can firstly be waxed on to check whether its mesio-distal width in relation to the position of the stop line justifies placement of the second molar. This is the right time to determine whether the first molar is the second last or the last tooth (Fig. 45).

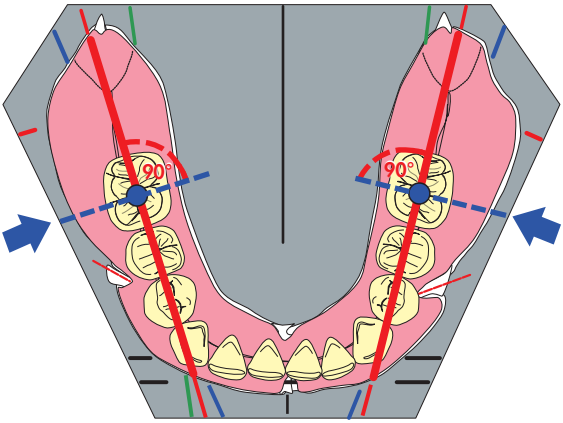


Fig. 44

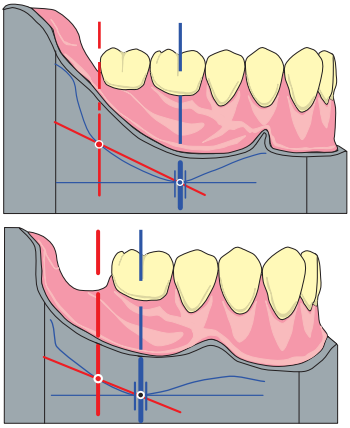


Fig. 45

If the first molar is the second last tooth of the set-up, then it is placed on the occlusal plane with its mesio-buccal cusp. The disto-buccal cusp only just protrudes the occlusal plane, i.e. less than this is the case for the mandibular first premolar (Fig. 46).

If no further posterior tooth can be placed due to the position of the stop line, the first molar is therefore the last posterior tooth to be placed and then its disto-buccal cusp protrudes the occlusal plane. For average set-ups or set-ups for training jobs, the disto-buccal cusp protrudes the occlusal plane by approx. 1 mm. This serves to ensure protrusive support of the dentures (Fig. 47).

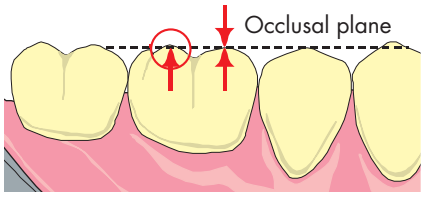


Fig. 46

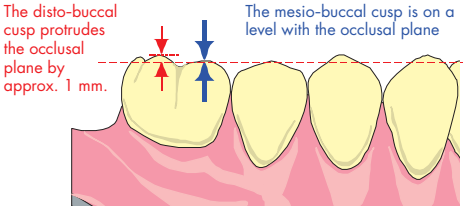


Fig. 47

A small step arises in each case in the area of the approximal marginal ridge and the lingual cusp from the premolar and first molar, which corresponds to the natural dentition (Fig. 48). The step set-up already described allows protrusive support, the equator of the tongue must also not be restricted. This in turns prevents the tongue being bitten during closure of the jaws (see Lerch,P.: Die totale Prothetik. Berlin 1986).

integral®

integral® is a fully anatomically shaped tooth (30° molar) with the corresponding steepness of the lingual cusps. In order to use the tooth in full denture treatment, the molars have to be transversally inclined to the occlusal plane by 9° (± 1°) (this applies to the first as well as the second mandibular molars) depending on the size of the set for the sizes S, M and L or by 6° (± 1°) for the size XS. This serves to achieve even steps and the associated protrusive support. A very easy-to-produce angle template or the ready-made angle template from Merz Dental (REF 1090390) is used for this purpose (Fig. 49).

