waters for the correction of metabolic derangements and the improvement of general health, so necessary a part of a concerted attack on the disease.

The disadvantages are the expense entailed in a spa cure, which must necessarily be prolonged if good results are to be achieved. In so chronic a disease swift improvement cannot be effected in a short space of time. Nevertheless, even in a limited period a start may be made and a patient be put on the high road to recovery, which may be followed up at home.

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A. Dubois (*Thèse Paris*, 1938, No. 140) states that there are numerous cases on record indicating the possibility of tumours developing after trauma. In the absence of any knowledge as to the mechanism of the formation of new growths it is impossible either to affirm or to deny the relation of cause and effect between the trauma and the tumour. Experimental work does not yet appear to have provided sufficient data to prove or disprove this connexion. Most discussion has taken place about the development of tumours after a single trauma, whereas the possibility of the formation of new growths after repeated injuries is readily granted. There are numerous cases on record of the occurrence of sarcoma after injury to bone or muscle, and a large number of cases have been reported in which tumours of the lung, stomach, intestine, or kidney have developed after a trauma and in which the most reliable methods of investigation—such as radiography or surgical operation—have shown the absence of any tumour before the trauma. Tumours of the testis or brain are remarkably frequent after trauma. Numerous cases are also on record in which aggravation of the tumour following trauma is shown by increase in its size and the formation of metastases, accompanied by deterioration of the general condition. In order to affirm that a tumour is of traumatic origin a number of conditions must be present—namely, a latent period varying with the nature of the tumour, identity of the site of the trauma and of the tumour, absence of any tumour before the trauma, and histological confirmation of the presence of the new growth.

ORTHOPAEDICS IN RHEUMATOID ARTHRITIS*

BY

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As a simple orthopaedic surgeon I feel very diffident in contributing to the opening discussion on this subject, which has such wide general medical aspects. Dr. Edgecombe, however, in his excellent exposition has prepared the ground very well for me. He has drawn attention to the need for special centres for the treatment of this crippling disease. It is not generally realized, however, that the orthopaedic hospitals of the country are being asked to do an increasing amount of work in this field. This is, for example, true of the orthopaedic hospitals of Devon, where it has been found that the facilities we have for the treatment of tuberculosis of joints, infantile paralysis, and fractures are applicable to the prolonged general and local treatment that Dr. Edgecombe has stressed.

To take bone and joint tuberculosis as an example, we have to deal with much else besides the purely orthopaedic problems of immobilization and surgery. Opportunities are provided for the more important general treatment of the disease, combined with facilities for physical treatment and with occupational and educational interests. These facilities render an orthopaedic hospital almost an ideal centre for the treatment of rheumatoid arthritis.

In orthopaedics our great concerns are to preserve as well as to restore function; to prevent just as much as to correct deformity. In rheumatoid arthritis, as to a large extent in bone and joint tuberculosis, we stress from the outset of the disease the importance of the natural recuperative powers of the body if placed under proper conditions—namely, the protection from painful stimuli, the utilization of the beneficial effects of sunlight, fresh air, warmth, cleanliness, discipline, and what is well called “physiological rest.”

Physiological Rest

This involves immobilization of an affected joint in the best physiological position for the relief of pain; for the arrest of the inflammatory process; for rest to over-active muscles and the retardation of muscle atrophy. The position should be the best for function should ankylosis occur. This immobilization is combined with periodic movement and with other measures to improve joint and muscle function of a type and quantity suitable for the particular state of the disease. In the active stage the amount of the permitted movement and physical therapy may be *nil*, and may remain so for two weeks or more. After the acute stage has subsided function is graduated according to the progress of the individual joint. While affected joints are being rested those unaffected are given greater opportunities and encouragement for movement.

Having generalized in this manner I feel that I should proceed with a detailed statement of what are these optimum positions for physiological rest. Before doing

* Read in opening a discussion at a joint meeting of the Sections of Orthopaedics and Fractures, and Physical Medicine and Physical Education at the Annual Meeting of the British Medical Association, Plymouth, 1938.

this there is, of course, no need for me to stress that a very careful physical examination of the whole locomotor system is necessary. From all points of view it is of importance that a detailed report of this examination be made.

Physical Examination

It is the practice of orthopaedic surgeons in dealing with anterior poliomyelitis to make a muscle chart before starting treatment. In such a chart the more important muscles of the body are listed and graded in such a way that the records can be used for comparative purposes by independent examiners throughout the course of the case.

In my view we should make a similar record in rheumatoid arthritis. I append a suggested scheme (Chart 1) for recording activity of disease, joint positions, ranges of movement, and so forth for the lower extremity.

