



DEGENERATIVE JOINT DISEASE IN THE APPENDICULAR SKELETON IN PORTUGUESE PEOPLE FROM EARLY 20th CENTURY

Ana Luisa SANTOS¹, Mario ARRIETA²

¹ Research Centre for Anthropology and Health (CIAS), Department of Life Sciences, University of Coimbra, Portugal

² Consejo Nacional de Investigaciones Científicas y Técnicas (CONICET) - Departamento de Ciencias Naturales, Universidad Nacional de Río Cuarto, Córdoba, Argentina

INTRODUCTION

Degenerative joint disease (DJD), or osteoarthritis (OA), is a pathological, chronic and progressive condition that produces degenerative changes in the synovial joints (Jurmain 1977; Bridges 1991; Waldron 2009).

Disease's progress is characterized by the breakdown of articular cartilage, followed by reactive bone formation (sclerosis), and finally the new growth of cartilage and bone in the joint margins (osteophytes) (Roberts and Manchester 2005; Waldron 2009).

DJD has an etiology of multifactorial nature, with patterns of response representing a wide range of underlying causes (Rogers and Waldron 1995). Variables such as age, sex, physical activity, mechanical stress, body constitution, nutritional status, as well as endocrine and hereditary factors can influence the manifestation and final expression of this disease.

Although the prevalence and incidence of DJD vary according to the studies, there is a general consensus that a large portion of the adult population is affected. The group of rheumatic diseases of the World Health Organization estimates that 10% of the world's population over 60 years of age presents problems associated with DJD.

For Portugal, Cunha-Miranda and co-authors (2015) reported that almost 10% of 1039 Portuguese people over 45 years of age have DJD. Costa and co-authors (2004), in a study conducted in Porto, observed that between 2.2 and 5.9% of 451 men, and between 7.4 and 14.2% of 787 women, older than 18 years, had DJD.

AIMS

- ✓ To explore the prevalence of DJD related changes in individuals between 25 and 55 years old with known sex, age-at-death, and occupation;
- ✓ To investigate the possible existence of a direct relationship between the expression of lesions associated with DJD and the age, sex, and occupation of these individuals.

SAMPLE

To this study, were selected 154 skeletons (78 males and 76 females) from the Identified Skeletal Collection, housed at the University of Coimbra.

These individuals died between 1910 and 1934 and were grouped in three age groups for each sex (25<35, 35<45, 45<55 years old). Regarding occupation, women were almost all housewife or maids, while men were mainly blue collars workers.

Observations were done without knowledge of the biographic data of the individuals.

METHODOLOGY

Changes in articular surfaces of elbow, wrist, hands, hip, knee, ankle, and feet were recorded.

Variables

(adapted from Zampetti *et al.*, 2016)

Marginal liping (ML):

- 0= Absence
- 1= Presence of a slight rim <1 mm in height
- 2= Presence of a clear rim or osteophyte 1 < 4 mm in height
- 3= Presence of a severe rim or osteophyte > 4 mm in height

Porosity (PO):

- 0= Absence
- 1= Affecting < 25% of the articular surface
- 2= Affecting 25 < 50% of the articular surface
- 3= Affecting > 50% of the articular surface

Eburnation (EB):

- 0= Absence
- 1= Affecting < 25% of the articular surface
- 2= Affecting 25 < 50% of the articular surface
- 3= Affecting > 50% of the articular surface

Surface osteophytes (SO):

- 0= Absence
- 1= Small exostosis < 1 mm in any dimension
- 2= Clear exostosis 1 < 4 mm in at least one dimension
- 3= Clear exostosis > 4 mm

Statistical analyses

Intraobserver error: 30 complete skeletons, 5 for each group. Differences were calculate using Excel Compare.

To calculate differences in the distribution of the variables observed in relation to sex, age, and side the results obtained to Marginal liping and Porosity were grouped as 'absent', 'barely discernible' (grades 0-1) / 'obvious' (grades 2-3).

Differences were assessed by chi-squared test. Statistical significance was inferred when the P value was lower than 0.05.

Only men were evaluated regarding occupations. To obtain occupational categories for comparison the following subdivisions were considered:

- load carriers (n=32) vs non-load carriers (n=45);
- repetitive movements (n=24) vs non-repetitive movements (n=53) (cf. Villote 2008).

To assess possible differences between occupational categories a Principal Component Analysis (PCA) was performed.

