

3 Sternoclavicular Joints

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3.1 Introduction

The normal anatomy of the sternoclavicular joints varies due to many developmental variations, age and different normal signs caused by a rather constant load on the joints. They are the only synovial joints between the upper extremity and the axial skeleton. They accompany movement of the arms and move slightly during respiration, which contributes to continuous strain.

3.2 Macroscopic Anatomy

The sternoclavicular joint is formed by the articulation of the medial end of the clavicle with the clavicular notch of the manubrium sterni and the adjacent cartilage of the first rib. The articular surfaces of the sternum and the clavicle are incongruent. Only a relatively small area of the medial clavicle is in contact with the manubrium sterni, but the joint contains a fibrocartilaginous intra-articular

disc that fills the space between the apposing articular surfaces (Fig. 3.1). The disc is strongly attached to the superior margin of the clavicular articular surface and to the first costal cartilage inferiorly and attached to the interior of the capsule (Fig. 3.1). The disc is an important buffer between the joint surfaces acting as a check-rein against medial displacement of the clavicle. In 97% of individuals this disc divides the joint into two compartments or a double gliding joint [5].

Owing to the discrepancy in size between the two articular surfaces, the stability of the sternoclavicular joint depends on surrounding ligaments in addition to the disc. The fibrous articular capsule surrounding the articulation is reinforced by the anterior and posterior sternoclavicular ligaments and the interclavicular ligament (Fig. 3.1). The joint is further stabilised by the costoclavicular ligament,

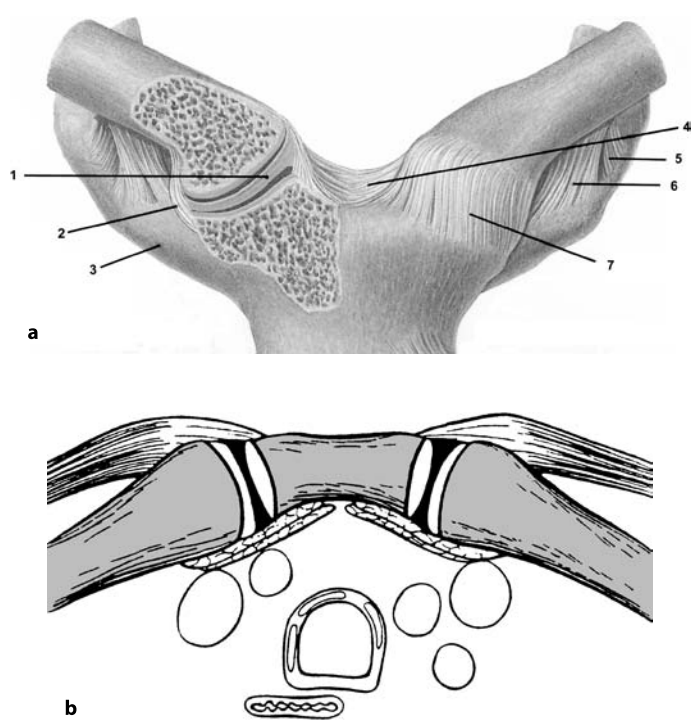


Fig. 3.1 Sternoclavicular joints. **a** Anterior aspect of the joints. The right joint is cut in the coronal plane. 1 Intra-articular disc, 2 articular capsule, 3 costal cartilage, 4 interclavicular ligament, 5 costoclavicular ligament, posterior fibres, 6 costoclavicular ligament, anterior fibres, 7 anterior sternoclavicular ligament. **b** Superior aspect of the sternoclavicular joint demonstrating the incongruence of the joint facets and intra-articular disc attached to the capsule anteriorly and posteriorly

which extends from the inferior surface of the medial end of the clavicle to the first rib and the adjacent costal cartilage [2, 11]. It is a short, flat, strong, rhomboid-shaped ligament with an anterior and posterior sheet separated by a bursa [2]. It nearly always merges with the sternoclavicular joint capsule [2]. The costoclavicular ligament resists forces that attempt to displace the medial clavicle anteriorly, posteriorly or medially and stabilises the joint by acting as a fulcrum with motion occurring around the axis through this ligament [10]. Ossification of this ligament does not occur in persons without rheumatologic disorders [9, 11]. The presence of stabilising surrounding ligaments implies that the costoclavicular region contains many areas with insertion of fibrous tissue into bones, usually named entheses [3], which can be involved in inflammatory disorders (enthesopathy).