The 9° or 6° inclination of the integral® molars produces the same size angle transversal to the occlusal plane in each case. In conjunction with the maxillary palatal cusps, it allows balancing with articulation movements. The inclination of the molars can be checked in a simple and effective way by placing burrs transversally over the molars. It is important, however, that the angle template is held perpendicular to the central fossa of the molars.

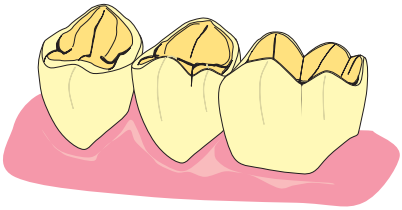


Fig. 48

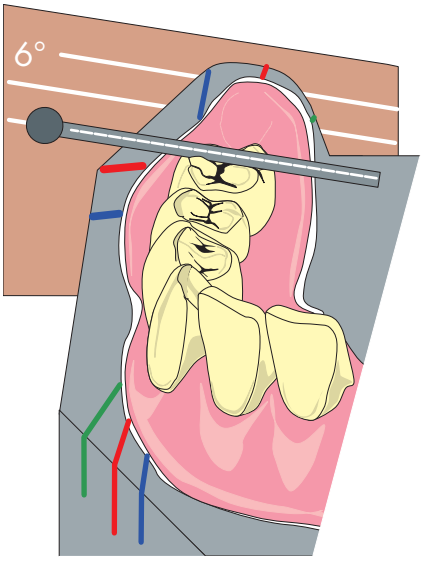


Fig. 49 Angle template with the burr test
9° for integral® L, M and S
6° for integral® XS and artegral® (all sizes)

Checks only for integral®

In order to be in a position to check the transversal alignment of the first molars with respect to their even spacing to the occlusal plane, in place of the burrs, an approx. 10 cm long wire is placed transversally over the occlusal molar surfaces (Fig. 50), then the articulator is carefully closed. To ensure that the first molars are not below the occlusal plane, on closing the articulator the checking wire placed touches the occlusal plane (= thin, round elastic thread or elastic rubber sewing thread) evenly on both sides (Fig. 51).

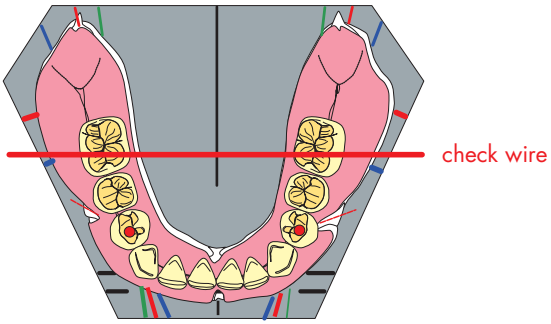


Fig. 50

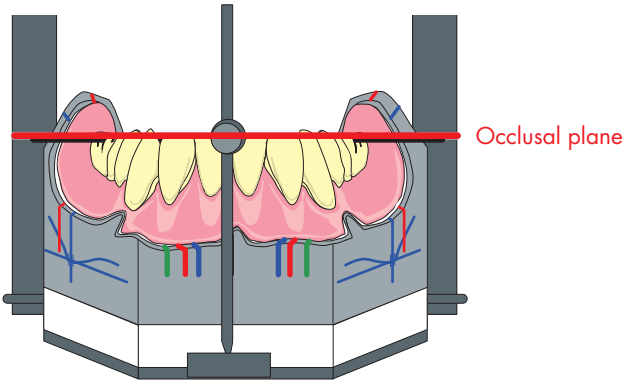


Fig. 51

artegral®

artegral® is also a fully anatomic posterior tooth, but its cusp inclination is only 25°. Therefore, only the 6° angle template (REF 1090390) is used to adjust the molar inclination of artegral® for all sizes. Occlusal burr and check wire tests are not required for the set-up with artegral® posterior teeth.