REFERENCES

- Bridges PS. 1991. Degenerative joint disease in hunter-gatherers and agriculturalists from [...]. *Am J Phys Anthropol* 85:379-391.
- Buckland-Wright JC, Macfarland DG, Lynch JA. Osteophytes in the osteoarthritic hand: their [...]. *Ann Rheum Dis* 50:627-630.
- Chung EB. 1967. Aging in human joints. III Marginal Liping (Osteophytic Exostosis). *J Natl Med Assoc* 59:121-125.
- Costa L, Gal D, Barros H. 2004. Prevalência auto-declarada de doenças reumáticas numa população urbana. *Acta Reumatol Port* 29:169-174.
- Cunha-Miranda L, Faustino A, Alves C, Vicente V, Barbosa S. 2015. Assessing the magnitude of OA [...]. *Rev Bras Reumatol* 55 (1): 22-30.
- Johnson VL, Hunter DJ. 2014. The epidemiology of osteoarthritis. Best Practice. *Res Clin Rheumatol* 28:5-15.
- Jurmain RD. 1977. Stress and the etiology of osteoarthritis. *Am J Phys Anthropol* 46:353-366.
- Jurmain RD, Kilgore L. 1995. Skeletal evidence of osteoarthritis: A paleopathological perspective. *Ann Rheum Dis* 54:443-450.
- Roberts C, Manchester K. 2005. *The archaeology of Disease*. Ithaca, Cornell University Press.
- Rogers J, Waldron T. 1995. *A field guide to joint diseases in Archeology*. Chichester, John Wiley & Sons.
- Shibata Y, Shirai Y, Miyamoto M. 2002. The aging process in the sacroiliac joint: helical computed tomography [...]. *J Orthop Sci* 7:12-18.
- Villote S. 2008. *Enthesopathies et activités des hommes préhistoriques*. Recherche [...]. PhD Thesis. University of Bordeaux.
- Waldron T. 2009. *Palaeopathology*. Cambridge, Cambridge University Press.
- Zampetti S, Mariotti V, Radi N, Belcastro MG. 2016. Variation of skeletal degenerative joint disease [...]. *Am J P Anthrop* 160:683-693.

RESULTS

Intraobserver error

Excel compare (n° of mismatches / n° of observations)

≈ 76% of errors corresponds to a differences in 0 to 1 grades assignations

	ML	PO	EB	SO	ML, PO, EB, and OS
Error (%)	13.57	7.71	0.42	0.83	5.62
	65/479	37/480	2/480	4/480	108/1919

Males

Degrees of severity in **Marginal liping** and **Porosity** were grouped in two categories: bone change absent or barely discernible (grades 0 and 1) / obvious change (grades > 2).

	25<35 years old				35<45 years old				45<55 years old				
	ML (%)	PO (%)	EB (%)	SO (%)	ML (%)	PO (%)	EB (%)	SO (%)	ML (%)	PO (%)	EB (%)	SO (%)	
RIGHT	Shoulder	4,0	0,0	0,0	0,0	28,0	8,0	4,0	0,0	25,0	0,0	0,0	0,0
	Elbow	4,0	0,0	0,0	0,0	12,5	0,0	0,0	8,0	28,6	0,0	0,0	28,6
	Wrist	8,3	0,0	0,0	0,0	16,0	0,0	0,0	0,0	25,0	3,6	0,0	3,6
	Hand	4,2	0,0	0,0	0,0	24,0	0,0	0,0	0,0	46,4	0,0	0,0	0,0
	Hip	12,0	0,0	0,0	0,0	25,0	4,0	0,0	24,0	42,9	3,6	0,0	35,7
	Knee	4,0	0,0	0,0	0,0	16,0	0,0	0,0	0,0	14,3	0,0	0,0	7,1
	Ankle	0,0	0,0	0,0	0,0	12,0	0,0	0,0	0,0	32,1	0,0	3,6	7,1
Foot	28,0	0,0	0,0	4,0	28,0	0,0	0,0	8,0	39,3	0,0	7,1	14,3	
LEFT	Shoulder	8,0	0,0	0,0	0,0	29,2	8,0	4,0	0,0	17,9	0,0	0,0	3,6
	Elbow	0,0	0,0	0,0	0,0	8,0	0,0	0,0	0,0	17,9	7,1	7,1	10,7
	Wrist	8,3	0,0	0,0	0,0	8,0	0,0	0,0	0,0	17,9	3,6	0,0	0,0
	Hand	4,0	0,0	0,0	0,0	24,0	0,0	4,0	0,0	21,4	0,0	0,0	0,0
	Hip	4,0	0,0	0,0	0,0	24,0	0,0	0,0	16,0	25,0	0,0	0,0	10,7
	Knee	4,0	0,0	0,0	0,0	16,0	0,0	0,0	4,0	28,6	0,0	0,0	10,7
	Ankle	12,0	0,0	0,0	0,0	12,0	0,0	0,0	0,0	28,6	0,0	0,0	7,1
Foot	20,0	0,0	0,0	0,0	28,0	0,0	0,0	4,0	42,9	3,6	3,6	7,1	

