Temporomandibular Disorders

A Problem-Based Approach

Dedication

This edition is dedicated to the memory of Robin Gray. You left fingerprints of grace on my academic career path. You shan't be forgotten.

For my 2Ms: my wife Manal and son-in-law Mohsi

For my 3Ls: Loujin, Lilas, and Leanne

Temporomandibular Disorders

A Problem-Based Approach

Second Edition

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Preface to the Second Edition

This is the second edition of *Temporomandibular Disorders: A problem-based approach*. This edition is an updated and revised copy of the first edition to enhance making clinical relevance immediately accessible to the reader.

All chapters have been revisited and two new chapters were added. More colour photographs have been used and flowcharts have been added in Appendix I for a brief description of some essential concepts in this field. A link in the text was added with a symbol indicating the number of the relevant flowcharts at the end. The text has been updated with many new relevant sections. There are two new chapters on evidence-based splint therapy management as well as the aetiology and management of bruxism. These are evolving and dynamic topics which need continuous updating. Some chapters have changed relatively little, such as Orofacial pain and You and the Lawyer, but the importance of these two aspects have been highlighted in different sections of the book. Self-directed learning is critical to develop understanding and some new questions were added to Appendix III. References have been updated and the most relevant evidence-based references and other key papers were included in the Further Reading of each chapter.

This edition, sadly, did not witness the contribution of Robin Gray. He died shortly after the book proposal of this second edition was submitted.

This book sets out to establish some new concepts and philosophies in temporomandibular disorder (TMD) learning. It contains a series of everyday situations that will be encountered in practice. The answers are there but it is up to the reader to find them!

Learning is a dynamic process and those who are involved actively will gain more than passive recipients of knowledge. Problem- or enquiry-based learning should provoke thought and arouse readers' curiosity, motivating them to learn and guiding them into creative thinking. Giving readers a real-life clinical scenario will structure their thoughts, increasing the effectiveness of information delivery and lead to a logical conclusion.

The case histories are stand alone, and each should contain sufficient information for the reader to reach the correct diagnosis and formulate a correct treatment plan that is in the patient's best interests.

There will inevitably be some repetition in the text especially in relation to the chapters on anatomy, function, pathology, classification, and clinical examination. This is because we did not want the reader to have to constantly cross-refer to earlier chapters when reading the case histories. Although there will be some duplication, the case histories will introduce new facts of specific relevance to that situation. We hope that this will meet students' demands because the earlier chapters which are for information can be applied in the later case studies.

There is a unique link to an online interactive quiz (www.wiley.com/go/al-ani/temporomandibular-disorders-2e). This quiz aims not only to test your knowledge of TMD but also to make reading this book more enjoyable, stimulating, and productive.

We have provided a further reading list of relevant evidence-based articles which, as far as possible, are either from systematic reviews or randomised controlled trials published in evidence-based dentistry journals. Therefore, they provide the most up-to-date information.

The final chapters are practical guides of how to make splints and samples of patient information sheets that can be used as templates. We hope therefore that we have addressed not only WHY but also HOW.

Acknowledgements

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Denise Margaret Coogan has been kind in permitting us to use her as a photographic model in Chapters 3 and 17.

I am very grateful to Tanya McMullin and Loan Nguyen for the advice and support in the production of this text.

Chapter 1

About the Book

About temporomandibular disorders: what is a 'TMD'?

The term 'temporomandibular disorders' (TMD) covers a constellation of conditions. There have been many attempts to categorise these conditions but all have shortfalls. Some classify by anatomy, some by aetiology, and some by frequency of presentation. We should be aware, however, that there is considerable overlap in any classification system because these are often not clinically appropriate. No one system, therefore, satisfies all the criteria.

TMD affect the articulatory system, consisting of the temporomandibular joints, mandibular muscles, and the occlusion.

Any factor that has an effect on one part of the system is likely to influence other parts of the system, so it is important to avoid tunnel vision when considering possible signs and symptoms of a TMD.