Mandibular second molars

The same criteria apply in principle for the set-up of the mandibular second molars as for the first molars. The following special features still need to be observed:

- The mesial marginal ridge is at the same height as the distal marginal ridge of the first molars (Fig. 52).
- The mesio-buccal cusp slightly protrudes the occlusal plane.
- The disto-buccal cusp is above the occlusal plane; in an averaged set-up it protrudes the occlusal plane, as well as the first premolar, by approx. 1 mm (Fig. 53).

integral®

Here a burr test is performed as with the first molars. If the central fossae of the molars of the same quadrant are aligned according to the definitive se-tup line, the burrs consequently have to lie parallel to one another. Symmetric alignment of the burrs only occurs if the atrophy of the alveolar ridges is the same and there is identical alignment of the definitive left and right set-up line to the anatomic model midpoint (Fig. 54).

Similarly, a set-up or check wire placed transversally over the molars and the articulator is closed carefully. To ensure that the second molars are not below the occlusal plane with the articulator closed, the wire evenly touches the thin, round elastic thread or elastic rubber sewing thread (representing the occlusal plane) on both sides. The same principles apply here as with the first molars. To check the second molars, it is recommended to also place a wire transversally over the first molars.

artegral®

The occlusal burr test is not applicable for artegral®. As a result of the transversal masticatory surface morphology, there is no symmetry. This renders the burr and wire placement wire tests superfluous.

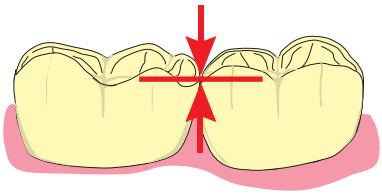


Fig. 52

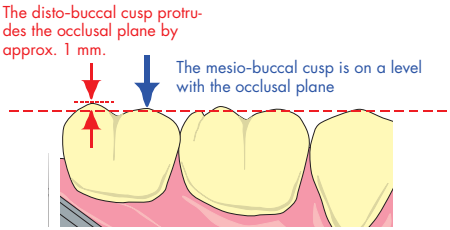


Fig. 53

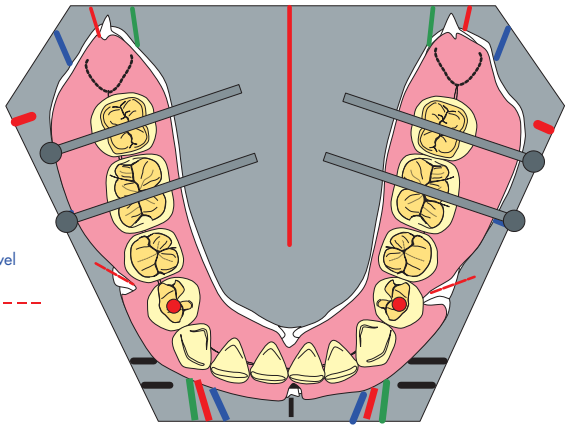


Fig. 54 Occlusal burr test only for integral®

MAXILLARY SET-UP

MAXILLARY SET-UP

The presentation of the maxillary set-up also follows averaged, structural criteria.
The maxillary anterior teeth can be set up before or after the mandibular teeth, i.e.

- on the patient
- before the mandibular anterior teeth according to the dentist's aesthetic requirements with the aid of the bite template or
- after the mandibular anterior teeth according to the averaged aspects, insofar as cosmetic and phonetic information is not available.

The maxillary posterior teeth are set-up after the mandibular posterior teeth. As with the mandible, it is recommended to set up the teeth in pairs, i.e. not to set up one side completely and then the other.

The sequence of the maxillary set-up according to averaged, structural aspects, is as follows and is described in the same order:

1. first molars
2. second molars
3. first premolars
4. second premolars
5. canines
6. central incisors
7. lateral incisors

The presentation of the posterior set-up relates to the static and dynamic contact relationships using integral® and artegral®.

Maxillary first molars

The posterior set-up starts with the statically most important tooth. This tooth is at the first molar position transferred from the mandible. Ideally, the mesio-palatal cusp of the first molar should be above this point, as the mandibular first molar with its centric fossa has been placed at the first molar position (Fig. 55).
Firstly the centric contacts are established and checked, then the protrusion is examined, followed by laterotrusion and finally mediotrusion.