Statistically significant differences were observed:

Side ML in the hands and SO in the hip in the group 45<55 years (both with greater prevalence on the right side);

Sex ML in the wrist in the group of 25<35 years, shoulder in the group of 35<45 years, and ankle in the group of 45<55 years (all higher in males). SO in the elbow and hip (both higher in males) in the group of 45 <55 years.

Age ML and SO in several joints, with higher prevalence in the group of 45<55 years.

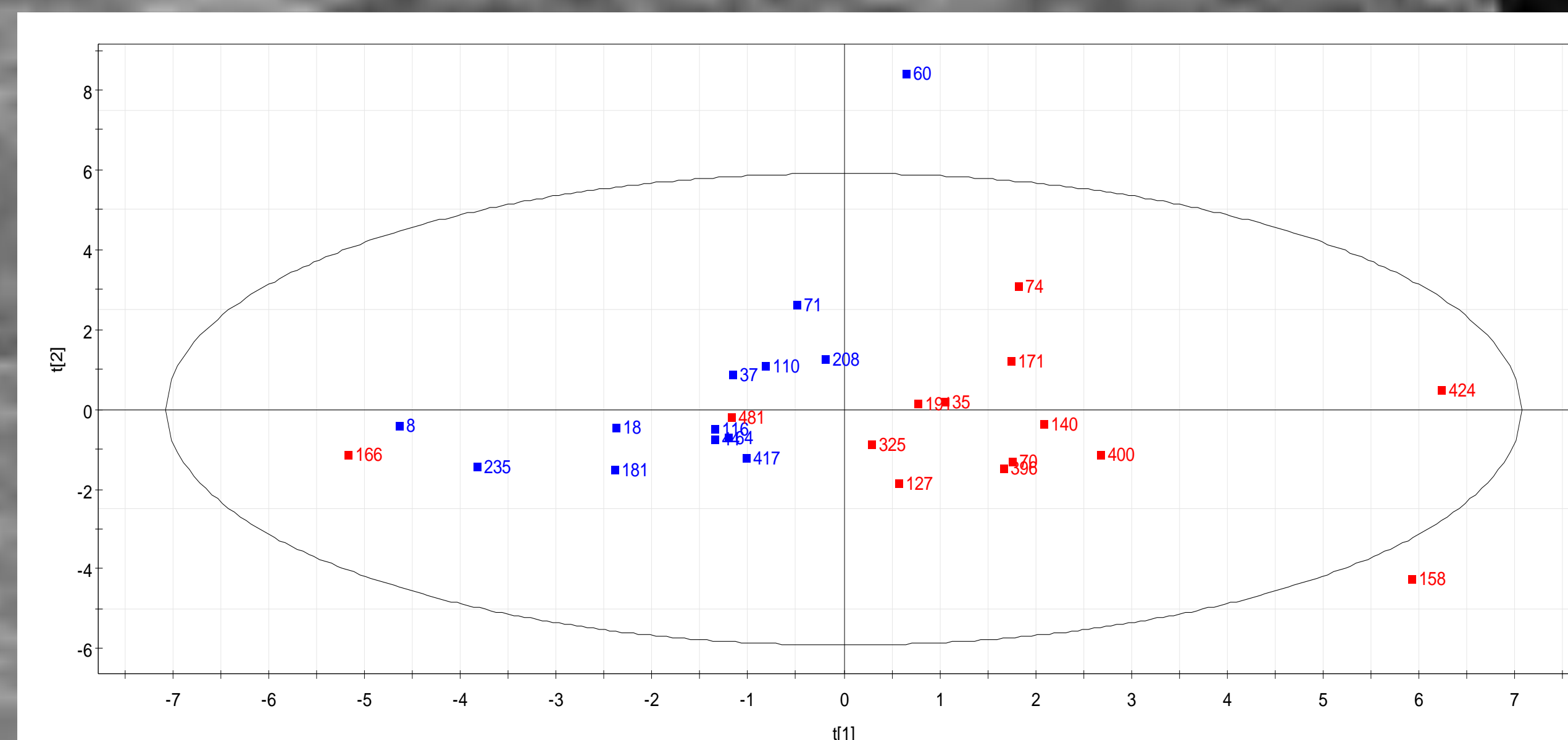
Females

Degrees of severity in **Marginal liping** and **Porosity** were grouped in two categories: bone change absent or barely discernible (grades 0 and 1) / obvious change (grades > 2).

