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SCJ osteoarthritis: The significance of joint surface location for diagnosis

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ABSTRACT

An evaluation of the method used to diagnose sternoclavicular joint (SCJ) osteoarthritis (OA) in skeletal remains is presented, with particular attention given to the anatomy of the joint. The current palaeopathological diagnostic criteria used to identify SCJ OA were found to be appropriate for both the sternal and clavicular surfaces of the SCJ, with eburnation indicating perforation of the intra-articular disc and advanced disease. Eburnation was found to occur rarely in the SCJ, and if used as the sole diagnostic criterion would result in an underestimation of SCJ OA prevalence in archaeological assemblages.

A key finding was the identification of changes characteristic of OA but confined to the attachment zone of the intra-articular disc on the clavicular surface of the SCJ. As this area of the joint is non-articular, and not normally covered with articular cartilage, a diagnosis of OA would be inaccurate and instead it should be considered as an enthesopathy. It is likely that SCJ OA has been incorrectly identified and over-diagnosed in the archaeological record in the past. More histological research into the disc attachment and its degeneration is required before this can be confirmed.

1. Introduction

The sternoclavicular joint (SCJ) is one of the joints of the shoulder complex and is involved in virtually every movement of the shoulder. As a moving synovial joint the SCJ is subject to a range of pathological and degenerative changes, the most common being osteoarthritis (OA). The SCJ, like the acromioclavicular joint, is an atypical synovial joint, being lined with fibrocartilage instead of hyaline cartilage. It possesses an intra-articular disc, a continuation of the intra-articular disc ligament, which usually completely divides the joint into two compartments (Fig. 1).

As an individual joint, it has received little attention in the palaeopathological literature. Roberts et al. (2007) recorded degenerative changes of the SCJ in their study of the shoulder complex, finding that 46% of the medial clavicle joints and 38% of the sternal facet joints were affected. SCJ OA was identified in approximately 5% of individuals from the post-medieval crypt burials at Christ Church, Spitalfields (Waldron, 1991) and in 3.1% of individuals recovered from a 14th century Black Death pit in London (Waldron, 1992). Studies using the Hamman-Todd skeletal collection also found SCJ OA to be uncommon (Rothschild and Robinson, 2007).

The current work examines the most commonly identified degenerative changes of the SCJ and the relationship with joint surface location and joint anatomy. The diagnostic criteria used to diagnose SCJ OA in archaeological human remains are evaluated based on the results obtained.

2. Material and methods

Analysis was carried out on medieval material from a cemetery site on the Island of Mis, Sudan (n = 61) and from an Anglo-Saxon cemetery site at Worcester Cathedral (n = 28). Individuals were selected only if the following criteria were met: both SCJs were present and well preserved (at least 75% of the joint surface present) and the medial epiphysis of the clavicle was fully fused. Age and sex were estimated using standard osteological techniques (Buikstra and Ubelaker, 1994). In total 39 were determined to be male, 47 female and 3 were of undetermined sex. A total of 25 were classified as young adult (less than 35 years of age), 31 middle adult (35–45 years of age) and 28 as old adult (greater than 45 years of age). For 2 individuals age was recorded as adult only.

SCJ surfaces were inspected for those bony changes diagnostic of OA, and laid out in the operational definition of Waldron (2009), namely eburnation, marginal osteophytes, new bone and/or pitting on the joint surface, and alteration in the joint contour. OA was diagnosed when eburnation or two or more of the other changes were present on a single joint surface. The joint surface location of each change was noted for both the clavicle and manubrium.

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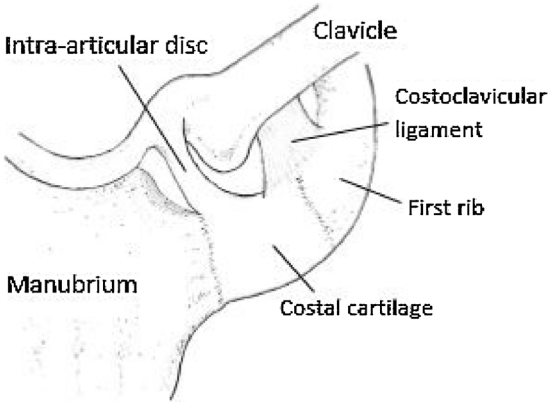

Fig. 1. The left sternoclavicular joint showing the location of the intra-articular disc between the clavicular notch of the manubrium and the sternal end of the clavicle. The disc attaches superiorly to the clavicle, and inferiorly to the costal cartilage of the first rib, separating the joint into menisco-clavicular and menisco-manubrial compartments (illustration by M.Dobson, adapted from Gray, 1998).

3. Results

The total recorded counts for each degenerative change are presented in Tables 1 and 2, for all joints and OA affected joints, respectively. Pitting was the most common change on all joints examined. Eburnation, the pathognomonic change for OA, was rare, being found on only one clavicular and one manubrial surface (from the same skeleton and joint, the right SCJ of an old adult male).

