# Section of Odontology

*President* W Roland Cleverley LDS RCS

*Meeting January 25 1971*

## Paper

## Surgery of the Temporomandibular Joint

by N L Rowe FDS RCS MRCS
(*Westminster Hospital, London SW1*)

The art and practice of surgery consist essentially in knowing when and how to operate, and whereas the purely technical skills of the craft can be acquired at a relatively early stage, the indications for the application of such expertise are not always so readily determined: it must be conceded that this qualification is particularly appropriate in the case of the temporomandibular joint.

There now exists a generally accepted concept of a triple complex involving both temporomandibular joints and the intact dentition, forming an integrated system which is carefully monitored by arthrokinetic reflex muscular activity to ensure a controlled and stable pattern of mandibular movement. A disturbance in the coordinated activity of this musculature, arising generally from malocclusion and often accentuated by psychological factors inducing neuromuscular tension, forms the basis for the majority of problems involving temporomandibular joint dysfunction.

The conditions which may necessitate surgical intervention are as follows. First, ankylosis, dislocation (unusual acute types; long-standing or chronic recurrent varieties), neoplasms (benign), or foreign bodies and sequestra; this group benefits in most cases from surgery. Secondly, arthrosis (intractable to conservative methods), intolerable arthritis, fracture (rarely), and hyper- and hypo-plasia; this group benefits from surgery in selected cases.

The operations which have been devised for the treatment of the more common clinical conditions arising from these etiological factors are: (1) Arthrotomy, drainage of excess fluid from the joint. (2) Meniscectomy, loose or torn disc. (3) Osteosynthesis, fractured condylar neck. (4) Capsulorrhaphy, recurrent dislocation. (5) Condylotomy, arthrosis. (6) Condylectomy, hyperplasia and hypoplasia. (7) Arthroplasty, arthritis, ankylosis and neoplasia. (8) Pseudarthrosis (joint or ramus, Esmarch type), ankylosis.

Arthroplasty may consist of an attempt to create a new joint in the location of the old joint or a false joint (pseudarthrosis) in the ramus, thus leaving the original anatomical, although pathological, joint untouched.

*Applied Anatomy*

The condyle and its capsule are covered by the parotid gland which, in this region, is termed the glenoid lobe. This lobe lies within the parotid fascia, which is derived from the divergent upward extension of the deep cervical fascia, and encloses the superficial temporal artery and vein with the temporal and zygomatic branches of the facial nerve. The fascia fuses with the perichondrium and periosteum of the external auditory meatus, and also the temporal fascia behind the joint capsule at the root of the zygomatic arch. If, therefore, a dissection is carried out in close contact with, and following the direction of, the anterior wall of the auditory meatus, a surgical cleft will be created along an almost avascular plane which leads naturally to the posterior aspect of the joint capsule behind and beneath the glenoid lobe of the parotid gland and its contained arteries, veins and nerves.

The general direction of the meatus is downwards, forwards and inwards and the dissection must proceed in this manner. Failure to appreciate this fact, leading to an injudicious attempt to deepen the incision at right angles to the surface, will result in transection of the cartilaginous anterior wall of the meatus and, possibly, injury to the tympanum.

The temporalis fascia is attached to the upper border of the zygomatic arch and blends with the periosteum overlying that structure. The branches of the facial nerve crossing the arch on their way to supply the frontalis and orbicularis oculi muscles lie immediately superficial to the periosteum. Any dissection in a forward direction in this area must proceed superficial to the bone and *deep* to the periosteum if injury to the nerves is to be avoided.

The maxillary artery will be in close medial proximity to the condylar neck, particularly in those cases of ankylosis characterized by massive bone formation in relation to the medial pole of the condyle. The medial pole is situated within approximately 0·5 cm of the pharyngotympanic tube from which it is separated by the downturned edge of the tegmen tympani. It also lies a similar distance from the carotid canal lying posteromedially, which is, however, separated by the tympanic plate of the temporal bone. In cases of gross hyperostosis affecting the medial aspect of the ankylosed joint, the normal anatomy will be distorted, and due attention should be paid to this when enthusiastically pursuing a dissection in this location and direction.

