

Occlusion and Restorative Dentistry for the General Practitioner

Part 2—Examination of the Occlusion and Fabrication of Study Casts

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This paper will discuss the specific examination of the occlusion, the making of study casts and special examination methods such as diagnostic waxing and pantographic surveys.

Examination of the occlusion should follow the history taking and general examination described in Part 1. Although it is implied that tooth relationships will be observed, it is imperative that the position of the mandible relative to the maxilla is also considered. The clinical significance of the observations will be considered in Part

Occlusal Relationships

The following should be observed: the intercuspal position, the retruded contact position, the movement between the retruded contact position and intercuspal position, 'slide in occlusion,' lateral contact positions and excursions, protrusive contact positions and excursions and the rest position.

It is important for the practitioner to know where to look and what to look for.

The Intercuspal Position (ICP)

This is the relationship of the mandible to the maxilla when the teeth are meshed maximally together (fig. 15).



Fig. 15.—The intercuspal contact position (ICP). Occlusal relationships—the teeth are in 'the position of best fit.'

Location. The patient is asked to bring his teeth together in 'the position of best fit.'

Observation. The overall arch relationships are noted, recording details of such irregularities as cross-bite and overerupted teeth. Horizontal overjet and overbite should be measured and recorded, especially noting if the upper and lower incisors and canines contact.

The Retruded Contact Position (RCP)

The relationship of the mandible to the maxilla in which initial occlusal contact has occurred following closure about the posterior and most superior rotatory axis of the mandible (fig. 16).

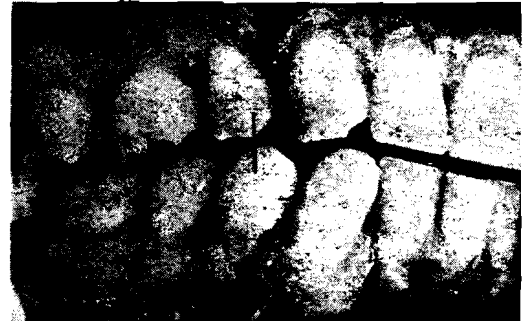


Fig. 16.—The retruded contact position (RCP). Occlusal relationships—tooth contact has occurred following gentle guidance by the dentist so as to position the mandible more posteriorly than in figure 15. Note the position of vertical lines as compared to figure 15.

Location. Many techniques have been described for this procedure, but the most useful is that described by Dawson¹. However slight modifications to Dawson's technique may be necessary to suit individual needs. Patients differ in the relative ease of location of this position and the technique for three stages of difficulty will be described.

Technique for 'easy' patient

The patient is placed in a reclining position in the dental chair and made as relaxed as possible. The head is cradled between the operator's chest and arm to offer stability. The patient should be spoken to calmly and confidently. The thumbs are placed on the chin, and the fingers support the body of the mandible as in figure 17. With slight



Fig. 17.—Technique for locating the RCP for an 'easy patient'—see text for description. The thumbs press gently down on the chin, while the fingers support the body of the mandible. Oscillate the mandible up and down.

downward pressure from the thumbs, and upward pressure from the fingers, the mandible is gently manipulated with oscillatory movements to a position just short of occlusal contacts. When the patient is felt to be relaxed, closure is then continued until initial contact is felt by the patient and he is asked to identify the area of such

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contact. The commonly used method of shaking the mandible violently does nothing more than precipitate fear in the patient and 'a tightening of the muscles' which is contrary to what is required.

Patients who present slight difficulty in manipulation to RCP

The application of the 'tongue spatula technique' is sometimes used. The tongue spatula is placed between the upper and lower teeth as in figure 18 and the patient asked



Fig. 18.—Technique for locating the RCP for a patient with 'slight difficulty in manipulation.' The tongue spatula has been in position for 5 min 'to break up' proprioception. The chairside assistant slowly removes the spatula while the mandible is manipulated as before.

to contact it with the lower incisors. He maintains this position for approximately 5 min, so as to 'break up' proprioceptive reflexes and allow the muscles to 'forget' the habitual position of the mandible. The mandible can then be manipulated as described previously, to open and close against the tongue spatula which is then slowly removed and the patient's jaw closed to initial contact as before.