The blood supply to the sternoclavicular joints comes from the internal thoracic artery, and this has to be taken into account when suspecting infection or aseptic necrosis.

3.3 Microscopic Anatomy

The sternoclavicular joint is a true diarthrodial synovial-lined joint. It has been described to differ from other diarthroses, except the temporomandibular joints, by containing fibrocartilaginous and not hyaline articular cartilage when fully developed [4, 7, 8, 11]. The cartilage has been reported placed directly on the bone and fixed by a network of fibrous fibres penetrating into the bone [8], making the junction between cartilage and bone anatomically somewhat similar to entheses [3]. However, examination of three necropsy specimens (a 23-year-old male, and two 47- and 49-year-old female crime victims) performed at our institution revealed that, for their age and sex, the cartilage is hyaline, but with intermingling fibrous fibres at the peripheral part corresponding to the attachment of the intra-articular disc, the capsule and the surrounding ligaments (Fig. 3.2a). These areas therefore gain an appearance similar to fibrocartilage. At the age of 47–49 years there was also dispersed fibrous fibres in the superficial part of the cartilage centrally, but with underlying hyaline cartilage (Fig. 3.2b). At the age of 23 years the cartilage was also hyaline superficially (Fig. 3.2c). Our finding of hyaline cartilage in adults is in accordance with the reported presence of hyaline cartilage in childhood and adolescence [4, 8]. The reported appearance simulating conversion to fibrocartilage in adulthood may be explained by more prominent intermingling ligamentous structures and probably also to the frequent occurrence of degenerative changes [6]. Irrespective of the type of cartilage, the articular cartilage of adults has been reported to be thicker on the clavicle than on the manubrium sterni [8, 11].

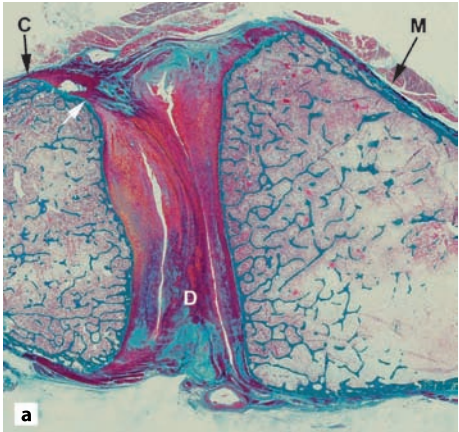


Fig. 3.2a Microscopic appearance of the sternoclavicular joint. Semiaxial 10- μ m-thick methyl methacrylate-embedded section through the joint of a 47-year-old woman stained with Goldner-trichrome. The intra-articular disc is seen to divide the joint into two compartments, being attached to the capsule anteriorly and posteriorly and also to the clavicle by a strong ligamentous structure (*white arrow*).