*Operative Techniques*

*Surgical exposure of the joint:* Both the postauricular approach, which transects the external auditory meatus and turns the pinna forwards, and the endaural route, with its necessarily limited access, have little to commend them. The conventional preauricular approach can be modified by an upward extension towards the temporal area to permit, if necessary, additional anterior mobilization of the tissues and exposure of the entire zygomatic arch without endangering the facial nerve. The submandibular approach provides excellent access to the lower end of the condylar neck and the lateral aspect of the ramus including the base of the coronoid process.

*Preauricular approach:* An incision 3 cm in length is made in the skin overlying the temporal fossa so that the long axis is inclined at 45 degrees to the zygomatic arch, the posterior limit reaching the point where the free margin of the helix is attached to the scalp. The incision then follows the groove between the anterior rim at the root of the helix and the facial skin anteriorly, passing downwards and posteriorly between the inferior limit of the helix and the upper border of the tragus. It is continued along, or slightly behind, the crest of this structure to the upper limit of the intertragal notch (the groove between the tragus and the lobe of the ear), at which point it inclines forwards, turning down to follow the crease between the lobe and the face.

To expose the posterior aspect of the joint capsule the skin is carefully dissected from the free edge of the tragus, and by blunt separation of the tissues the anterior wall of the cartilaginous part of the external auditory meatus is closely followed, immediately superficial to the perichondrium, in an anteromedial and inferior direction passing behind and beneath the glenoid lobe of the parotid gland and the superficial temporal vessels which are then retracted forwards.

The temporal extension of the incision is now deepened, and it may be necessary to isolate, divide and ligate the posterior branch of the superficial temporal artery at this juncture. An important step at this stage is to incise *through* the temporal fascia until the muscle is seen and then to cut through the fascia and periosteum attached to the root of the zygoma in the region of the postglenoid tubercle where a small emissary vein is often exposed. The upper part of the incision in the temporal area is thus made continuous with the lower part anterior and superficial to the tragus, and a sharp periosteal elevator used to dissect the periosteum forwards off the arch to a point about half-way along its length. Proceeding downwards from the rim of the glenoid fossa, it will now be possible to dissect away the tissues overlying the lateral aspect of the capsule and condylar neck.

Incision of the capsule should take the form of an inverted reverse L-shaped cut which divides the superior and posterior attachments but does not disturb the anterior portion which is covered on its lateral aspect by the temporomandibular ligament. Further dissection will then expose the condylar head and neck, and it is essential to keep close to the bone at all times. From this stage onwards, the technique will vary according to whether a high or low-level condylectomy, a meniscectomy, or some form of arthroplasty is to be performed.

In the case of the high-level condylectomy, as advocated by Henny (1957), the anterior portion of the condylar head into which the fibres of the lateral pterygoid muscle are inserted is retained together with the disc, and only the superior and posterior aspects of the articular surface are removed to a depth of approximately 3 mm. The inferior aspect of the disc must be protected to avoid damage to its smooth surface and bone is best removed by a surgical burr, the cut surface being carefully smoothed afterwards.

If a low-level or subcondylar condylectomy is selected, the neck of the condyle is cut through

almost to the medial aspect and the tissues on this side which are adjacent to the maxillary artery are carefully protected by a retractor. The division is finally effected by a light tap with an osteotome which splits the remaining section of bone. The neck of the condyle is now grasped with bone-holding or Kocher's forceps and twisted to display the insertion of the lateral pterygoid muscle which is dissected off the anterior aspect of the condyle. The head of the condyle can then be delivered by a combination of traction and rotation. The stump remaining on the upper end of the ramus is finally smoothed with a large burr.

*Meniscectomy:* When meniscectomy is to be carried out it is essential, if postoperative traumatic arthritis is to be avoided, not to damage the joint surfaces by a periosteal elevator or other instrument. The separation of the disc from the capsule and muscle is assisted by the use of a muscle relaxant, and facilitated by distraction of the joint surfaces by pressure on the last molar teeth with a gag. This procedure may also be reinforced by direct downward pressure on the edge of the mandibular notch.