CHART 1

RECORD CHART FOR AN ARTHRITIC CASE

Date of Examination: Right side in black.
Left side in red.

Joint	Pain and Swelling	Deformity*	Movement	Range of Passive Movement*	Range of Active Movement*		Remarks (e.g., activity, muscle wasting, etc.)
					Against Gravity	Gravity Removed	
Hip ..	<i>S 0</i>	<i>30°</i>	Flexion	$(60-30)=30$	<i>20°</i>	<i>30°</i>	<i>Not active</i>
	<i>P 1</i>	<i>20°</i> <i>15°</i>	Extension Abduction Adduction Int. rotation Ext. rotation	<i>0</i> $(30-20)=10°$ $(30-15)=15°$ <i>0</i>	<i>20°</i> <i>10°</i> <i>0</i> <i>15°</i>		
Knee ..	<i>S 2</i>	<i>45°</i>	Flexion	$65-45=20°$	<i>10°</i>	<i>15°</i>	<i>Extremely painful</i> <i>Very active</i> <i>Marked quadriceps wasting</i>
	<i>P 3</i>		Extension Rotation	<i>+</i> <i>0</i>	<i>0</i> <i>0</i>		
Ankle ..	<i>S 1</i>	—	Dorsi-flexion	<i>10°</i>	<i>10°</i>	<i>10°</i>	<i>Very little change</i>
	<i>P 0</i>	—	Plantar flexion	<i>20°</i>	<i>20°</i>	<i>20°</i>	
Subastrag. & Midtars.	<i>S 0</i> <i>P 0</i>	— <i>Extreme</i>	Inversion Eversion	<i>0</i> <i>0</i>	<i>0</i> <i>0</i>	<i>0</i> <i>0</i>	<i>Bony ankylosis</i>
Midtars. & Tars.-Met.	<i>S 0</i>	—	Adduction	$<5°$	—	—	<i>Fibrous ankylosis</i>
	<i>P 1</i>	<i>20°</i>	Abduction	<i>0</i>			
	—	Dorsi-flexion Plantar flexion	$<5°$ <i>0</i>				
Metatarsophalang., First	<i>S 1</i> <i>P 2</i>	—	Dorsi-flexion	$\pm 20°$	<i>20°</i>	<i>20°</i>	<i>Hallux valgus</i> <i>Active</i>
		—	Plantar flexion	$\pm 20°$	<i>0</i>	<i>0</i>	
		— <i>45°</i>	Abduction Adduction	$\pm 10°$ <i>0</i>	<i>0</i> <i>0</i>		
2 ..	<i>S 1</i>	<i>P 0</i>	<i>30° exten.</i>				<i>Old Kohler</i>
3 ..	<i>S 0</i>	<i>P 0</i>	<i>20° "</i>				<i>No active disease</i>
4 ..	<i>S 0</i>	<i>P 0</i>	<i>20° "</i>				
5 ..	<i>S 0</i>	<i>P 0</i>	<i>40° "</i>				
Interphal. Proximal	<i>S 0</i>	<i>P 1</i>	<i>Clawed</i>				<i>No active disease</i>
1 ..	<i>S 0</i>	<i>P 0</i>					
2 ..	<i>S 0</i>	<i>P 0</i>					
3 ..	<i>S 0</i>	<i>P 0</i>					
4 ..	<i>S 0</i>	<i>P 0</i>					
5 ..	<i>S 0</i>	<i>P 3</i>					
Distal	<i>S 0</i>	<i>P 0</i>					
	2 ..	<i>S 0</i>	<i>P 0</i>				
	3 ..	<i>S 0</i>	<i>P 0</i>				
	4 ..	<i>S 0</i>	<i>P 0</i>				
5 ..	<i>S 0</i>	<i>P 0</i>					

S=Amount of Swelling: 0—Nil; 1—Appreciable; 2—Synovial thickening + fluid; 3—Hydrops.

P=Amount of Pain: 0—Nil; 1—Only at extremes of movement; 2—Through full range; 3—Also present at rest.

*Degrees of movement and of deformity are from the "normal anatomical" position.

A similar chart is used for the upper extremity.

Optimum Physiological Positions for Rheumatoid Joints

No hard-and-fast rule can be laid down which is applicable to every case and joint, but certain positions may be given as a guide for the majority of cases (Charts 2 and 3). Generally speaking, these positions are equally suitable for the earlier treatment to preserve and to restore function as for the prevention of disabling deformity should ankylosis be inevitable.

