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Age and sex affect osteoarthritis and the outcome on knee replacement

Abstract

Background: Arthrosis has a huge impact due to its consequences on suffering and function loss and because it damages the well-being and the physical, emotional and social aspects of Health-Related Quality of Life. Our objective was to assess the influence of Age and Sex on Knee Osteoarthritis and Total Knee Arthroplasty on the perception of the patients with regard to their quality of life, before and after the intervention.

Method: We carried out a quasi-experimental intervention study with a before and after design in a sample of 125 patients with knee osteoarthritis who were assessed before and after the operation. They all were operated by the same orthopedic surgeon and with the same type of total knee arthroplasty between the year 2008 and 2012. The Health-Related Quality of Life was assessed with the questionnaire SF-36.

Results: We have observed that knee osteoarthritis significantly affects all the dimensions of Health-Related Quality of Life before the operation and that all the dimensions included in the SF-36 show a clinical improvement after the intervention with total knee arthroplasty. Female Sex has an influence diminishing Physical Function (p=0.044) in Knee Osteoarthritis (before the intervention), but it does not influence the outcome after Total Knee arthroplasty. Age has an influence on Bodily Pain (p=0.012) and Vitality (p=0.002) in knee Osteoarthritis (before the intervention), and on Physical (p=0.040) and Mental Health Components (p=0.002) after Total Knee arthroplasty. However, we can state that the operation of total knee arthroplasty significantly improves Health-Related Quality of Life in all its dimensions and components, except for Physical Functioning and Role-Physical, although they also improve over time after the operation.

Conclusion: Total knee arthroplasty is justified according to the perception of clinical improvement and the improvement of Health-Related Quality of Life reported by the patients. Sex influences Knee Osteoarthritis and Age influences on Knee OA and Total Knee Arthroplasty outcomes.

Keywords: Knee Osteoarthritis, Quasi-experimental intervention study, Total Knee Arthroplasty, Health-Related Quality of Life, Risk Factors, Age, Sex

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Abbreviations

OA, Osteoarthritis; HRQOL, Health-Related Quality of Life; TKA, Total Knee Arthroplasty

Introduction

Osteoarthritis is a degenerative, disabling and multifactorial disease with a high prevalence that increases exponentially with age.[1-3] It is divided into categories as primary and secondary Ostearthritis, depending on the related causes.[2] It mainly affects weight bearing joints such as knees and hips, which are the most frequently affected areas.[2] Knee osteoarthritis is more disabling than any other orthopedic and musculoskeletal disorder.[2]

The impact of osteoarthritis is huge regarding suffering, function loss and use of social-health resources. Also, it worsens well-being and Health-Related Quality of Life (HRQOL) in its physical, emotional and social aspects.[2] Consequently, it is important to know the impact of this condition on HRQOL in order to make therapeutic decisions in the context of health policies related to the efficiency and sustainability of the health system.[4]

Health-Related Quality of Life is expressed as the degree of perception to which the disease or its treatment affects the physical, psychic, emotional and social abilities of an individual.[5] It is a global index of clinical results in the field of Health which makes it possible to associate the therapeutic/surgical objectives with the results obtained in the individual and social spheres of the patient. Also, it can be measured with generic or specific health questionnaires.[6]

Total knee arthroplasty (TKA) is the orthoprosthetic operation with the highest clinical success rate, with good prognosis and sustained clinical results in over 95% of the patients after 10 years. Also, it reduces pain and improves function and HRQOL.[7]

There is controversy on whether age and sex are risk factors that could influence on Knee Osteoarthritis and Total Knee Arthroplasty. However, there is agreement that OA is more frequent in older people and in females.[1-5]

The objective of this study is to assess the influence of the clinical intervention (TKA) from the perspective of the perception of the operated patient with regard to HRQOL. Also, we want to analyze Age and Sex can affect these results. The hypothesis of this work is based on the fact that there are no statistically significant clinical differences between Age/Sex and HRQOL of patients with knee osteoarthritis before and after the operation.

Methods

In order to reach our objectives and prove our hypothesis, a quasi-experimental intervention study with a before and after design was

carried out. It is an experimental or intervention study on a sample of patients with knee osteoarthritis who were assessed before and after the operation of TKA. This type of epidemiological study has a good scientific evidence level, according to the categories and classification proposed by the Task Force US and the Centre for Evidence Based Medicine (CEBM) of Oxford.[8,9]

The clinical research was carried out in the Health Area of Salamanca, which comprises the Clinical University Hospital of Salamanca, and it included all patients with severe knee osteoarthritis who were referred by Primary Care Doctors in order to assess the possibility of a surgical operation.

Our series was made up of 125 (46.8%) patients out of a total of 267 patients. They were all operated by the same orthopedic surgeon and with the same type of TKA (Scorpio-Stryker®) between the years 2008 and 2012. All the patients filled out the SF-36 survey before and after the operation, and their clinical history was reviewed in order to obtain the independent variables related with HRQOL, such as age, sex, comorbidities, other arthroplasties, other operations on the locomotor system, and in-hospital stay.