As a dentist in practice, you will inevitably encounter patients with symptoms of a TMD, who may present with facial pain, earache, toothache, jaw joint sounds, or limited movement.

It is estimated that between 50% and 70% of the population will at some stage in their life exhibit some sign of a TMD. This may be subclinical and the patient might not relate the signs to a jaw problem.

In about 20%, these signs will develop into symptoms, which implies that the patient will take notice of hitherto ignored signs, and about 5% of the population will seek treatment. This will happen if the symptoms become intrusive in day-to-day life. It is important for you, as a dentist, to identify these patients and recognise their particular needs and treatment requirements.

The patient may attend complaining of toothache because their natural assumption would be that a tooth was causing the problem, but your role as a clinician is to diagnose the actual cause of the symptoms.

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A patient presenting with a TMD may have symptoms, in any combination, which might include preauricular or facial pain, restriction or alteration of the range of mandibular movement, muscle pain that is worse with function, localised jaw joint pain, jaw joint sounds such as clicking or crepitation, unexplained tooth sensitivity, tooth or restoration fracture, and chronic daily headache. You must be able to diagnose what is and what is not appropriate for you to treat.

All treatment should be evidence-based. Numerous treatments, either on their own or in combination, have been proposed in accordance with various aetiological theories of TMD. A wide range of pharmacological, occlusal alteration, psychotherapeutic, and physiotherapeutic treatments have also been suggested for the management of TMD, mainly aimed at the reduction of pain and improving the range of movement.

This is possibly the area of most contention in TMD management. Several treatments have been proposed which are not evidence- or scientifically based and when the literature is critically evaluated it is obvious they have little rationale. It is not sufficient to argue that if a treatment modality is published in a journal, which may not be subject to peer review, be un-refereed, or is accessible through the Internet, then it is validated. The dentist has a responsibility only to prescribe treatment for patients that has a proven therapeutic value and ignorance of currently accepted views of what a reasonable body of dentists would do is not an excuse.

All TMD managements and treatments discussed in this second edition of the book are based, as much as possible, on scientific evidence and on sound clinical judgment in cases where only partial evidence or contradictory data were found.

About the book

In modern dental schools, there is a shift from traditional teaching to more interactive methods. In classical didactic textbooks, readers are frequently seen as passive recipients of information, without any engagement in the learning process. Problem-based learning increases the effectiveness of delivering information and makes learning a more memorable experience for the reader.

A green flag denotes a positive pathway and suggests that the reader should follow this train of thought.

A red flag signals caution and suggests that the reader should think hard about this aspect of diagnosis, investigation, or treatment.

The ‘information’ symbol indicates a passage of text that imparts fact(s) that should be remembered.

Assessment of knowledge is by a link to online self-assessment multiple-choice questions, which are marked correct or incorrect, and by short answer questions at the end of the book to which answers are not given because the reader needs to research the topic in the text.

The ‘S’ symbol (with a number) indicates a link to the flowcharts which can be found at the end of the book in Appendix I.

Chapter 2: Clinical aspects of anatomy, function, pathology, and classification

This chapter deals with the need for a basic understanding of the normal anatomy, physiology, and pathology of the temporomandibular joint and mandibular muscles, which is essential not only for an understanding of the disease processes involved in TMDs but also for an appreciation of treatment objectives.

Chapter 3: Articulatory system examination

This chapter discusses clinical examination and is indispensable! It outlines an easy yet comprehensive examination routine that should be employed for all your patients, not just those with a TMD.

Chapter 4: I've got 'TMJ'

This chapter illustrates a classic history of a common TMD in a patient who thinks that she knows best. This highlights the importance of critical evaluation of the information (baggage) that a patient might bring to the consultation.

Chapter 5: I've got a clicking joint

This represents the most common condition about which you will be asked. Does a click need treatment? This raises your awareness of the need for treatment and the different treatment options for a commonplace complaint.

Chapter 6: I've got a locking joint

Joint locking can be acute or long-standing. Intervention is often necessary, but how and when? The various options are discussed, as is their practical relevance. We explore the range of options from 'doing nothing' to 'surgery'.