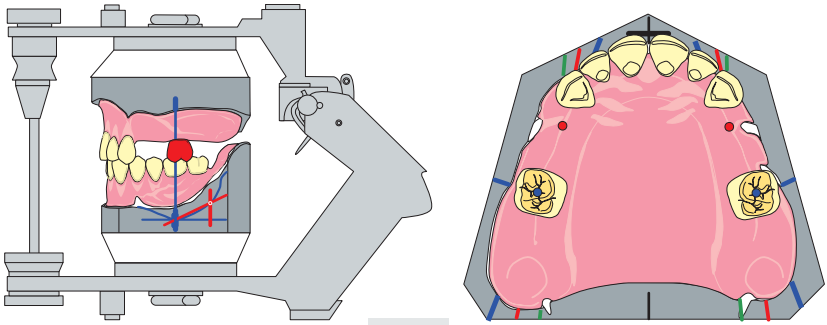


Fig. 55

Centric contacts
Optimal structural support is always in the form of a tripod contact, i.e. the mesio-palatal cusp of the maxillary first molar contacts with the centric fossa of the mandibular. The disto-palatal cusp can have contact with the distal marginal ridge of the mandibular first molar (Fig. 56). Buccal contacts are only allowed if they are enabled by the model analysis, in this case particularly with regard to the definitive outer correction.

Protrusion contacts
The upper mesio-palatal cusp slides on the disto-lingual cusp of the mandibular first molar; the protrusion distance supported is approx. 2.5-3 mm (Fig. 57).

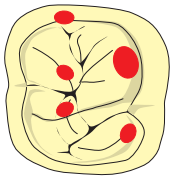


Fig. 56

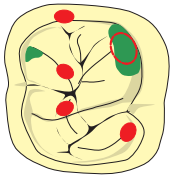


Fig. 57

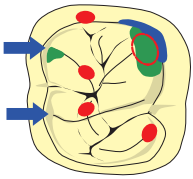


Fig. 58

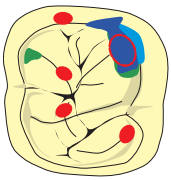


Fig. 59

Laterotrusion contacts
The upper mesio-palatal cusp slides on the lingual cusps, especially on the mesio-lingual cusp of the mandibular first molar (approx. 1-1.5 mm). Provided buccal contacts are permitted in centric/static occlusion (see model analysis), the maxillary buccal cusps slide through between the mandibular buccal cusps (Fig. 58).

Mediotrusion contacts
The maxillary mesio-palatal cusp slides on the inner lingual incline for a distance of approx. 1-1.5 mm. Provided buccal contacts are permitted in centric/static occlusion (see model analysis), the disto-palatal cusp slides on the lingual incline of the mandibular second molar (Fig. 59).

Maxillary second molars

The set-up of a second upper molar depends on the position of the stop line, which was determined during the model analysis. However, if a tooth were to be set up behind this line, it stands on a highly inclined area in relation to the horizontal condylar inclination (HCI). The mandible would then always be pressed forwards and downwards on taking up terminal occlusion (Fig. 60). Prof. Gerber terms this phenomenon anterior sliding. If there is too little space, instead of the second molar, a premolar could be placed in each case to avoid anterior sliding. This is certainly not disadvantageous in the non-visible posterior region and is always functional.

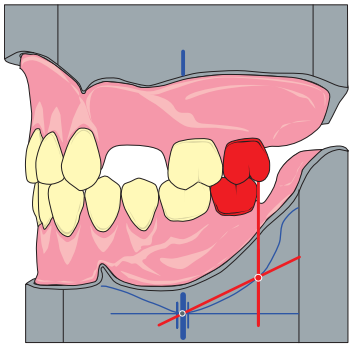


Fig. 60

The second maxillary molar is set up in the same way as the first. Checking the centric stops and the extrusion movement is almost identical: The mesio-distal cusp is always in contact with the mandibular centric fossa of the second molar, which does not apply for crossbites, however. A tripod contact can be achieved (Fig. 61).