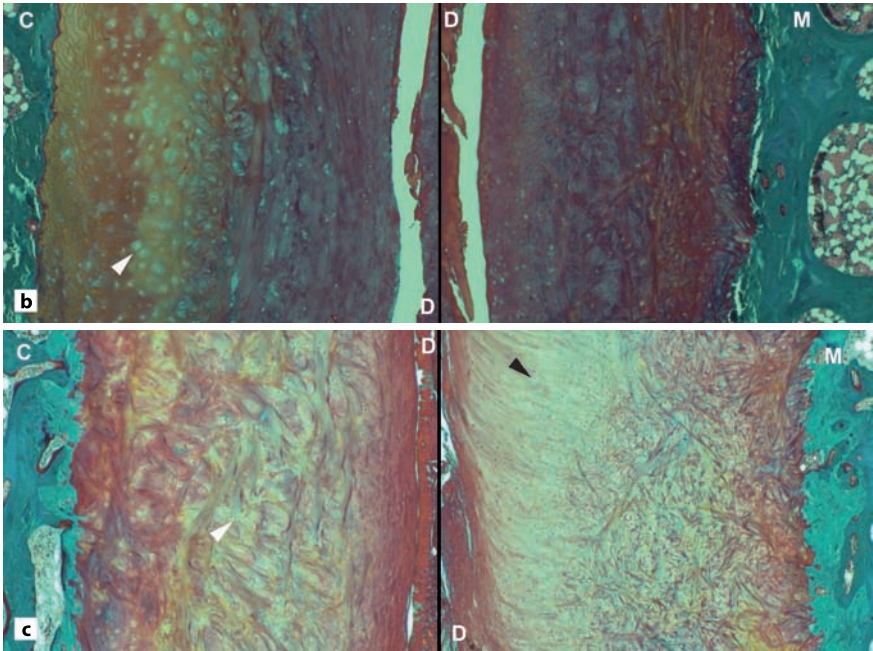


Fig. 3.2b,c Microscopic appearance of the sternoclavicular joint. **b** Magnified views of the clavicular (*left*) and the sternal cartilage (*right*) in Fig. 3.2a show the existence of hyaline cartilage beneath a layer of cartilage intermingled with fibrous structures, most obvious in the clavicular cartilage (*white arrowhead*). **c** Joint from a 23-year-old man (stained similarly). Magnified histological sections of the clavicular (*left*) and the sternal cartilage (*right*) show hyaline cartilage superficially, especially on the sternal side (*black arrowhead*). At the clavicular side there were some fibrous structures surrounding cartilage cells (*white arrowhead*). C Clavicle, M manubrium sterni, D intra-articular disc

3.4

Appearance at Imaging

The normal sternoclavicular joints are difficult to visualise by conventional radiography due to overprojecting structures. Computed tomography eliminates this problem and can visualise the osseous structures clearly, especially when using multislice CT (MSCT) with secondary reconstructions. The increasing use of MSCT with routine multiplanar reconstructions has revealed a wide variable appearance, for example seen at chest CT for other disorders. This is due to a frequent occurrence of degenerative changes. Advanced osteoarthritis is infrequent before the age of 40 years, but occurs in almost all persons older than 70 years [6]. Osteoarthritis often includes calcification of the first costal cartilage (Fig. 3.3). MSCT is

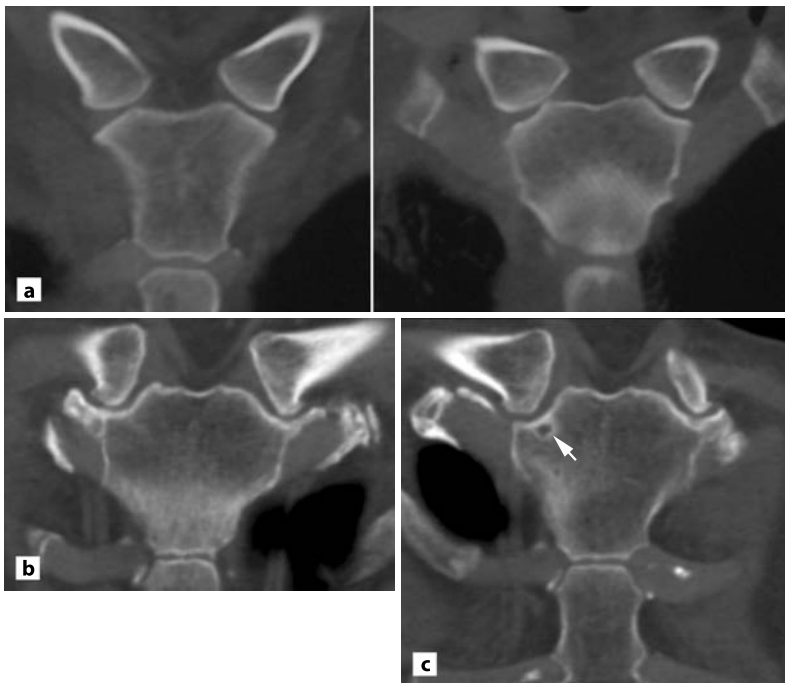


Fig. 3.3 Computed tomography appearance of normal sternoclavicular joints. **a** Coronal MSCT reconstructions of a 40-year-old woman without signs of degenerative changes. **b** In a 47-year-old woman there is slight joint space narrowing inferiorly with small clavicular osteophytes and also calcification of the first costal cartilage. **c** A 57-year-old woman who in addition to joint space alteration had a subchondral cyst (*arrow*) in the manubrium. **d** see Page 34