Chapter 7: I've got a grating joint

Degenerative joint disease in the temporomandibular joint is very different from disease in the hip. Nature has a part to play, but we can intervene to make life more tolerable for the person with the condition. Learn about the cyclical nature of this condition and its ramifications.

Chapter 8: You've changed my bite

The possibility of introducing iatrogenic changes to a patient's bite is quite real and can have immediate consequences. Avoidance of the problem is the best approach but to do this you must be aware of the potential pitfalls in restorative care.

Chapter 9: I've got pain in my face

Differential diagnosis is often a complex procedure but must not be avoided. You must avoid tunnel vision and keep an open mind about a patient's complaint no matter how badly explained or difficult to follow. Facial pain is a minefield of potential diagnoses and must be approached logically.

Chapter 10: I've got a dislocated jaw

Although true dislocation is rare, immediate action gives your patient (and you) the best chance of resolving the problem. Learn how to differentiate dislocation from other conditions and how to manage the acute case.

Chapter 11: My teeth are worn

Management of tooth surface loss is a complex treatment, but some straightforward rules will help in diagnosis of the cause, monitoring of the situation, and its management.

Chapter 12: I've got a headache

Headache is a very complex condition even to diagnose. The relationship of headache to TMD is explored, as is the role of the dentist in treating patients whose primary complaint is headache.

Chapter 13: I've got whiplash

Nowadays litigation, especially in relation to road traffic accidents, is commonplace. TMD can be caused by a 'whiplash-type' injury. Make sure that your examination of such a patient is comprehensive and that you are able to produce the necessary records on demand. Be aware that a TMD can become apparent immediately after an accident as well as becoming evident some time later.

Chapter 14: What's of use to me in practice?

You must be aware of what is available and useful in general practice. There is little point in a costly treatment plan being developed if the patient cannot afford it. Similarly provision of a splint that you know your patient will not wear is pointless. This gives guidelines towards accessing the best treatment for your patient and when to employ it.

Chapter 15: You and the lawyer

Litigation is never too far away! Although you should not practise 'litigation dentistry' because this is not in your patient's best interests, you should be aware of the common pitfalls. Above all else maintain good records and good communication, and do not over-reach your abilities.

Chapter 16: The referral letter

A good referral letter is of great help to the specialist. A poor referral letter is a waste of everyone's time and can, on occasion, be embarrassing for all.

Chapter 17: How to make a splint

This is a 'how-to-do' chapter. It is important for you to know what the technician does from impression taking to delivering the splint back to you ready for insertion and fitting. The patient will often ask about this and appreciate an explanation.

Chapter 18: Bruxism: Current knowledge of aetiology and management

This chapter deals with the most updated information about the postulated theories of aetiology and management of bruxism. New definitions and outcomes of recent international consensus are always discussed.

Chapter 19: Splint therapy for the management of TMD patients: An evidence-based approach

The effectiveness of splint therapy for the management of TMD and Bruxism have been discussed in this chapter. The results of the most updated randomized controlled trials and systematic review have been discussed.

Chapter 20: Patient information

This chapter contains general patient information, in template form, that you might like to use for imparting patient advice when appropriate.

Appendix I: Flowcharts

This chapter contains 13 flowcharts which summarise some essential concepts in the management of a TMD. A reference for each relevant chart has been indicated in the text.

Appendix II: Glossary of terms

This is more of a dictionary of terms than merely a glossary of terms used in this book. This provides the reader with a 'TMD and occlusion' dictionary.

This chapter identifies the relevant terms from the glossary of prosthodontic terms published regularly in the *Journal of Prosthetic Dentistry*. Additional terms are added from the book *A Clinical Guide to Temporomandibular Disorders*, BDJ Publications, 1997.

Appendix III: Short answer questions

This chapter includes short answer questions for the reader to practise. The knowledge gained from reading this book will enable the reader to answer these questions effectively.