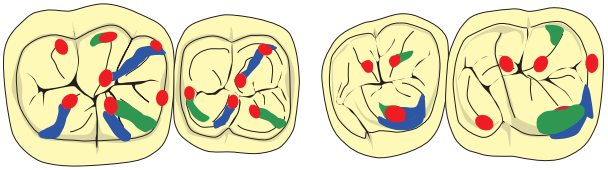


Fig. 61

The second molars are subordinate to the first molars in extrusion movements, i.e. they "accompany" their guidance, but do not take over.

Maxillary first premolars

The position of the maxillary premolars is determined by the "first premolar position" from the model analysis. It is almost perpendicular to the occlusal plane and with its pronounced youthful buccal face clearly covers the mandibular first premolar, such that the integral® also allows premolar guidance. On the other hand, artegral® has a less anatomically shaped buccal face, so grinding is usually not necessary. The maxillary first premolar occludes in a tooth-to-tooth relationship, however visually it appears like tooth-to-two teeth occlusion (Fig. 62).

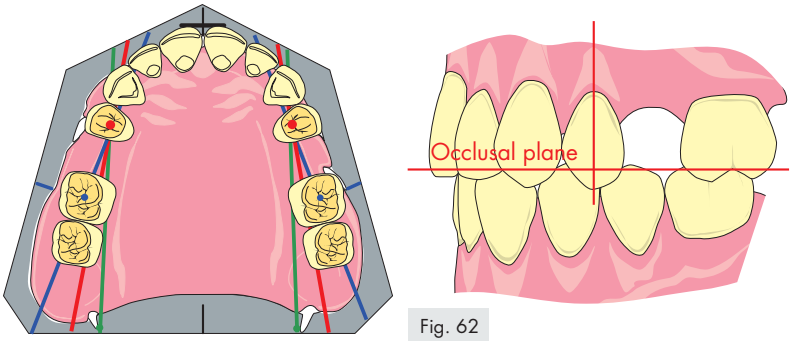


Fig. 62

Centric contacts
Only the mandibular buccal cusp has a tripod contact with the mesial fossa of the maxillary first premolar.
The palatal cusp does not occlude at all with the mandibular premolar (Fig. 63).

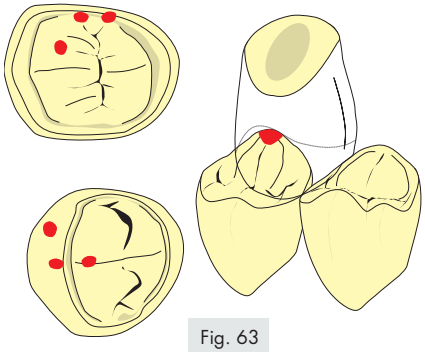


Fig. 63

Protrusion contacts
The protrusion of the mandibular first premolar is via its outer disto-buccal incline and the mesio-buccal cusp of the mandibular second premolar. At the same time, there is additional contact via the maxillary palatal cusp of the first premolar and the mesio-lingual incline of the maxillary second premolar (Fig. 64).

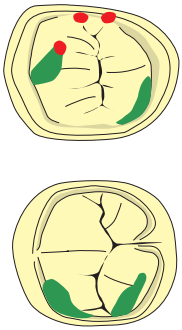


Fig. 64

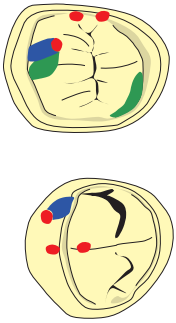


Fig. 65

Laterotrusion contacts
The laterotrusion is via the outer disto-buccal incline of the mandibular first premolar (Fig. 65). To achieve a balance through to molar guidance, for integral® the mesial buccal face of the maxillary first premolar must be adjusted and shortened (Fig. 66); for artegral® this is usually not necessary. The laterotrusion path is approx. 1.5-2 mm.

Mediotrusion is not supported by the first maxillary premolar.