Patients who present more difficulty in manipulation

It may be necessary to fabricate an anterior jig the function of which is to break up the proprioceptive reflex² (fig. 19).



Fig. 19.—Technique for locating RCP for a 'difficult patient.' The anterior jig (arrowed) has been in place for 15 min and the mandible is now being manipulated.

The equipment needed is: autopolymerising acrylic such as Red Duralay*, petroleum jelly, straight handpiece, tungsten-carbide trimmer†, blue articulating paper.

The technique for making a jig is as follows:

*Duralay Inlay Pattern Resin—Reliance Dental Mfg Co, Worth, Ill, USA 60482 and Cottrell & Co.

†Jotta Burr No 146/22—Cottrell & Co, 15-17 Charlotte Street, London W1.

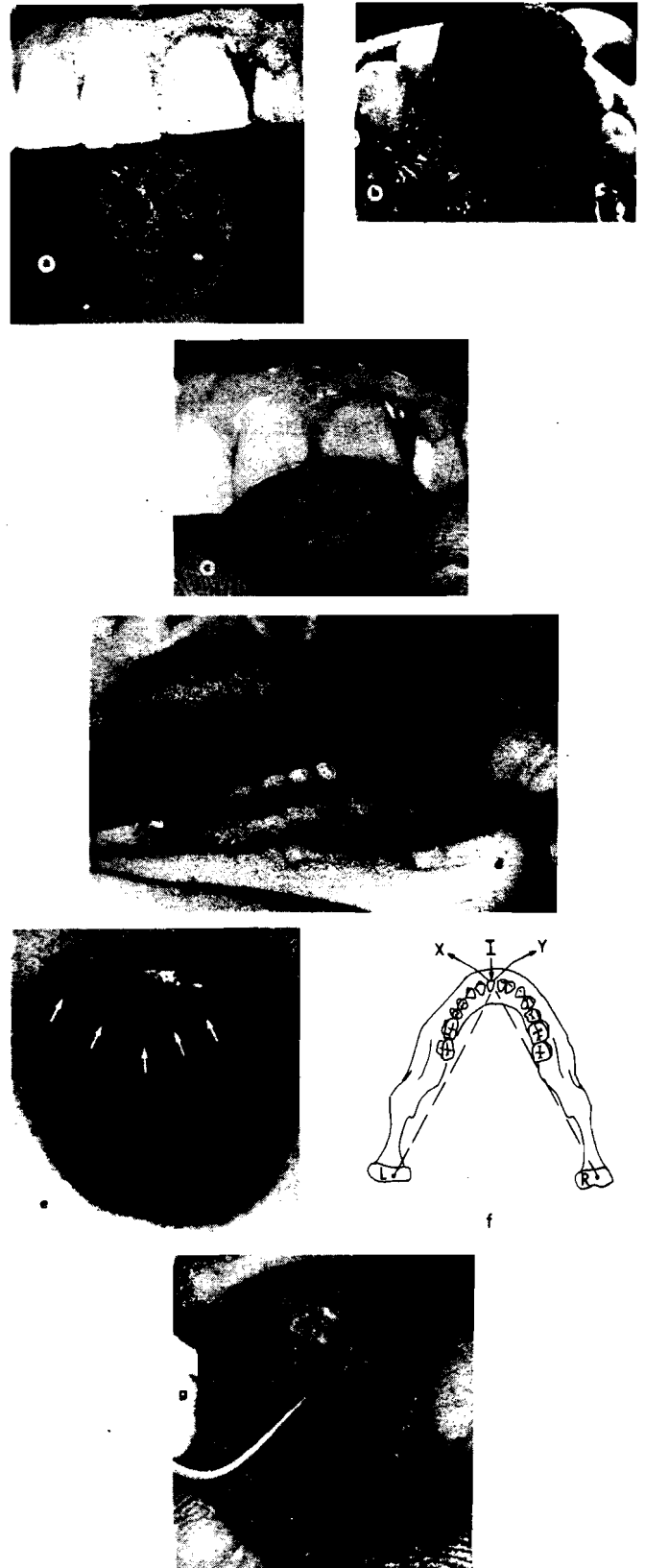


Fig. 20.—Stages in the fabrication of an anterior jig. See the text for description. a, Application of acrylic at dough stage. b, Forming the palatal platform. c, Labial coverage. d, Blue articulating paper in place. e, Mark of a lower incisor (arrowed). f, Occlusal diagram of mandible to explain the reason for the V-shaped mark. L—left condyle, R—right condyle, I—lower incisor, LI—radius from L, RI—radius from R, IX—movement of lower incisor with left lateral excursion, IY—movement of lower incisor with right lateral excursion. Note: IX, IY form 'V' shape with I at the apex. g, Limbs of V trimmed off.

