Section of Odontology

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Paper

Criteria for Condylotomy: A Clinical Appraisal of 211 Cases

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Oblique osteotomy of the condylar neck of the mandible (condylotomy) was described by Ward (1961) for the treatment of some cases of temporomandibular joint pain/dysfunction. Since that date various workers (Campbell 1966, Sada 1967, James 1971, Tansanen & Konow 1973) have indicated that the operation appears successful in relieving pain in approximately 80% of patients. However, no long-term assessment of a large series of patients has been made. In the past twenty years 211 condylotomies have been carried out at the Queen Victoria Hospital, East Grinstead, using the original blind Gigli saw technique described by Ward (1961). In the past five years an average of 364 patients have presented annually at this unit with a diagnosis of temporomandibular joint pain/dysfunction syndrome. Taking account of total patient referrals over the twenty-year period it has been estimated that less than 3% fail to respond to conservative measures and are treated surgically.

Clinical Investigation

Since 1954, 211 condylotomies have been carried out on 174 patients (153 female, 21 male). All received a questionnaire asking them to assess the result of each operation as cured, improved, no better, or worse. Subsequent pain in the unoperated joint was also recorded.

The two authors independently examined 119 patients (68.3%) clinically and radiographically. Symptoms and function in each temporomandibular joint were recorded. An assessment of occlusal environment was made and the presence of psychological factors and other joint disease noted. Radiographic assessment by tomography in open and closed articulation was made. Finally the original notes and radiographs were examined to assess criteria for operation and long-term radiographic changes.

Of treated patients 141 (86.8%) replied to the questionnaire about 172 condylotomies (Table 1). Only 16 patients were no better or worse; 32.2% subsequently developed pain in the unoperated joint and in fact 34 (18.5%) had bilateral operations.

Of the 174 patients 119 re-attended for clinical examination. They were asked whether the joints were painful either intermittently at rest or related to movement and these answers were compared with the patient's own original assessment of the operation. A small number of patients cured by operation subsequently developed pain in the operated joints. Conversely other patients whose condition was only improved after surgery had become pain free in the intervening period (Fig 1.)

Joint excursion was assessed as hinge, restricted or full and the range of opening was measured by means of a bite gauge. Of the bilateral cases 45.7% had a gape less than 3 cm as opposed to only 13.6% of unilateral ones. In the unilateral series only 4.4% of cured patients opened less than 3 cm as opposed to 20.9% of those only improved. In general restriction of joint movement was more common in patients with persistent painful symptoms.

Some previous treatment for anxiety or depression had been given to 46 cases. This feature was present in 26.7% of cured patients,

Table 1

Results of condylotomy in 141 patients

	Left		*Right*		*Bilateral*	
	No.	*%*	*No.*	*%*	*No.*	*%*
Cured	31	46.9	23	48.9	21	36.5
Improved	30	45.5	20	42.6	28	50.9
No better	4	6.1	3	6.4	4	7.3
Worse	1	1.5	1	2.1	3	5.4
Total	66		47		56 (28 patients)	

48.8% of improved and 5 out of the 6 no better or worse category.

The average duration of painful symptoms prior to operation was 2.57 years. There were no cases of facial palsy after surgery but paræsthesia of the inferior dental nerve occurred in 15.

Radiographic Findings

Although there were variations in condylar position after operation no particular relationship to operative success was noted. The main observable effect immediately after surgery was an increase in the radiographic joint space – 71% in the unilateral and 68.8% in the bilateral series.

When 117 patients were examined by orthopantomography, the relative increase in joint space found in the postoperative radiographs was consistently noted in the long-term radiographs of the unilateral cases where 63.2% showed this feature. This was observed in 59% of the patients who were completely free of pain whereas the figure fell to 28% where joint space increase was not observed (Fig 2). However, in the bilateral series only 12.2% showed sustained increase in joint space compared with 68.8% in the immediate postoperative assessment. Among these patients with no joint space increase 31.2% only were symptom free, a proportion almost identical with the unilateral cases with no increase (Fig 2) and commensurate with the poorer long-term results in the bilateral series as a whole.

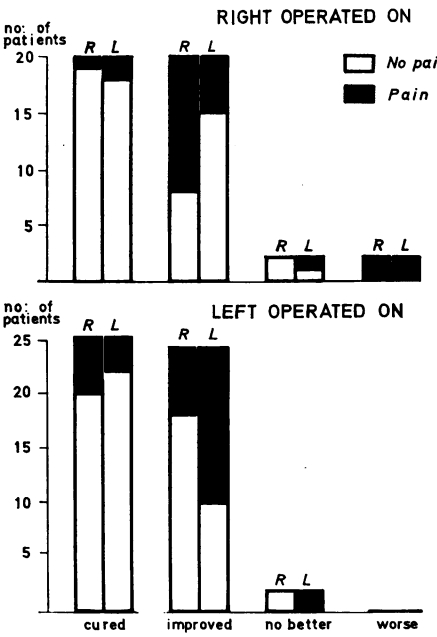

Fig 1 *Result of clinical examination after unilateral condylotomy of 96 patients to show painful joints. The patients have been sub-divided according to their own original assessment of the results of surgery*