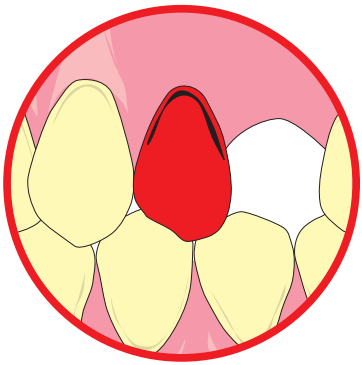


Fig. 66 For integral®: adjustment of the youthful, fully anatomical buccal face

Maxillary second premolars

The tooth is almost perpendicular to the occlusal plane. The second premolar has no pronounced buccal face like the first premolar, so it does not assume any premolar guidance (Fig. 67). Just like the first premolar, the second premolar occludes in a tooth-to-tooth relationship, although visually it appears like tooth-to-two teeth occlusion.

Centric contacts

The mandibular buccal cusp has contact in the mesio-central fossa of the maxillary second premolar. Tripod contact in the mesio-central fossa of the maxillary second premolar is ideal. The palatal cusp of the maxillary second premolar can have contact in the distal fossa of the mandibular second premolar (Fig. 68).

Protrusion contacts

The maxillary second premolar is not supported on its main antagonist during protrusion, but on the mesio-lingual cusp of the mandibular first molar. This support is possible during protrusion if the palatal cusp of the tooth already has disto-central fossa centric contact with the mandibular first molar. Then there is protrusive support on the mesio-lingual cusp of the mandibular first molar (Fig. 69).

Laterotrusion contacts

During laterotrusion, the mesio-buccal cusps of the maxillary and mandibular second premolars slide on one another, provided the model analysis allows for a centric buccal stop (definitive outer correction). The laterotrusion path supported is then approx. 1.5-2 mm (Fig. 70). Additional support can be provided from the mesio-lingual marginal ridge and the mesio-palatal cusp of the mandibular second premolar.

Mediotrusion contacts

As with protrusion, here it is also the case that mediotrusion contact to the mesio-palatal cusp is achieved if there is mesio-central centric contact. Then the palatal cusp slides on the inner distobuccal cusp incline of the mandibular second premolar (Fig. 71). The mediotrusion path is approx. 1.5-2 mm.

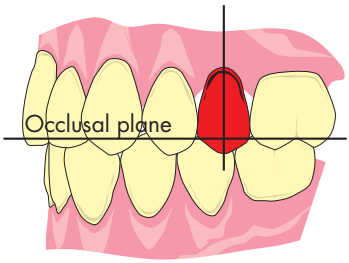


Fig. 67

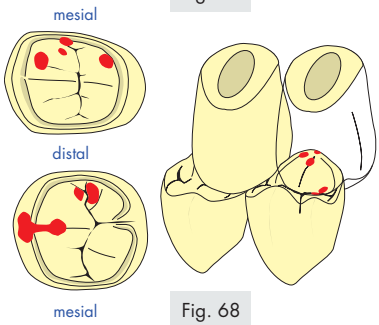


Fig. 68

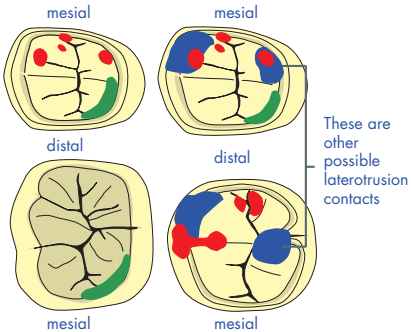


Fig. 69 Fig. 70

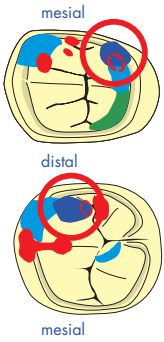


Fig. 71

CHECKING THE POSTERIOR SE-TUP

The posterior set-up follows the definitive set-up line, inner and outer corrections. This should always be checked at the end of setting up a tooth. Here one can ask the following questions, which are actually best answered by the person who set up the teeth:

1. Do the centric fossa of the mandibular molar and the mesio-palatal cusp of the maxillary first molar lie within the tolerance range of the markings for the largest masticatory unit, the masticatory centre (Fig. 72)?