There is a unique link to an online interactive multiple-choice question (MCQ) site at www.wiley.com/go/al-ani/temporomandibular-disorders-2e. This quiz aims to test your knowledge of TMD and to make reading this book more enjoyable, stimulating, and productive.

Chapter 2

Clinical Aspects of Anatomy, Function, Pathology, and Classification

The joint anatomy, histology, structure, capsule, synovial membrane, and fluid, ligaments

The articulatory system comprises the temporomandibular joints (TMJs) and, intra-articular discs, mandibular/jaw muscles and occlusion.

In the simplest terms, the temporomandibular joint is the articulation between the upper and lower jaws. The teeth form the contacts between the upper and lower jaws, and the muscles are the motors that move the mandible. This system is unique in that the TMJs are paired; any stimulus that affects one joint or any other single part of the articulatory system can have a 'knock-on effect' in the rest of the system.

It is important to have an understanding of anatomy not only to be able to differentiate between what is physiological and what is pathological but also to understand the objectives of some treatment options.

The TMJ (Figure 2.1) is a synovial diarthrodial joint, which means that the joint is lubricated by synovial fluid, and the joint space is divided into two separate compartments by means of an intra-articular disc. The movements that take place in the compartments are predominantly a sliding movement in the upper joint space between the upper surface of the disc and the inferior surface of the glenoid fossa, and a rotational movement in the lower joint space between the head of the condyle and the undersurface of the intra-articular disc. Unlike the articular surfaces of other synovial joints, where the surfaces are typically lined by hyaline cartilage, the articular surface of the TMJ is covered by a layer of fibrocartilagenous tissue. It was thought that this arrangement reflected a non-load bearing functional role for the TMJ; however, a more likely explanation is that, because the covering layer of the condyle is derived

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Figure 2.1 The temporomandibular joint (M. Ziad Al-Ani, Robin J.M. Gray.)

from intramembranous ossification, rather than endochondrol ossification, it therefore lacks the endochondrol template from which hyaline articular cartilage is derived.

Histology

There are four distinct layers or zones described in the articular surface of the condyle and mandibular fossa. These layers are the articular zone, proliferative zone, cartilagenous zone, and calcified zone (Figure 2.2):

1. The articular zone is dense fibrous connective tissue and forms the outer functional surface of the condyle head. As a result of this fibrous connective tissue layer, it is suggested that it is less susceptible to the effect of ageing and breakdown over time. In addition, despite a poor blood supply, it has a better ability to repair, good adaptation to sliding movement, and the ability to act as a shock absorber when compared with hyaline cartilage.
2. The proliferative zone is mainly cellular and is the area in which undifferentiated germinative mesenchyme cells are found. This layer is responsible for the proliferation of the articular cartilage and the proliferative zone is capable of regenerative activity and differentiation throughout life.
3. The cartilagenous zone contains collagen fibres arranged in a criss-cross pattern of bundles. This offers considerable resistance against compressive and lateral forces but becomes thinner with age.