- (1) Apply petroleum jelly to the upper anterior teeth and block out any anterior diastemata.
- (2) Mix autopolymerising resin.
- (3) At the dough stage, the resin should be applied to the anterior teeth (fig. 20A) and shaped into a platform

covering the palatal surfaces (fig. 20b) and extending about 3 mm over the incisal edge onto the labial surfaces. (fig. 20c).

(4) While the resin is soft guide the mandible as closely as possible to the retruded position, making sure that the lower incisors contact the palatal platform, and that there is sufficient material to allow posterior tooth separation of approximately 2 mm.

(5) As the resin begins to set prize it off gently to prevent locking into undercuts and an excessive build up of polymerisation heat.

(6) After it has set, replace the jig in the mouth and ensure that it is rigidly retained on the anterior teeth, if not add more material to the fitting surface and repeat until rigidly retained.

(7) Place blue articulating paper on the jig and guide the mandible along left and right lateral paths (fig. 20D).

(8) Remove the jig and look at the markings and identify the movements of a single lower incisor against the upper platform (fig. 20E).

(9) Because of the direction of movement of the mandible (fig. 20F) a lower incisor will trace V shaped marks with the apex pointing palatally. Be aware that sometimes more than one tooth marks. Identify the mark from one incisor and remove the others.

(10) Trim the limbs of the V and repeat marking until the apex becomes smooth.

(11) Trim off limbs of the V leaving only the apex (figure 20G).

(12) Replace in mouth and guide patient to contact this point.

(13) Leave in patient's mouth for approximately 10 min and then check for freedom of movement of the mandible (opening and closing). Guide the mandible and let the patient tap against the jig, and when free movement occurs remove the jig and locate the initial contacts.

Sometimes it may be necessary to have the jig in place for half an hour prior to the examination and the patient may do this while in the waiting room.

It may be necessary to make some form of 'disocclusion appliance' (fig. 21) which is adjusted periodically until the mandible can be manipulated easily. The fabrication will be described in part 5 (occlusal splint).



Fig. 21.—Occlusal splint—for 'very difficult patient.' Adjusted and worn until the mandible can be manipulated easily (see Part 5 for fabrication).

Location with occlusal indicating tape

The procedure is as follows:

Specific location of the occlusal contacts can be obtained by the use of occlusal indicating tape.

(1) Dry the teeth with a gauze square.

(2) Place blue occlusal paper* between the upper and lower teeth and direct the patient to rub his teeth in all directions.

(3) Instruct the patient to open.

(4) The chairside assistant places double sided black occlusal tape† between the upper and lower teeth, holding the tape in Millers forceps as in figure 22.



Fig. 22.—Insertion of occlusal tape, held in forceps by the chairside assistant.

(5) Manipulate the mandible to the retruded position, and instruct the patient to tap once in this position.

(6) Remove the tape, warm a mouth mirror and observe the black marks on the blue background. It must be emphasised that it is impossible to locate occlusal contacts precisely with the blue articulating paper alone, owing to its thickness³. The blue layer merely aids the subsequent marking with the thin occlusal tape and is not always necessary.

Observation. Note: teeth in contact, area of contact, horizontal and vertical overjet and ease of manipulation.

Movement from RCP to ICP

Location. Manipulate the mandible to the RCP and then instruct the patient to 'squeeze' the teeth together until a position of 'best fit' is reached. Repeat the procedure using occlusal tapes as follows:

(1) Teeth dried.

(2) Blue tape and teeth rubbed in all directions.

(3) Mouth open and dryness of teeth obtained by assistant using suction.