CHART 2

OPTIMUM PHYSIOLOGICAL POSITIONS (Upper Extremity)

Joint	Position	Remarks
Shoulder	Abduction 45° Flexion 30° External rotation : 30° on left Nil on right	Minimizes possibility of adduction contracture. Assists restoration of abduction. Favours circulatory flow to whole upper extremity by removing drag across 1st rib. Allows of abduction and adduction of the upper extremity through rotation of scapula if ankylosis occurs. Permits hand to be used in front of mid-sagittal plane: left side at mouth for feeding; right side at table for writing or bench work
Elbow	Right at about 80° (that is, full extension less 80°) Left at about 105° (that is, full extension less 105°)	Positions to be varied according to patient's occupation. The positions given permit right-hand use for table knife and writing, and left-hand for table fork; both in knitting and sewing
Radio-ulnar ..	Left: Mid position Right: Slightly more pronation	The right forearm is more commonly used in pronation
Wrist	Dorsiflexion so that posterior metacarpal surface makes angle of 25° with line of centre of forearm	In this position the thumb metacarpal in its neutral position continues the line of the forearm
Fingers } (including metacarpophalangeal joints)	Each joint slightly flexed	Position of semi-grasp
Thumb }	Opposed and flexed sufficiently to enable its tip to touch tips of index and middle fingers	

The above positions are based upon the individual being a right-handed person.

CHART 3

OPTIMUM PHYSIOLOGICAL POSITIONS (Trunk and Lower Extremity)

Joint	Position	Remarks
Spine	Preservation of normal antero-posterior curves	Avoid lumbar lordosis
Hip	Single joint : 25° flexion Neutral abduction adduction No rotation Both joints : Few degrees abduction, otherwise the same as for single joint	When lumbar spine also involved and if ankylosis of both inevitable, then possibility of more flexion of hips to permit of greater ease of sitting to be decided with patient's wishes—walking, of course, more difficult
Knee	Flexion 15° to 25°	Full extension to be avoided—through possibility of neuritis of sciatic nerve or its peroneal branch
Ankle	Plantar flexion 10°	Permits use of heeled shoes
Tarsus	Slightly pronated	Avoid high-arched varus position. A relatively broad weight-bearing surface prevents painful pressure points
Toes	Anatomical position	Avoid claw position

Retentive Apparatus

There is little disagreement that plaster-of-Paris forms the best type of splintage available, because it can be made to fit a limb exactly and because it can be readily converted from a splint maintaining almost absolute immobility to one that, when the indications permit, can be removed for physical therapy. Personally I favour the use of well-made hospital bandages as are available in orthopaedic hospitals, where such material is produced on a large scale. Where perfect bandages cannot be obtained there are good manufactured substitutes which are infinitely preferable to the bandages made by nurses unpractised in the art. There appears to be a vogue, extending from the field of fracture treatment to that for arthritis, in which the unpadded plaster mould is used as a splint. Possibly I am a reactionary, but I think it is unnecessary: it is disagreeable to the patient, and to my mind is a confession of poor plaster technique. I would make a plea for the greater comfort of the patient when held in a padded plaster, which, both in the treatment of fractures and of arthritis, need not, and should not, contain an "exuberance" of padding. Stockinet with a thin cellulose covering does not materially reduce efficiency, and is warmer and less irritating to the patient's skin, besides offering an opportunity for ventilation, which is so desirable owing to the clamminess often encountered.

There is one position in which I agree that the initial mould can best be of the unpadded type, and that is for the wrist and hand, where with small joints it certainly is difficult to obtain perfect approximation to limb surfaces.

Space does not permit of detailed instructions for each joint. The shoulder is not really suitable for plaster application, for its use here involves extension on to the trunk, a matter that should be avoided owing to possible interference with respiratory function. I regard the full development of respiratory capacity as fundamental in the general treatment of the disease. For the shoulder there are available adjustable abduction splints which are both light and efficient, and which can be used in conjunction with plaster for the distal portions of the limb.

Reconstructive Orthopaedics by Manipulative and Operative Surgery

Much of the work described under this heading should not be necessary if the methods of treatment already dealt with by Dr. Edgecombe and myself have been adequately carried out. Unfortunately facilities for this treatment are either not sufficiently available or are not sufficiently made use of. Patients with appalling deformities and disabilities continue all too frequently to come for treatment. Even for these pathetic cases there is no reason for the attitude of hopelessness with which they are so often regarded.