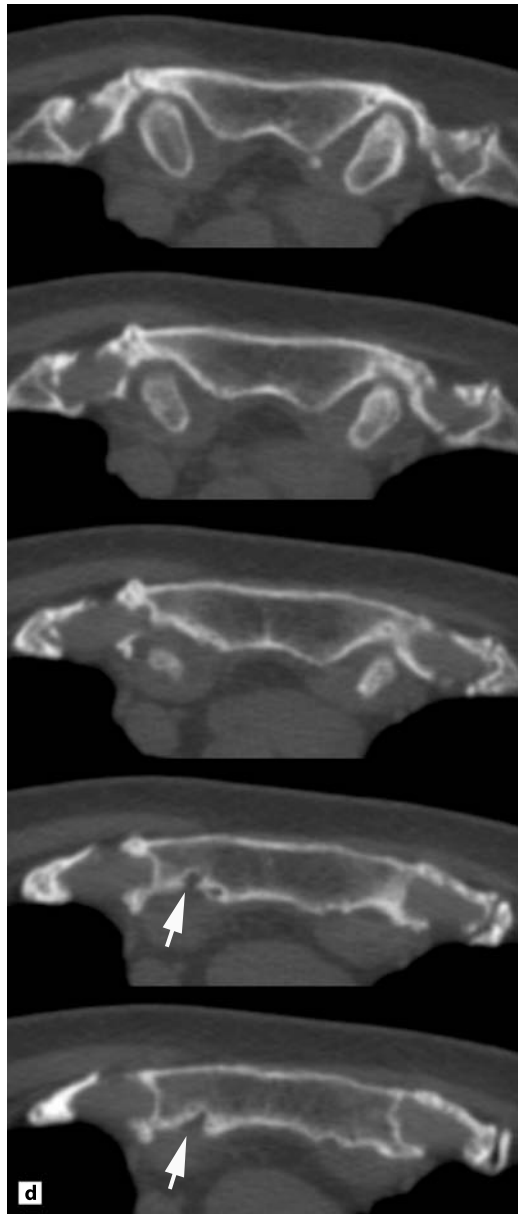


Fig. 3.3 (*continued*) Computed tomography appearance of normal sternoclavicular joints.
d Supplementary axial slices show that the cystic appearance may be due to cortical indentations (*arrows*)

an excellent method for delineating calcified structures, but soft tissue structures can only be visualised to the extent possible by X-ray attenuation.

Magnetic resonance imaging (MRI) allows detailed imaging of the normal soft tissue structures of the sternoclavicular joint (Chapter 7). This has been documented by MRI of non-moving specimens [1]. The normal anatomical structures can usually be delineated at clinical MRI when performed appropriately and not influenced by the occasional problems with movement artefacts. On axial images the anterior and posterior part of the capsule, and the anterior and posterior sternoclavicular ligament are delineated, in addition to the anterior and posterior attachment of the disc, and the costoclavicular and interclavicular ligaments. Coronal images are superior for displaying the articular surface of the medial end of the clavicle and the manubrium in addition to the disc. The costoclavicular ligament is also well delineated, but differentiation between the anterior and posterior portion is not possible. The thickness of the costoclavicular ligament is best delineated on sagittal images, but the two fascicles of this ligament and the bursa between them are seldom seen. The extent of the anterior and posterior sternoclavicular ligaments and the attachment of the intra-articular disc to the capsule anteriorly and posteriorly is also delineated by this slice orientation [1].

3.5 Conclusions

The anatomy of the sternoclavicular joint is rather complex being composed of incongruent joint facets with an intervening intra-articular disc and with many surrounding ligaments and entheses, which may be involved in seronegative arthritis. The joint cartilage is basically hyaline, but with intermingled fibrous fibres which contribute to an appearance simulating fibrocartilage. This may partly be due to a frequent occurrence of degenerative changes.

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