(4) Insert red occlusal tape. (Double sided red GMH tape is not available. Cut a strip of single sided tape, twice the length of the forceps beaks, fold it back on itself and secure in the forceps. Ensure that the dull sides are facing outwards).

(5) Manipulate to RCP and mark, then instruct the patient to squeeze teeth.

(6) Remove red tape.

(7) Insert black tape.

(8) Manipulate to RCP and tap teeth together once.

(9) Insert green tape.

(10) Tap once in ICP (fig. 23).

*Cottrell & Co, 15-17 Charlotte Street, London W1. Thin blue
†GMH Occlusion—PREW-SOLIE, 22 mm Hanzel Medizinal Nurtin-
gen, Precious Metals, 43 Devonshire Street, London W1, and Cottrell
and Company, 15-17 Charlotte Street, London W1.

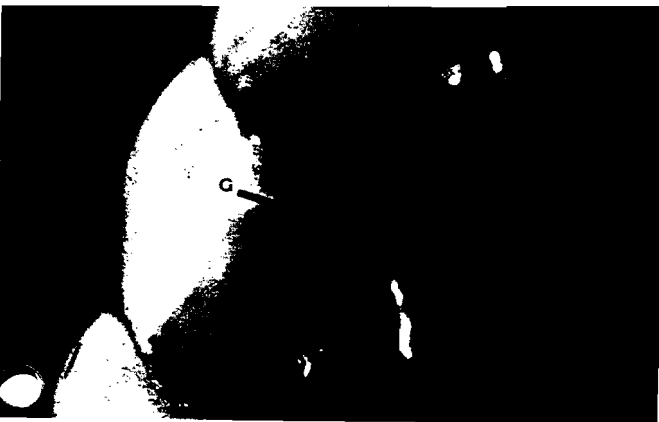
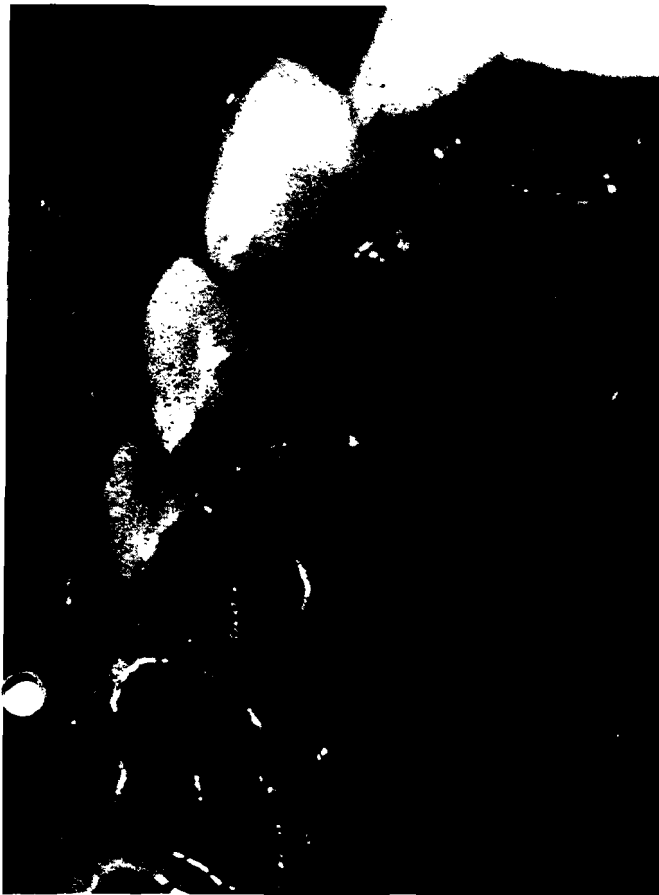


Fig. 23.—A, The initial blue layer marking the teeth. This is 'gross' and does not represent true contacts. It is not always required. B, Red (R)—slide from RCP to ICP; green (G)—ICP contact; black (B) = RCP contact.

Observation

Note at the incisors, the:

- (1) Dimensions of slide from retruded to intercuspal positions.
- (2) Direction—whether slide is straightforward, forwards to one side or only to one side.
- (3) Vertical and horizontal components of slide. This is the change in the distance between the upper and lower incisors in the vertical and horizontal planes occurring during the slide from RCP to ICP. Figures 24A and B show a large vertical component and a small horizontal component at the incisal region. Compare this with figures 25A and B which show a small vertical and a large horizontal component.