In operations in this area there is often a brisk venous ooze from the medial aspect of the condylar neck after removal of the disc or condylar head. The immediate bleeding can be controlled by firm packing with hot wet swabs, and a postoperative hæmatoma avoided by the insertion of human fibrin foam into the depths of the wound. Closure is effected in layers in the usual manner and, where drainage is desirable, a vacuum drain is led out of the tissues through a stab wound in the crease of the skin immediately behind the lobe of the ear, a site which is invisible and does not impair healing of the incision line. A firm pressure dressing is applied for 48 hours.

*Condylotomy*, or section of the condylar neck alone, may be performed via the preauricular route previously described, although the temporal extension of the incision is not usually required. However, when a long-standing dislocation of the condyle exists, it must be appreciated that the site of section lies a great deal further forward than when the condyle is seated in the glenoid fossa, and the anterior limit of the dissection must accordingly be extended.

Ward (1961) advocated condylotomy by the closed route utilizing a technique based on Kostecka's original procedure for the surgical correction of prognathism. In this case, however, the object is to create a fracture-dislocation in order to alter the relationship of the joint surfaces which will be of benefit in the treatment of intractable temporomandibular joint arthrosis. A special curved introducer is inserted through a stab incision about 1 cm beneath the lobe of the ear and, keeping the mouth open wide, with the tip of the instrument in close contact with the bone on the inner aspect of the ramus above the level of the inferior dental foramen, the point is directed so as to emerge through the skin at a level between the lower border of the zygomatic arch and the upper border of the ramus at the mandibular notch. A line drawn from the point of entry to the lower border of the inferior orbital rim will demonstrate the correct axis of the shaft of the introducer.

A Gigli saw is temporarily attached by a traction wire to the eye in the tip of the introducer which is then withdrawn along its path of entry until half the length of the saw has passed through the tissues. The traction wire is untwisted and replaced by the handle of the Gigli saw, the other handle being attached to the opposite end. The two lengths of the saw protruding from the tissues should form an angle of 140 degrees to one another, and during the passage of the saw to and fro through the bone this angle must be kept constant and the edges of the skin protected. Just before the bone is finally divided, firm pressure is applied with the thumb over the lateral aspect of the condylar head to create an anteromedial fracture dislocation.

An intraoral approach to the condylar neck can also be made after an incision has been effected through the mucoperiosteum overlying the external oblique ridge of the mandible, extending upwards towards the coronoid process but terminating about a centimetre below the tip so as to avoid herniation through the wound of the buccal pad of fat. The periosteum is stripped away from the lateral aspect of the ramus and the condylar neck is displayed. This is particularly easy when there has been a forward dislocation of the condylar head beyond the articular eminence and the mouth is gagged open. Firm lateral retraction of the tissues will enable the bone to be divided with a surgical fissure burr or a Stryker saw. Following division of the bone the intraoral route permits the operator to remove more bone if necessary and convert the osteotomy into an ostectomy, thus minimizing the risk of bony union.

*Submandibular approach:* The inferolateral or submandibular approach is well known and does not require detailed elaboration. The length of the incision, placed if possible in a skin crease, will be dictated by the extent of the surgery envisaged.

The submandibular approach is preferable when it is necessary to resect an extensive amount of bone as, for example, when fusion has taken place between the condyle, coronoid process and

zygomatic arch, particularly when this is associated with previous surgery in the area resulting in shortening of the condylar neck and massive bone formation on the medial aspect of the obliterated joint space. The margin of the glenoid fossa is not displayed to advantage by this route and, in some cases, it will be advisable to combine both the preauricular and the submandibular approaches.

The wider exposure of the tissues permitted by the submandibular technique can be advantageous should excessive and persistent hæmorrhage develop or be anticipated. Access to the maxillary artery on the medial aspect of the ramus, or exposure of the external carotid artery on the deep aspect of the posterior belly of the digastric muscle, is rapidly achieved when the tissues are exposed in this manner.