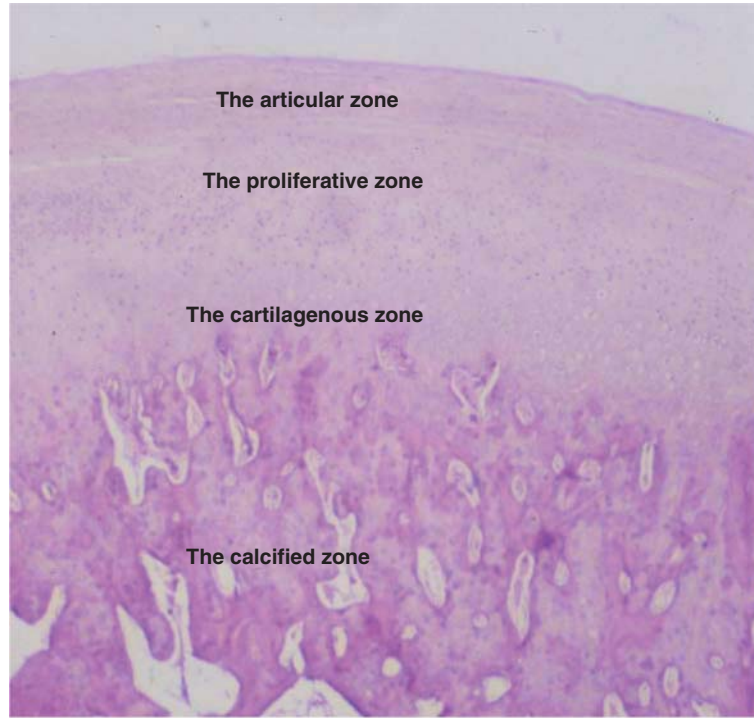

Figure 2.2 The four distinct zones described in the articular surface of the condyle and mandibular fossa (M. Ziad Al-Ani, Robin J.M. Gray.)

4. The calcified zone is the deepest zone and is made up of chondrocytes, chondroblasts, and osteoblasts. This is an active site for remodelling activity as bone growth proceeds.

The joint capsule

The joint capsule (Figure 2.3) envelops the articular disc and is attached superiorly to the rim of the glenoid fossa and articular eminence and inferiorly to the neck of the condyle. Posteriorly it is attached to the bilaminar zone and anteriorly becomes continuous with the pterygoid muscle attachment. Although it is thin both anteriorly and posteriorly, it is strengthened laterally by the lateral temporomandibular ligament which is not a discrete ligament but a thickened part of the capsule.

Synovial membrane

The glistening inner surface of the capsule comprises the synovial membrane. At birth, this membrane covers all internal joint surfaces but is lost from articular surfaces as function commences. The flexibility of the inner

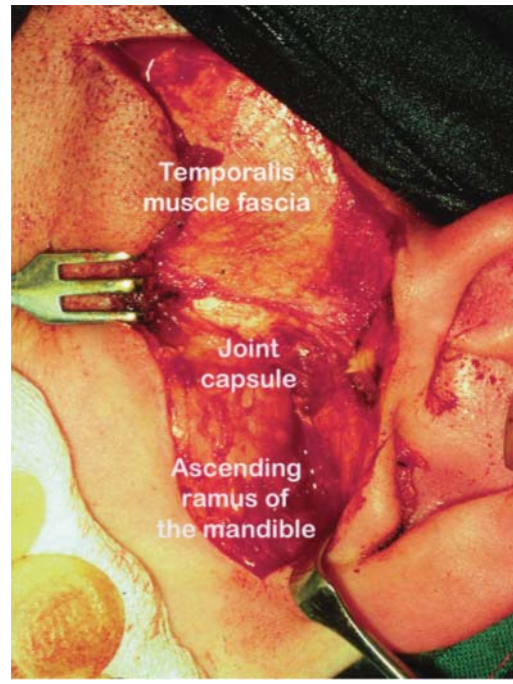

Figure 2.3 The joint capsule (M. Ziad Al-Ani, Robin J.M. Gray.)

surface of the capsule is increased by finger-like projections (villi) of the synovial membrane which disperse the synovial fluid.

The function of the synovial membrane is considered to be

- regulatory because it controls electrolyte balance and nutrients
- secretory via the interstitial cells
- phagocytic.

Synovial fluid is a clear, pale-yellow, viscous solution secreted by the synovial tissues and consists mainly of an ultrafiltrate of plasma enriched with a proteoglycan-containing hyaluronic acid synthesised by synovial cells. The high viscosity of this fluid is a result of the presence of sodium hyaluronate which provides lubrication. The synovial fluid also allows removal of degradation products from the joint space, lubrication of the joint surfaces, and nutrition of the vascular parts of the joint.