2. Is anterior sliding avoided by observing the stop line (Fig. 72)?

3. Are the centric stop lines OK (Fig. 73)?

4. Balanced full dentures (Fig. 74, left side):
   Is the definitive outer correction (modification) the vestibular limit of the balanced buccal contacts?
   Does the definitive inner correction delimit the position of the maxillary palatal cusp and the mandibular central fossae?

5. Set-up oriented on Prof. Gerber (Fig. 74, right side):
   Do the centric contacts of the molars only lie on the the maxillary palatal cusps? Is the relatively narrow "corridor" to support the sideward movements (definitive outer correction) considered? Does the definitive inner correction delimit the position of the maxillary palatal cusp and the mandibular central fossae?

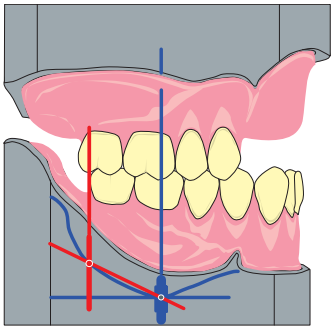


Fig. 72

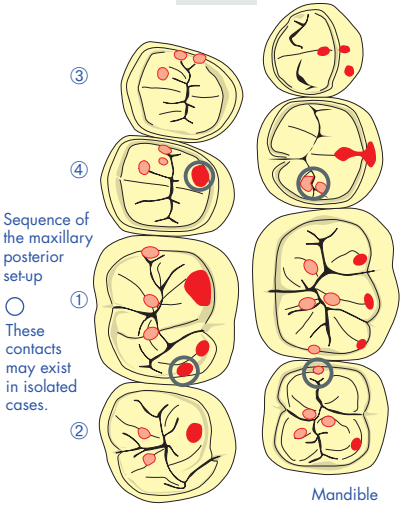


Fig. 73

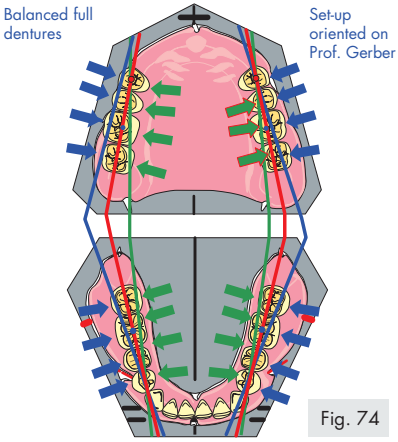


Fig. 74

SET-UP ACCORDING TO THE AVERAGE VALUE PRINCIPLE OF THE MAXILLARY ANTERIOR TEETH

Maxillary canines

The first large pair of palatine rugae points towards the canine position and can be taken as orientation for an averaged set-up (Fig. 75). Viewed from buccal, the tooth is almost perpendicular to the occlusal plane and is orientated on the first premolar. Viewed from frontal, the principle: "Edge in - cervix out" (Fig. 76). The canine is placed with an even sagittal step to the mandibular canine with approx. 1-1.5 mm, i.e. the overbite corresponds to the overjet (Fig. 77).

For balancing, the incisal edge of the maxillary canine is adjusted from palatal and the mandibular canine from labial (Fig. 78). The laterotrusion contacts of the canines should exist for the first and possibly the second molars for around 1.5-2 mm.

Besides balancing, integral® also allows canine-premolar guidance if the extrusion paths of the first premolars and of the canine are not adjusted until they are balanced.