*Application of Selected Surgical Techniques*

*Ankylosis:* When there has been sufficient initial disorganization of the joint to result in subsequent ankylosis, it is very doubtful if any residual growth activity of consequence persists. In the child, it is preferable to eliminate the ankylosis and provide mobility to the mandible rather than to perpetuate the pathology into adolescence where a restricted diet, impaired speech and appearance, the likelihood of dental caries and the hazard of an acute respiratory obstruction which cannot be relieved other than by tracheostomy are all factors which may result in both physical and psychological disability. Indeed, there is some evidence to suggest that the function which ensues after liberation of the ankylosis brings about an increase in bone growth which is probably due to increased subperiosteal apposition through the medium of improved activity of the pterygomasseteric muscle sling. The secondary distortion of the middle third of the facial skeleton, which is such a feature of the untreated case of unilateral ankylosis in adult life, is reduced, though not entirely avoided.

Elimination of the ankylosis, whether unilateral or bilateral, is desirable as soon as the condition is established. Treatment of the residual problem is then, to some extent, dependent upon the age of the patient. It is also related to the degree of bony malformation and the number of previous operations, together with a consideration of any disease process responsible for the condition. Ankylosis, apart from being either extra- or intra-articular, bony or fibrous, may be confined to the region of the temporomandibular joint or extend forwards to such a degree that there is a complete fusion of the upper end of the ramus to the zygomatic arch and infratemporal fossa.

*Unilateral ankylosis in the adult:* If the onset of the disease process has taken place after the growth of the mandible and the eruption of teeth has been completed, the resultant deformity will be confined to the immediate vicinity of the joint. Unless there is a massive degree of bone formation involving the coronoid process, condylectomy by the preauricular route is generally adequate. It is, however, essential to assess the precise nature of the condition by radiographs which must include tomography in both the sagittal and coronal planes. In some cases of intracapsular comminuted fracture of the condyle the medial pole may be split off and become fused to the surrounding bone.

The function of a mandible with one condyle removed, or following a fracture-dislocation, is generally adequate, and it is open to question whether any replacement, of either an autogenous or alleloplastic nature, is necessary. It is also debatable, provided that an adequate amount of bone has been resected, whether it is necessary to interpose various natural substances such as temporalis muscle, cartilage, fascia or dermal grafts between the bone surfaces, or to cover the cut end of the condylar neck with artificial but physiologically acceptable substances such as stainless steel, vitallium, titanium or silicone rubber. Provided there is molar support on the affected side, the upward and posterior movement of the ramus following operation is limited, and immediate postoperative mobilization with appropriate muscle-training exercises, such as those instituted in the case of fracture dislocation, should be adequate to prevent a recurrence unless a co-existent pathological bone disease persists.

*Unilateral ankylosis in the child:* In the young child the condyle has a thinner cortex and possesses a greater osteogenic potential. The condyle is the primary mandibular growth centre and an injury severe enough to result in ankylosis will cause interference with the development of the bone, and asymmetry which will increase progressively as maturity is reached. The rate of change is most marked at puberty when skeletal growth and dental eruption coincide and are influenced by the associated hormonal changes which are taking place. Owing to the adaptive capability of the alveolar bone, under the guiding influence of the lip, cheek and tongue musculature, the derangement of the occlusion is often minimal although there is necessarily alteration in the axial inclination of most teeth since the apical base is both restricted and distorted.

The risk of recurrence of ankylosis is higher in childhood and ideally treatment should include

restoration of the destroyed growth centre. There is a dual problem related to both form and function of the mandible and, in all cases, orthodontic cooperation is essential for the planning and timing of surgery and the post-operative control of the dentoalveolar tissues.