Deformity of the knees is one of the most common and serious problems. When these joints are severely flexed the patient is led to early confinement in bed or wheelchair, and accordingly suffers from the unfavourable reaction that this exerts upon the general course of the disease. Not only do deformities occur secondarily in the feet and hip, but the general metabolic state is depressed and increasing generalized bone absorption from disuse occurs. I venture to suggest that such mobilization of the calcium reserves may itself be an important factor in the stiffening process throughout the rest of the body.

The correction of flexion deformity of the knees, when ankylosis is not present, can readily be carried out. It is

important, however, that during the process the joint be securely held at rest, for by this means the correction can be made relatively painlessly. The use of a double inclined plane splint with traction is not to be recommended, as it does not satisfactorily maintain immobilization. For the severer deformities amounting to 90 degrees or more the correction may be begun by manipulation under an anaesthetic. This manipulation is not forced so as to cause extensive tearing of capsular tissues, but is merely enough to stretch the contracted hamstring muscles to their limit. In less severe cases manipulation under anaesthetic is not necessary. In both types of case, after suitable manual correction has been obtained, a plaster cast is applied from the groin to the ankle, which is well padded behind both these points and with an extra thick pad in front of the knee. When dry a cut is made around the back and sides of the plaster transversely. The plaster shell is thus almost divided into two, but is left solid in front of the knee. Into the gap thus made thin wooden blocks are inserted daily in order to wedge the two portions apart and thus straighten the knee, the amount of correction obtained each day stopping just short of pain. Pain in front of the patella always commands relaxation of correction. During the process of correction the wooden blocks may be removed each day so that the joint may be exercised through the range of corrected movement.

A very excellent modification of this method is provided by the use of a metal hinge-piece of the Zimmer type joining the two halves of the plaster, instead of the bridge of plaster in front of the knee. The great advantage of this is that a greater range of controlled movement may be given each day and pressure upon the patella is avoided. As soon as possible, and usually long before full correction is obtained, the patient should be encouraged to become ambulatory.

In the correction of any deformity the principles of Hoffa should be borne in mind: (1) mobilization and correction; (2) retention; (3) re-education. Therefore, when the knee flexion is corrected, bivalved plaster splints or light callipers should be used while re-education of the quadriceps and the fullest development of active movement are achieved.

Elsewhere in the body the same principles should be employed. Where necessary, manipulations under nitrous oxide or evipan are carried out, retentive plaster moulds applied, and hydrotherapy and other forms of physical therapy given, with the education of muscular control and active movements. Where possible, interesting occupations must also be provided to encourage these movements, and in the case of the hands the useful occupation of knitting is really valuable.

Concerning manipulation a word of warning is necessary, for I believe that one should as a rule be satisfied with small corrections at any one time. If ligaments with osteoporotic surroundings are torn from their attachments, I believe fibrositic reactions may develop (akin to the fibrositis ossificans after fracture of the elbow) and the affected joint afterwards become stiffer rather than looser.

Operations

Synovectomy is an operation having a limited scope. In osteo-arthritis, particularly of the traumatic type, it is of great value. There are certain cases of rheumatoid arthritis, however, in which synovial effusion with pain is a marked feature, and which do not respond well to more conservative measures, in weight-bearing joints

particularly. I have carried out the operation in a few of these rheumatoid joints, removing as much as possible of the synovial membrane, the results being surprisingly good. The most remarkable feature is the development afterwards of a new synovial sac.

Patellectomy.—Brooke has shown how well patients can manage without a patella, and for those individuals with ankylosis of the patella to the femur I do not hesitate to remove it.

Osteotomy, particularly in ankylosis with deformity of the wrist-, hip-, knee-, and foot-joints, is a most valuable and simple procedure, the positions obtained being those already discussed. In most cases the site of osteotomy is at the old joint line, but for hip deformities it is intertrochanteric. If the ankylosis of the hip is fibrous then the bifurcation type of osteotomy is done, with displacement of the shaft beneath the acetabulum as devised by McMurray.

Arthroplasty has its greatest sphere of usefulness in non-weight-bearing joints such as the temporo-mandibular and elbow. The best results are obtained in cases previously having bony ankylosis. It is very important to remove an ample amount of intervening bone. For the hip-joint, where it would often be desirable to obtain free movement, particularly in bilateral ankylosis, the successes are not very frequent. For the distressing cases of spondylose rhizomélisque, in which both hips and spine are ankylosed, it is worth making a good effort to obtain at least one movable hip. The method recently described by Girdlestone of removing the entire head and neck of the femur offers great encouragement in this direction.