Note at the contacting surfaces from the marks made by the occlusal tapes (fig. 24) the initial contact in the RCP (black), the surfaces in contact while the slide (if any) occurs (red) and ICP contacts (green).

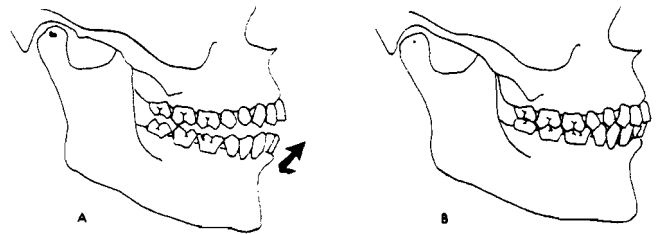


Fig. 24.—Slide from RCP (fig. 24A) to ICP (fig. 24B). Large vertical and small horizontal components.—RCP: the arrow in the incisal region shows the direction of movement to the ICP. N.B. Condylar movement is mainly rotation.

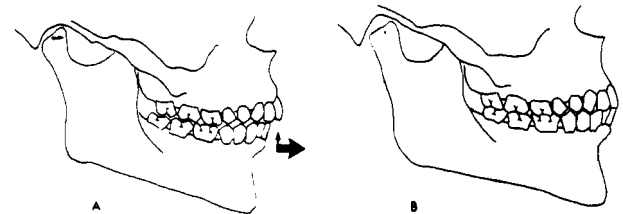


Fig. 25.—Slide from RCP (fig. 25A) to ICP (fig. 25B). Small vertical and large horizontal components. A,—Arrows in the incisor and condylar regions show the direction of movement to the ICP (25B). Note that condylar movement is mainly translation.

'Ease of slide.' Determine the degree of freedom of movement from RCP to ICP and whether this movement is influenced in any way by the inclined plane of the opposing cusps. In other words is the movement forced?

Lateral Positions and Excursions

Locations and observations are made on both the working side and the non-working side.

Working Side Contacts

Contacts of teeth made on the side of the occlusion towards which the mandible has been moved* (fig. 26).

Location. The patient is instructed to close into the ICP and then move to whichever side is to be investigated. Frequently, the patient may have difficulty in moving to

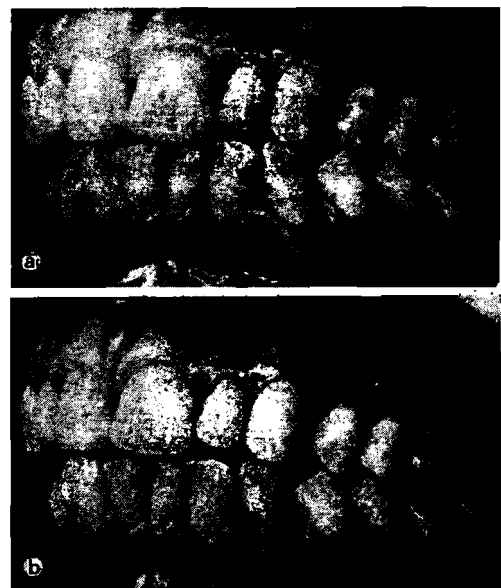


Fig. 26.—Left lateral excursion. A, Group function—multiple teeth contact on the working side. B, With further excursion this becomes canine guidance—only the canines contact.

the required side. This may be facilitated by the patient using a face mirror to observe the movement of the lower jaw. Instruct the patient to move to the edge-to-edge position, and slightly beyond (the cross-over position).

Ideally the contact should be located from the RCP as well but this is frequently difficult. Once located the contacting surfaces can be marked as before.

Observation. With the teeth in contact during lateral excursion, note:

- (1) Whether there is group function (contact of multiple teeth on the working side, (fig. 26A) or
- (2) Whether there is canine guidance (contact only between the canines with the other teeth separated or discluded (fig. 26B). Frequently, there will be a combination of (1) and (2) such that initially there is group function, but in the edge to edge position only the canines contact.
- (3) If the guiding teeth move excessively.
- (4) Whether the lateral movement is smooth or restricted.
- (5) The teeth are in contact in the cross-over position.