Although it is generally accepted that elimination of the ankylosis as early as possible is desirable, opinion is divided with regard to the optimum time for restoration of lost tissue. During the first five years of life, growth of the jaws is much influenced by subperiosteal apposition of bone, which is itself stimulated by active muscle function, and it is doubtful whether it is necessary to do more at this stage than free the mandible and maintain active function. At 11 or 12 years of age, the eruption of the permanent teeth and the onset of the changes associated with puberty would make this the ideal time to transplant bone, particularly if this can be devised in such a way as to retain some inherent capacity for growth.

Although this interesting aspect of the problem cannot be pursued in depth, it will suffice to mention that essentially splints are prepared with a detachable acrylic block between the occlusal surfaces of the molar teeth on the affected side of such a thickness that the mandibular occlusal plane will be displaced downwards, after elimination of the ankylosis, to just below the level of the normal side. If the ankylosis has previously been eliminated, a submandibular approach is selected but, if this is not the case, a combined preauricular and submandibular route will be indicated.

A costochondral graft from the 8th or 9th rib can be inserted so that the cartilaginous end lies in the glenoid fossa and the bony end, lightly decorticated on its inner aspect, is inlaid into a bed prepared in the outer plate of the mandible at the angle and along the posterior border. Two transosseous wires effect local fixation of the graft at the angle while the mandible is immobilized by means of maxillary and mandibular cap splints.

In cases with deficient or absent condylar growth activity but no ankylosis, the temporomandibular joint should not be disturbed. A horizontal osteotomy of the ramus permits distraction of the cut surface and the interposition of a bone graft. Either rib, or the inner plate only of the ilium with the cartilaginous rim attached, is suitable. The pterygomasseteric sling, in all instances of ramus elongation, must not be reconstituted but loosely united without tension so that it may gain attachment at a higher level. Osteotomy, preferably of the Obwegeser sagittal-split type, on the normal side is undertaken to allow reorientation of the mandible without torsion being exerted upon the joint or the muscles.

The acrylic block between the occlusal surfaces takes the strain off the graft and defines the elongation required. Fixation is maintained for six weeks, after which the splints are removed; the orthodontist must then insert an appliance to maintain the position of the basal bone which can be selectively trimmed to permit eruption of the permanent teeth to the level of the new occlusal plane. Ware (1970) considers that the costochondral rib junction is superior as a growth transplant centre to either the head of the fibula or the metatarsal joint of the little toe and there is no doubt that, from a purely technical point of view, the use of rib is simpler and less disturbing to the patient both at the time of operation and subsequently.

*Bilateral ankylosis in the child:* Before 5 years of age any bilateral interference in the condylar growth activity results in severe deformity; between 5 and 14 the deformity is progressively reduced in degree, and after this the influence upon mandibular growth is often surprisingly small.

If bilateral ankylosis results from a lesion which occurred at the same time and to a similar degree on either side, there is no asymmetry, but failure of downward and forward growth produces the well-known 'bird-face' deformity. The occlusal plane is tilted downwards anteriorly and upwards posteriorly and there is a corresponding alteration in the angulation of the floor of the mouth, base of tongue, epiglottis and laryngeal inlet, which makes blind nasal intubation difficult and occasionally impossible. The surgeon should therefore appreciate that tracheostomy may be necessary as an emergency in cases of failed intubation, or as an elective procedure in cases of gross deformity in order to safeguard the airway.

It is desirable to free the lower jaw and prevent the development of both mandibular deformity and the secondary deformities in the middle third of the face which accompany the untreated cases. Bilateral autogenous growth centre transplants may be inserted and the costochondral rib graft is preferable. The age of 11–12 years would seem to be the optimum moment but more precise guidance can be given by the orthodontist using serial cephalometric analysis.

*Condylar hyperplasia:* The asymmetry of the mandible resulting from an enlargement of one side which is not due to neoplasia or dysplasia may be considered under three headings: (1) Non-progressive mandibular asymmetry. (2) Condylar hypertrophy. (3) Condylar hyperplasia.

True condylar hyperplasia does not generally present until the onset of puberty. It is often rapidly progressive, particularly during this stage of accelerated growth, but declines in activity and usually ceases at about 18 years of age although some slight residual activity may persist until 25 years. In rare cases, the rate of growth may initially be very slow and escape detection until a pronounced increase in activity after the time when mandibular growth has normally ceased draws attention to the abnormality (Hovell 1963).