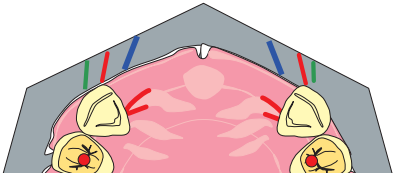


Fig. 75

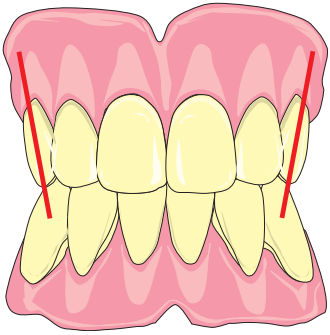


Fig. 76

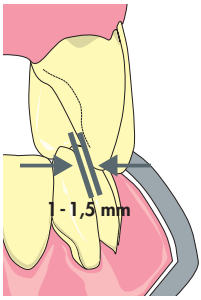


Fig. 77

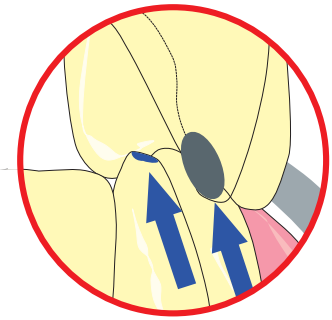


Fig. 78

Maxillary central incisors

With a set-up according to the average value principle, the labial surfaces of the central incisors should be approx. 7-8 mm in front of the middle of the incisive papilla (Fig. 79). There is a sagittal step of approx. 1-1.5 mm, so the overbite corresponds to the overjet. Consequently there is no centric occlusal contact (Fig. 80).

During protrusion, the central incisors should have simultaneous contact with the first molars and possibly the second molars. The protrusion path supported for the central incisors is a maximum of 2-3 mm. They can have contact during laterotrusion, but do not have to (Fig. 81).

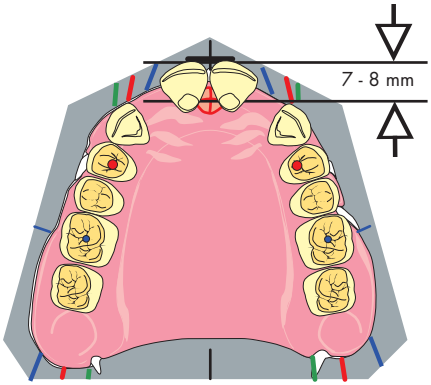


Fig. 79

Maxillary lateral incisors

The lateral incisors are placed harmoniously between the canines and the central incisors. As with the canines and the central incisors, here an even sagittal step of approx. 1-1.5 mm has to be set up. Here too, there is no centric occlusal contact (Fig. 80).

During protrusion, the lateral incisors should also have an effect, i.e. for balancing extrusion movements, slight "twisting" can provide (additional) support, especially if, due to a necessarily large sagittal step place, the central incisors only makes support contact after a long distance (Fig. 82).

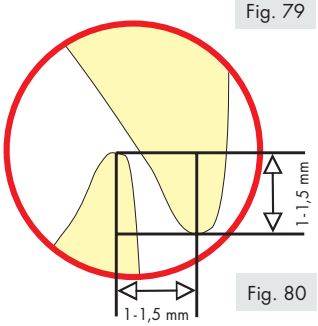


Fig. 80

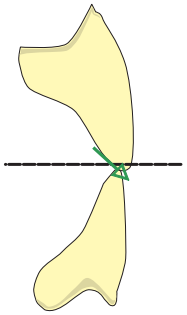


Fig. 81

In case of group guidance, the last maxillary anterior tooth placed must be subordinate to the guidance surface previously achieved, the Fig. 81 second molars (if applicable), the first premolars and finally the second premolars. If the maxillary anterior teeth have been placed before the posterior teeth, the guidance surfaces of the first molars are considered to be "synchronised" with the anterior teeth, then the second molars are placed (where possible), then the first premolars etc.

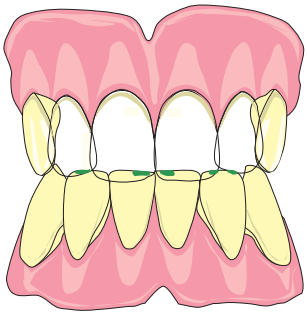


Fig. 82

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