Non-working Side Contacts

(Balancing side contacts) Contacts of teeth made on the side of the occlusion from which the mandible moves during lateral excursion, that is the side opposite the working side. For example, right lateral excursion, working side—right; non-working side—left.

Location of non-working side contacts can be made at the same time as the working side contacts. However, the operator should support the mandible on the non-working side while doing this (fig. 27) as there is a tendency for the patient to 'skirt around' the non-working side contacts.



Fig. 27.—Right lateral excursion. Supporting the mandible on the left, non-working side contacts are observed on the patient's left side.

Observation. Note:

- (1) Presence or absence of non-working side contacts.
- (2) Movement of teeth on the non-working side.
- (3) Corresponding working side contacts.

Protrusive Positions and Excursions

These are two relationships: straight protrusion, or lateral protrusion, that is movement forward and slightly to one side.

Location. Instruct the patient to close into the ICP and then slide forward until the incisors come edge-to-edge. Again, the face mirror simplifies this procedure. Similarly, for lateral protrusion instruct the patient to close to the ICP then move forward and to one side. Specific contacts may be located with tapes.

Observation. Note:

- (1) The direction of movements.
- (2) The mobility of teeth during jaw movements.
- (3) Whether the teeth are in contact during movement.
- (4) The presence or absence of posterior contact during protrusive movements.

The Rest Position

The relationship of the mandible to the maxilla when the

patient is relaxed and sitting upright.

Location. Position the patient comfortably and upright in the chair. Use one of the many prosthetic methods to assess inter-occlusal clearance. For example, tell the patient to lick the lips and swallow, say 'Mmm . . .' relax, then part the lips and assess the space between $\underline{1|1}$ and $\overline{1|1}$.

Observation. Interocclusal clearance is observed. However, be aware that many factors can influence the rest position such as stress, pain, and muscle hyperactivity.

Special Investigations

Study Casts

Study casts provide an essential record of the dentition, and it is important that these casts are carefully fabricated. Compare figure 28A with figure 28B and note the discrepancy between the occlusal surfaces owing to

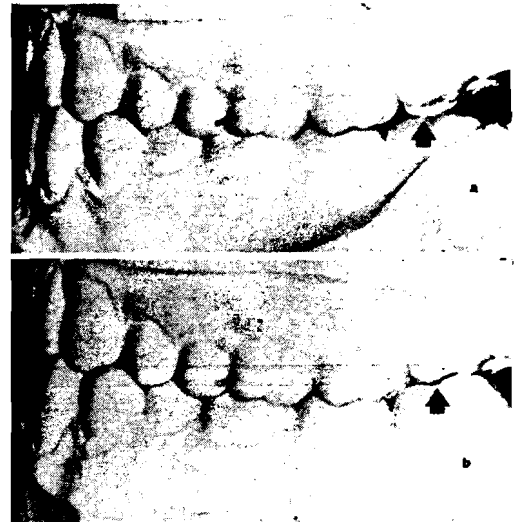


Fig. 28.—Distorted study casts resulting from the unsupported heels of the lower impression resting on the bench. A, Distorted casts ($\overline{8}$ is out of occlusion). B, Correct cast.

distortion of the alginate impressions caused in this case by carelessly allowing excess alginate at the heels of the tray to contact the worktops while the stone was setting in the impression.

Equipment required: Either reversible hydrocolloid or irreversible hydrocolloid (alginate), 'Rimlock tray'* (conventional perforated tray is adequate), 2×2 inch gauze square, rubber bowl and spatula.

The teeth should be cleaned and the correct sized trays selected. The occlusal surfaces are lightly wiped with a gauze while the chairside assistant mixes the impression material according to the manufacturer's instructions. A small amount of alginate is taken on the finger and applied to the occlusal surfaces of the teeth, forcing it into the grooves (fig. 29). (With reversible hydrocolloid, syringe



Fig. 29.—Forcing alginate into the occlusal grooves with a finger.