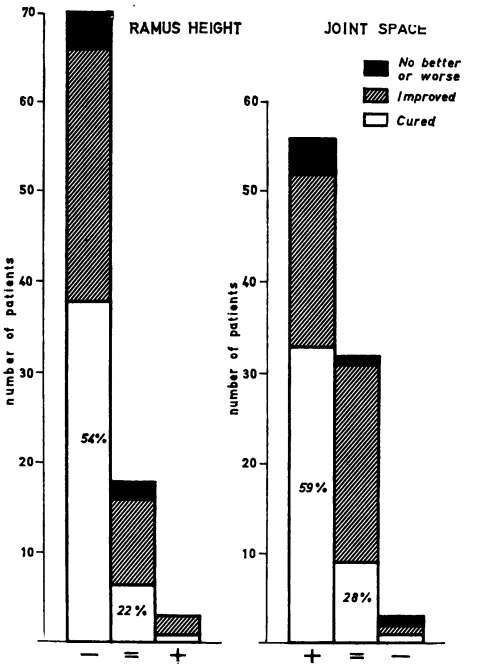

Fig 2 *Results of orthopantomography in 91 patients who had unilateral condylotomies. Ramus height relative to opposite side is indicated as decreased (—), the same (=) or increased (+). Same symbols are used for radiographic joint space. Symptomatic assessment of surgery is superimposed. The percentage figures refer to the cured patients in that column*

A remarkably consistent feature in all cases was that whatever the postoperative condylar position had been the long-term radiographs generally revealed a backward angulation of the condylar neck, a shortening of the ramus height and an increased radiographic joint space.

Discussion

This series represents a highly selected group (3%) of patients with temporomandibular joint pain/dysfunction who had failed to respond to conservative treatment; 91% of the patients were cured or improved by surgery. The main demonstrable effect of the operation was an increase in the radiographic joint space which was generally maintained, particularly in unilateral cases. Experimental investigation of condylotomy (Banks & McKenzie 1975) and fracture dislocation (Walker 1960, Boyne 1967) in primates indicates that remodelling does not occur with minor displacement of the condyle (condylotomy) whereas it does when the periosteal matrix is substantially distorted by fracture dislocation. There is evidence (Toller 1975) that in the pain/dysfunction syndrome there has been an increase in the load-bearing requirements of the joint to which it has failed to adapt with resulting changes in the ultrastructure of the

articular cartilage and frictional conflict with the articular disc. It is proposed that subsequent capsular distortion during disorganized movement leads to a painful joint with increased reflex protective muscle spasm. It is probable that the 'reflex disturbance of endogenous coordinating patterns of muscle behaviour' as Ballard (1956) has put it initiates the process but the evidence is in favour of pain originating from the joint rather than muscle (Taverner 1954).

The effect of condylotomy is probably entirely mechanical. As in the high condylar shave operation (Henny 1957) surgery effectively removes the articulating surface from conflict with the articular disc during forward movement. The joint space is increased and capsular distortion no longer occurs. There is relief of pain and damaging secondary muscle spasm is eliminated. It is probable that maintainance of this favourable relationship as occurs in unilateral condylotomy accounts for the better long-term results when compared with the bilateral operations.

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Cryosurgery

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Observations on Ice Crystals in Tissue Subjected to Repeat Freezing

Although cryosurgery in one form or another has been in existence since the turn of the century, it was not until relatively recently that a repeat freeze technique was suggested as a means of ensuring reliable cell death. Such techniques use a probe at a tip temperature of between −170°C and −70°C applied to the surface of the lesion to be treated. The tissues are deeply and rapidly frozen, allowed to thaw for varying lengths of time and then refrozen and thawed.

It appears that Kurtin & Orentreich (1954) were the first to describe a repeat freeze technique, but it was largely ignored until Cahan (1964) emphasized its use clinically. Myers *et al.* (1966) noted that there were fewer recurrences of mouse tumours following double freezes rather than single freeze techniques, and Goldenburg *et al.* (1969) stated that a single freeze can be totally destructive, but only with progression of time, whilst a double or multiple freeze cycle induces immediate death.

There is a paucity of laboratory work on repeated freeze cycles in cryosurgery, but Gill *et al.* (1968) carried out experiments on rat liver and showed that with each successive freeze-thaw cycle the freezing effect travelled through the tissues at a greater rate. These workers believed that repeated freezes disrupted cell membranes, producing a homogeneous zone which would facilitate thermal conductivity. An alternative explanation was that the hæmorrhagic condition of the tissues perhaps resulted in increased conduction of cold.

Direct measurements of thermal conductivity in tissue demonstrate an increase following a single freeze-thaw cycle (Poppendiek *et al.* 1967), but the relationship of these findings to ice-crystal dimensions and locations in the frozen tissues does not appear to have been studied.

This present paper seeks to examine ice-crystal formation during repeat freeze cycles in conditions comparable to those of cryosurgery.

Methods

A technique for the preservation and demonstration of ice-crystal spaces in biological tissues following cryosurgery has previously been described (Whittaker 1974); it allows studies at both the light and electron microscope levels.

Tissues subjected to cryosurgery are excised from the living animal, whilst still frozen and attached to the cryosurgical probe, and are dropped into various freeze substitution mixtures maintained at the same temperature as the cryosurgical probe.

In the present experiments, freezing of rodent sublingual oral mucosa was carried out by means of a probe at −70°C (Spembly Ltd, Andover) either for 2 min as a single freeze, or as two separate freezes of 1 min each separated by an interval of thawing varying between 5 and 30 min.

Tissues were freeze substituted for 8 weeks at −70°C followed by 5 weeks at −50°C, 3 weeks at −30°C and one day at −15°C. The specimens were then slowly warmed up to ambient temperature and prepared for both light and electron microscopy. Forty animals were used in the