Ligaments

The temporomandibular ligament

The temporomandibular ligament is a strong band of fibrous tissue originating as a thickening of the lateral aspect of the joint capsule. It starts at

Figure 2.4 The position of stylomandibular ligament. (M. Ziad Al-Ani, Robin J.M. Gray.)

the root of the zygoma and passes obliquely towards the posterior margin of the neck of the condyle, blending into the joint capsule. In the rest position, this ligament is relaxed, but it is thought that, during retrusive and protrusive movements of the condyle, it limits movement in an anteroposterior direction.

The stylomandibular ligament

This is considered as an accessory ligament. It is a specialised band of cervical fibrous tissue extending from the styloid process to the medial border of the mandible at its angle (Figure 2.4). The function of this ligament is not clear but it is thought to limit anteroposterior movements of the mandible.

The sphenomandibular ligament

This ligament is also considered to be accessory. It comprises a flat band of fibrous tissue originating from the spine of the sphenoid bone and passes down to its insertion at the inferior margin of the mandibular foramen (lingula) (Figure 2.5). Again, its function is not certain, but it is thought to limit lateral condylar movements.

The intra-articular disc (meniscus)

About 55 years ago, Rees described the intra-articular disc as being like a 'school-boy's cap'. It is an oval-shaped tense sheet of fibrous

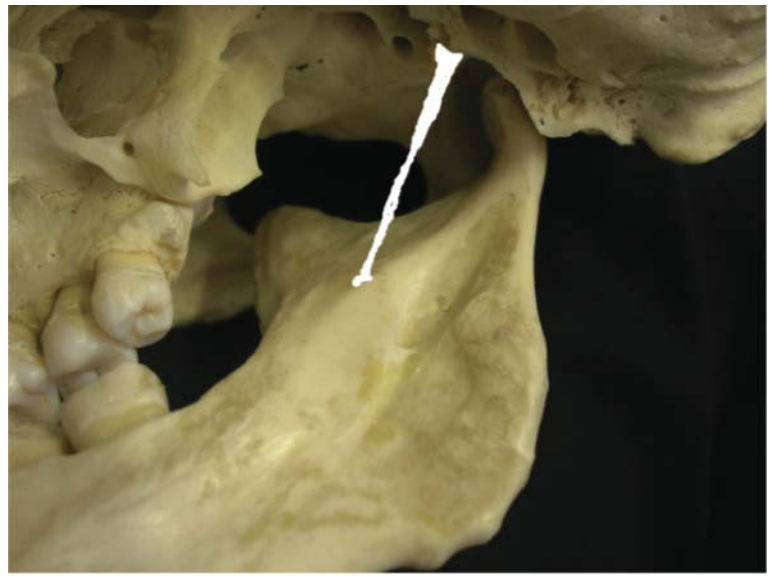

Figure 2.5 The position of sphenomandibular ligament. (M. Ziad Al-Ani, Robin J.M. Gray.)

tissue with a concave inferior surface sitting on the head of the condyle (Figure 2.6). On its posterior aspect, it has a convex upper surface; it becomes saddle-shaped on its anterior aspect. It overlays the condylar head and blends medially and laterally with the capsule. It is also attached to the medial and lateral poles of the condyle and anteriorly to the superior pterygoid muscle. This structural arrangement, as it is interposed between the head of the condyle and the glenoid fossa, divides the joint into the upper and lower joint spaces (Figure 2.7).

There are four zones of the disc:

1. The anterior band which is of moderate thickness but narrow in an anteroposterior direction.
2. The intermediate band, which is the thinnest zone of the disc.
3. The posterior band, which is both the thickest and the widest transverse zone of the disc.
4. The bilaminar zone, which consists of two parts: the superior band, which is attached to the posterior wall of the glenoid fossa and squamotympanic fissure and is elastic, and the inferior band, which is attached to the neck of the condyle and is fibrous.