*Treatment*

Condylar hyperplasia in the fully mature form produces secondary deformity of the upper jaw which is twisted mainly in the coronal plane so that the nasal septum, tip of the nose and commissure of the lips all reflect this distortion in the skeletal pattern. The outer aspect of the ramus on the affected side becomes markedly convex and the normal side assumes a pronounced concave shape. Although repositioning of the chin and the occlusion may be adequately achieved following surgery, the residual deformities elsewhere persist and present a disproportionately difficult and sometimes insuperable problem. Therefore, correction of the mandibular distortion should be undertaken whenever the diagnosis is no longer in doubt, a decision which will be considerably assisted by orthodontic analysis and assessment, and surgery should be instituted before the secondary deformities have become manifest to any significant degree.

Condylectomy, while being inevitable in some cases, is not always indicated and may on occasions be contraindicated. The change in position of the mandible after condylectomy is essentially similar to that observed immediately after a fracture-dislocation. The jaw is deviated towards the side of surgery and is displaced posteriorly and superiorly with gagging on the last molar tooth. Provided the condylar hyperplasia has resulted in protrusion of the mandible with a cross-bite, and provided the inclination of the occlusal plane conforms approximately to the path of postoperative displacement, condylectomy can produce an acceptable result, particularly if the procedure is undertaken when alveolar bone growth is still active and postoperative discrepancies in the occlusion can be corrected naturally rather than by grinding or extractions. However, some condylar function will be lost and consideration should be given to the removal of bone from the elongated condylar neck or elsewhere, followed by transosseous wiring, as an alternative measure in selected cases. In such instances some degree of overcorrection is advisable. Although it must be conceded that the abnormally active condyle is retained and that the estimation of the extent to which overcorrection must be carried out is empirical, the results to date, including 2 cases of my own extending over fifteen years, suggest that a stable end-result can be obtained without sacrifice of the condylar process.

The second major variation of condylar growth abnormality is manifested by an increase in the mass of the condyle, particularly in a medial direction, often associated with a corresponding increase in the overall size of the ramus. It may be that such examples are incomplete manifestations of what is essentially a unilateral mandibular hypertrophy with, or without, a corresponding hypertrophy of the associated musculature. Whatever the etiology, the effect is to displace the mandible primarily downwards rather than forwards, thus rotating the transverse axis in the coronal plane and producing a separation of the occlusal surfaces of the molar and premolar teeth. If this distortion should take place when compensatory adaptation of the associated alveolar bone is still possible, the teeth will be maintained in occlusion, but, if the growth potential is insufficient to cope with the alveolar height required, a posterior open bite will persist. When there is both an increase in the length of the ramus and a corresponding compensatory increase in the height of the alveolar bone, it will be evident that no upward movement or shortening of the ramus can occur unless there is also a corresponding alteration in the level of the occlusal plane; this must generally be achieved by surgical means such as extractions of the maxillary premolars and molars on that side or, in some cases, upward displacement of these teeth and associated alveolar bone into the antrum by the Schuchardt technique. Condylectomy alone, in such cases, is an inadequate procedure since no correction of the mandibular deformity will result from the operation. The change in the transverse axis required in such cases will also necessitate a compensatory osteotomy of the contralateral ramus if the dental midline relationship, which is not disturbed in such cases, is to be maintained. In this context, it will be obvious that a simple pivotal movement in the coronal plane around the normal condylar axis would result in displacement of the mandibular arch into gross buccal relationship with the maxillary arch on the affected side.

REFERENCES

Henny F A (1957) *Journal of Oral Surgery* 15, 24

Hovell J H (1963) *British Journal of Oral Surgery* 1, 105

Ward T G (1961) *Annals of the Royal College of Surgeons of England* 28, 139

Ware W H (1970) In: Oral Surgery (Transactions of Third International Conference). Ed. R V Walker. Edinburgh; p 148