	25<35 years old				35<45 years old				45<55 years old				
	ML (%)	PO (%)	EB (%)	SO (%)	ML (%)	PO (%)	EB (%)	SO (%)	ML (%)	PO (%)	EB (%)	SO (%)	
RIGHT	Shoulder	0,0	0,0	0,0	0,0	12,0	0,0	0,0	4,0	15,4	0,0	0,0	3,8
	Elbow	0,0	0,0	0,0	0,0	12,0	4,0	0,0	8,0	11,5	0,0	0,0	0,0
	Wrist	0,0	0,0	0,0	0,0	16,0	0,0	0,0	0,0	19,2	0,0	0,0	0,0
	Hand	8,0	0,0	0,0	0,0	16,0	0,0	0,0	0,0	42,3	0,0	0,0	0,0
	Hip	12,0	0,0	0,0	0,0	20,0	0,0	0,0	4,0	34,5	0,0	0,0	23,1
	Knee	4,0	0,0	0,0	4,0	4,0	0,0	0,0	0,0	26,9	0,0	0,0	7,7
	Ankle	4,0	0,0	0,0	0,0	12,0	0,0	0,0	0,0	7,7	0,0	0,0	0,0
Foot	36,0	0,0	0,0	4,0	24,0	0,0	0,0	8,0	46,2	0,0	3,8	7,7	
LEFT	Shoulder	0,0	0,0	0,0	0,0	12,0	0,0	0,0	4,0	11,5	0,0	0,0	3,8
	Elbow	0,0	0,0	0,0	0,0	12,0	0,0	0,0	8,0	15,4	0,0	0,0	3,8
	Wrist	0,0	0,0	0,0	0,0	12,0	0,0	0,0	0,0	7,7	0,0	0,0	0,0
	Hand	0,0	0,0	0,0	0,0	12,0	4,0	0,0	0,0	38,4	0,0	3,8	7,7
	Hip	8,0	0,0	0,0	0,0	28,0	0,0	0,0	16,0	46,2	3,8	3,8	7,7
	Knee	4,0	0,0	0,0	0,0	12,0	0,0	0,0	8,0	23,1	0,0	0,0	11,5
	Ankle	0,0	0,0	0,0	0,0	8,0	0,0	4,0	0,0	3,8	0,0	0,0	0,0
Foot	20,0	0,0	0,0	4,0	32,0	0,0	0,0	4,0	38,5	0,0	7,7	11,5	

No statistically significant differences were observed for laterality in any joint and in any age group.

Significant differences were observed between the age groups in ML and SO in several joints, with higher prevalence in the group of 45<55 years.



Occupation

Plot on PCA of men 45-54 age group. Load carriers (red points) and non-load carriers (blue points) constitute two clearly different groups.

DISCUSSION and CONCLUSIONS

ML was the change most registered in each of the six age groups. PO was the second in prevalence, but the vast majority of registered lesions were slight. Low prevalence of EB suggest aging as an important factor.

Side Differences in prevalence and statistical analyses in male 45<55 group suggest a greater use of right hand and hip. To the hands, these results support a predominant dextral affection. Buckland-Wright et al. (1991) stated that the dominant hand is more often affected by OA in contemporary populations.

Sex Statistically significant differences in ML for wrist, shoulder, and ankle, and SO in elbow and hip suggest a higher physical and mechanical stress in males.

Age Increase of degenerative changes with age was evident both in males and females. Differences were most notable among the age groups 25 <35 years and 45 <55 years. Articular osseous changes have been reported to increase with age in several studies (e.g. Chung, 1967; Jurmain and Kilgore, 1995; Shibata et al., 2002; Johnson and Hunter, 2014).

Occupation PCA plots of the 45<55 years old male group suggest a relationship between the expression of DJD and the occupation of individuals. Future analyses will be necessary to confirm this hypothesis.

ACKNOWLEDGEMENTS The Department of Life Sciences, University of Coimbra for granting access to the collection. To CONICET, Coimbra Group and CIAS.