The disc is attached anteriorly to the margin of the articular eminence superiorly and to the articular margin of the condyle inferiorly. Posteriorly, the disc is attached to the glenoid fossa and squamotympanic fissure

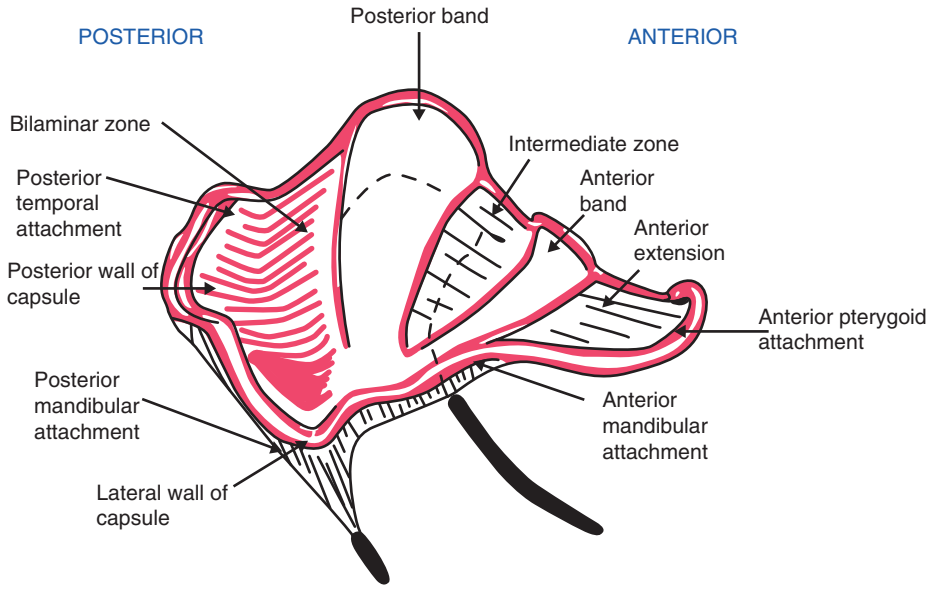

Figure 2.6 Diagram of disc morphology. (Rees LA. The structure and function of the mandibular joint. J Br Dent Assoc 1954; XCVI:126–33.)

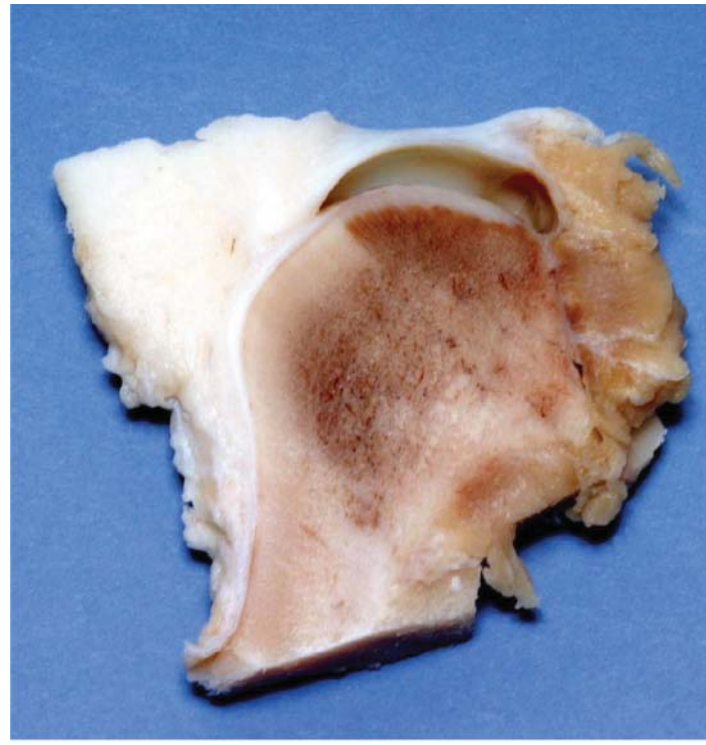

Figure 2.7 Sagittal section of porcine temporomandibular joint. As in human beings, the articular surface of the mandibular condyle is convex and joins the lower articular surface of the meniscus, which is concave, to form a condylomeniscal joint. (M. Ziad Al-Ani, Robin J.M. Gray.)