Arthrodesis.—In a disease that tends to produce ankylosis, arthrodesis is not commonly required. In the wrist and foot, however, painful fibrous ankylosis, with or without deformity, may have to be dealt with by this fixation operation. Subastragaloid arthrodesis may enable a patient to walk who is otherwise crippled by pain, and for distressing multiple claw-toe deformities Lambrinudi's method of multiple interphalangeal arthrodesis gives most remarkable results, and to the patient pleasing relief.

J. Touati (*Thèse Paris*, 1938, No. 121), who records six cases in patients aged from 22 to 63, illustrates the rarity of osteoperiostitis in the enteric fevers by drawing attention to the fact that only four cases were encountered in a series of 1,600 typhoid patients. The condition is most frequent in young subjects, its incidence being highest under 25, and it is very rare above the age of 35, although it is occasionally found in elderly persons. The complication is most commonly met with in atypical forms of the fever in individuals who have not acquired a high degree of immunity against the specific bacillus and are apt to show a low degree of agglutination. It is due to persistence in the bone marrow of the bacillus, which gives rise to circumscribed lesions and behaves like a pyogenic organism. The osteo-periostitis may appear at an early or late stage of the fever, but in the great majority of cases it develops six to eight weeks after the onset, and sometimes not till several years later. The commonest organism is *Bact. typhosum*. *Bact. paratyphosum B* comes next, and *Bact. paratyphosum A* is hardly ever found. In some cases the typhoid or paratyphoid organism may disappear and be replaced by secondary invaders, such as the streptococcus, staphylococcus, pneumococcus, or *B. coli*, in which case the prognosis is usually grave. As a rule, however, the outlook is favourable, and in spite of the slow course and frequency of relapse complete recovery takes place. In non-suppurative forms vaccine treatment alone is required. In some acute suppurative forms operation may suffice, but usually both vaccine and operation are employed.

EFFECT OF SPONTANEOUS JAUNDICE ON RHEUMATOID (ATROPHIC) ARTHRITIS*

ATTEMPTS TO REPRODUCE THE PHENOMENON

BY

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When patients with rheumatoid (atrophic, chronic infectious) arthritis or with primary fibrositis become definitely jaundiced a notable event usually occurs: their rheumatic symptoms are rapidly, markedly, and generally completely alleviated for some weeks or months. My first observations on this phenomenon were reported in 1933 and later (Hench, 1933a, 1933b, 1934, 1935). This phenomenon was unmentioned in the modern literature on rheumatic diseases, but was casually noted by Still in 1897, by Wishart in 1903, and in three recent discussions, not on arthritis but on cinchophen toxicity (Parsons and Harding, 1932a, 1932b; Grigg and Jacobsen, 1933). More recently further observations on the phenomenon were reported by Sidel and Abrams (1934), and by Borman (1936). Heretofore the possible significance of the phenomenon has not been fully appreciated.

Recently I presented further observations (Hench, 1937, 1938a, 1938b) on two new groups of cases: (1) studies on thirty-one additional rheumatic patients who experienced the phenomenon; and (2), of equal importance, studies on four patients with rheumatoid arthritis and on nine patients with other types of articular and neuritic complaints who were *not* relieved of symptoms coincident with jaundice. These observations will be summarized briefly.

Effect of Spontaneous Jaundice

Symptomatic remissions lasting from five to ninety-two (average 19.5) weeks occurred in nineteen cases of rheumatoid arthritis (average 5.5 years' duration) in which intrahepatic or obstructive jaundice lasted an average of nine weeks. Remissions continuing for four to 104 weeks occurred in nine cases of fibrositis in which the jaundice lasted an average of 5.6 weeks. Two patients with lumbo-sacral and sciatic pain and one with secondary hypertrophic arthritis of the hips associated with "Otto pelvis" experienced jaundice and symptomatic remissions, both jaundice and remissions lasting an average of five weeks. The degree of symptomatic relief was complete for 100 per cent. of the fibrositic and for 63 per cent. of the arthritic patients; 37 per cent. of the arthritic patients had marked but incomplete relief. "Relief" implies notable or complete amelioration of the symptoms of active disease. Articular pain, active articular swelling, and muscular stiffness, soreness, and fatigue were considerably reduced or disappeared. Residual articular thickening and stiffness from deformity were, of course, unaffected. Nevertheless a moderately severe spontaneous jaundice was able to evoke a remission even in a case of long-standing very severe rheumatoid arthritis.

Four patients experienced more than one attack of jaundice; attacks of mild jaundice did not produce remissions in rheumatic symptoms, but when the jaundice was more intense the phenomenon of relief was repeated

* Communicated to the International Conference on Rheumatic Diseases, Bath, 1938.