The location of the changes on OA affected joints is shown in Table 3. For the clavicle the changes were found distributed across the entire joint surface, throughout the sample. The inferior part of the joint was most commonly affected. For the manubrium the centre of the joint was the area most commonly affected.

Although relationships between the prevalence of SCJ OA with increasing age, with sex and with laterality were all noted, due to the small sample size they were not found to be statistically significant and will not be discussed further.

It was noted that in some cases the degenerative changes on the clavicle SCJ were confined to specific areas of the joint, either being located on the anterior/inferior surface or in a semi-lunar shape around the superior/posterior surface (Fig. 2), and that this could be related to the anatomy of the joint.

4. Discussion

In palaeopathology the diagnosis of OA is based on the observation of clinically relevant joint changes, with either eburnation alone or a combination of two or more alternative diagnostic criteria used for its identification. In this study pitting of the joint surface was the most common change in SCJ OA for both the clavicle and manubrium. Eburnation is pathognomonic of OA but was only found on a single SCJ in this study. Roberts et al. (2007) also concluded that eburnation was a rare finding in SCJ OA.

The SCJ is anatomically different to many of the synovial joints in the body in that there is a fibrocartilaginous intra-articular disc separating the two bones. The only way that the bone surfaces could meet, and eburnation develop, is if the disc is perforated. There have been some clinical studies looking at the degeneration of the SCJ disc. Emura et al. (2009) found that the disc was perforated in 42% of 51 SCJs, with study subjects aged from 68 to 94 years of age at death. Van Tongel et al. (2012) examined 25 SCJs from individuals aged from 43 to 103 years of age. They found that in 56%, the disc was incomplete, having a central hole with signs of degeneration and fraying. They noted that when the disc was incomplete there was more severe cartilage degeneration on the articular surfaces of both the clavicle and manubrium in comparison to joints where the disc was intact, with a statistically significant correlation between the morphology of the disc and the cartilage damage found for both the clavicle and manubrium. The age of the study subjects makes comparison with the archaeological assemblages examined here difficult.

Rando and Waldron (2012) had similar findings in their study of the temporomandibular joint (TMJ). Like the SCJ, the TMJ has a disc between the articulating surfaces of the mandible and temporal bones. Again, eburnation was a rare finding, only observed in the advanced stages of disc displacement or disc perforation. The single case of eburnation observed here was found in an adult male where degenerative changes were found affecting both joints. It can be concluded that the disc was perforated and that OA was present in its advanced stages.

This study looked at the location of the OA diagnostic changes to determine if there was any relationship with joint anatomy. The most affected area for the clavicle was the inferior portion of the joint. For the manubrium, the centre of the joint was most commonly affected. This mirrors the findings of clinical studies and does reflect the anatomy of the joint. Both Ghasemi et al. (2007) and Kier et al. (1986) observed that the most common site for osteoarthritic changes was the inferior portion of the clavicular head. This area has been termed the 'articular' area – the area where the clavicle contacts and articulates with the manubrium. Dissection studies have observed that only the anteroinferior surface of the medial clavicle is covered by articular cartilage while the remaining joint surface acts as the insertion point for the intra-articular disc, with the disc attaching in a crescent shape (Figs. 3 and 4) (Barbaix et al., 2000; Lee et al., 2014; Van Tongel et al., 2012).

The distinction between the articular cartilage covered and disc

Table 1
Total recorded counts for degenerative changes, all joints, combined assemblages.

SCJ Joint Surface		EBN	OP	NB	PIT	AJC
Clavicle	Right	1	4	23	45	7
	Left	0	2	20	37	4
Total		**1**	**6**	**43**	**82**	**11**
Manubrium	Right	1	2	11	21	8
	Left	0	2	9	16	6
Total		**1**	**4**	**20**	**37**	**14**

Table 2
Total recorded counts for degenerative changes, OA affected joints, combined assemblages.

SCJ Joint Surface		EBN	OP	NB	PIT	AJC
Clavicle	Right	1	4	21	23	7
	Left	0	2	15	17	4
Total		**1**	**6**	**36**	**40**	**11**
Manubrium	Right	1	1	8	11	8
	Left	0	2	8	9	6
Total		**1**	**3**	**16**	**20**	**14**

(Key: EBN – eburnation, OP – marginal osteophytes, NB – new bone, PIT – pitting, AJC – alteration in joint contour).

Table 3
Joint surface location of degenerative changes for OA affected joints, combined assemblages.

SCJ Joint Surface	ANT	POST	SUP	MED	INF	LAT	CEN	ENT
Clavicle	26	24	29	–	50	–	39	30
Manubrium	17	9	–	15	–	10	20	9

(Key: ANT – anterior, POST – posterior, SUP – superior, MED – medial, INF – inferior, LAT – lateral, CEN – central, ENT – entire).

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