*Caulk Company Rimlock Tray—M J Dental Supplies Ltd, 100 High Street, Ramsey, Camb PE17 1BS

material may be used.) It is important that saliva does not contaminate the surface of this layer as it may affect the uniform setting of the whole impression. The loaded tray is inserted. The impression is removed when set, and covered with the damp gauze or placed in a humidior prior to pouring. Ensure that any unsupported heels of the impression material are not left resting on the worktop, otherwise this will cause distortion of the impression. The cast should be poured with minimal delay and based. It should have a date and be stored for future reference. (It is frequently useful to make a second model for diagnostic 'cutting' and waxing of teeth.)

Use of study casts

- (1) For future reference: it may not be possible to make a definitive diagnosis without study casts. Referral to the original casts enables the operator to determine the presence or absence of occlusal deterioration with time.
- (2) Tooth positions and surface features: it is frequently easier to locate diastemata, fractured cusps, worn areas, on study casts than directly in the mouth.
- (3) Intercuspal relationships: the cast may be held manually in the intercuspal position to observe tooth relationships.
- (4) Mounting of casts: casts mounted in a semi-adjustable articulator (fig. 30) will facilitate evaluation of tooth

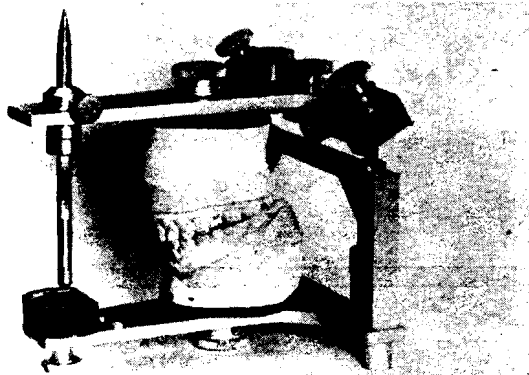


Fig. 30.—Study casts mounted in a semi-adjustable articulator (Whip Mix).



Fig. 31.—a, Clinical picture. b and c, Diagnostic waxing.

relationships in the various jaw positions, that is retruded contact position, intercuspal position, protrusive and lateral positions. The procedures for carrying out such mounting will be described in Part 5.

(5) Diagnostic waxing. Some cases require a 'diagnostic waxing' or 'tooth repositioning' (fig. 31) before a treatment plan can be evolved. Either a single tooth or a whole dentition may be waxed up. It is a pity that this procedure is often dismissed as a 'waste of time' since it provides much valuable information regarding aesthetics, contour, potential preparations, the occlusal plane, the need for elective periodontal surgery to increase crown height and the need for orthodontic treatment. It also provides a template for the fabrication of temporary restorations.

Pantographic Survey

A dental pantograph is a device used to trace mandibular movement and consists essentially of an upper and lower facebow each attached to the corresponding dental arch (fig. 32). Styli attached to one bow contact a flat plate on

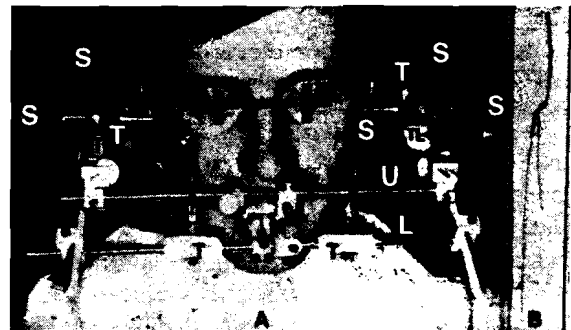


Fig. 32.—Pantograph (from the Stuart system). a, Assembled on patient. Upper bow—U; lower bow—L; styli—S; tracing plates—T. (Left horizontal plate—TL.) b, Enlargement of the tracings from the left horizontal tracing plate.

the opposite bow. As the patient performs lateral jaw movements the styli will trace their paths on the plates. Some authors' consider that non-reproducibility/reproducibility of pantographic tracings provides valuable graphic information regarding the need for occlusal therapy prior to extensive restorative dentistry.

Conclusions

This article has described the procedures used to locate and observe the various occlusal relationships. The advantages of study casts have been outlined, and the pantograph briefly mentioned. In Part 5 mounting of the casts in articulators will be described. The clinical significance of the observations made will be described in Parts 3 and 4.

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(To be continued)