The criteria for inclusion as CASES were: adult patients of any age and sex with a diagnosis of osteoarthritis of the knee who were operated with TKA type Scorpio and/or with diverse comorbidities. The criteria for exclusion were: patients with disorders and/or pathologies that prevented them from knowing, understanding or assessing their clinical situation. Also those in which it was impossible to obtain updated personal data or who failed to attend the post-intervention interview in which the questionnaire was filled out, after the first post-intervention visit, which took place after 2 to 3 months. As a consequence, some cases were lost during the study because they failed to attend, or due to a severe disease caused by any of their comorbidities, death or any other social reason.

The collection of data was carried out with a Clinical and Epidemiological Protocol created by the research team for this study and filled out during a personal interview to each patient. In the assessment of HRQOL we used the SF-36 questionnaire, due to its characteristics of viability, reliability, sensitivity to change and transcultural validation in Spain.[10,11]

SF-36 is the most widely used generic questionnaire in the world because it makes it possible to compare the impact/result of an intervention, and it has been used with different chronic diseases and in different population groups.[12] SF-36 measures HRQOL, it provides a profile of the health condition that can be applied to the general population and to the patients, as well as in studies that assess clinical results. It is also used in musculoskeletal and orthopedic clinical studies to obtain a more detailed description of the Health parameters and to research changes in the health condition.[13-15]

The data collected from the clinical histories and the results of the SF-36 questionnaire were introduced and coded for processing and analysis with the statistical package SPSS version 21. The statistical analysis included, first of all, a descriptive study (univariate analysis) which calculated the adequate frequency measures to assess the different indexes and indicators, as well as the subsequent descriptive statistics (mean value, standard deviation). Once that the different data were obtained, together with their prevalence and/or proportions we calculated their 95% confidence interval as a measure of precision (Inferential statistics). Chi-square test was used for the qualitative variables and Student's t-test and ANOVA were used for quantitative variables in order to assess whether the differences observed in the clinical parameters and the components of the SF-36 and other indicators and the abovementioned epidemiological variables regarding the patients were statistically significant or, on the contrary, they could be explained by chance. Finally, a logistic regression model was used so as to assess the influence of the presence or absence of several clinical and epidemiological variables on HRQOL (bivariate and multivariate analysis). The level of statistical significance (error) used by the research team was 5% (degree of statistical significance $p < 0.05$).

Results

The distribution according to sex in our 125 cases was 78 women (62%) and 47 men (38%), with a 1.6:1 man/woman ratio and an average age of 70 years (Figure 1). The most common age was 71 years, with a range between 37 and 86 years (Figure 2). The average time of in-hospital stay was 8.12 days; the most common value was 8 days, and the range was between 4 and 13 days.

Half of our patients had a prior orthoprosthetic history. 33% had TKA, 13% had a THA (total hip arthroplasty), and 2.5% had both prostheses (Figure 3). Also, 20% of the patients had a prior history of operations in the locomotor system, and 31.2% of the patients had a history of other prior surgery.
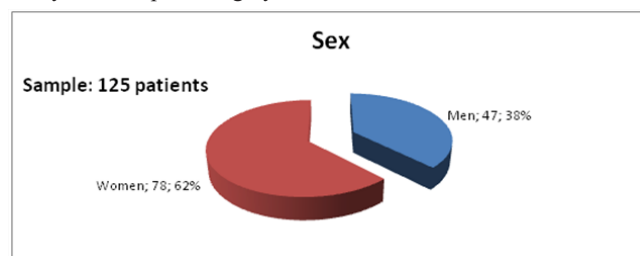

Figure 1 Sex as a demographic variable in the analyzed sample.
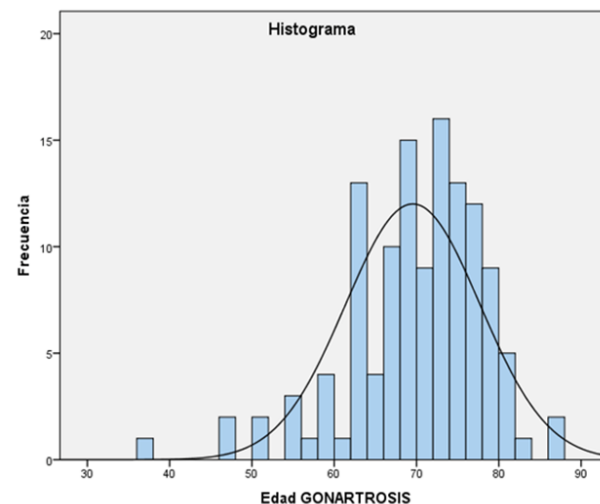

Figure 2 Age as an epidemiological variable, and its distribution on the sample (n=125).

With regard to comorbidity, 95 patients (76%) showed associated comorbidity, 28 patients (22.5%) presented with a single comorbidity and 67 patients (53.6%) revealed two or more comorbidities. Also, in 17 patients (15%), the comorbidity was musculoskeletal, and 92 patients (81%) showed other comorbidities.

We have observed that osteoarthritis significantly affects all the dimensions of quality of life (before the intervention). All the dimensions of the SF-36 questionnaire reveal a clinical improvement after the operation (TKA) (Figure 4).
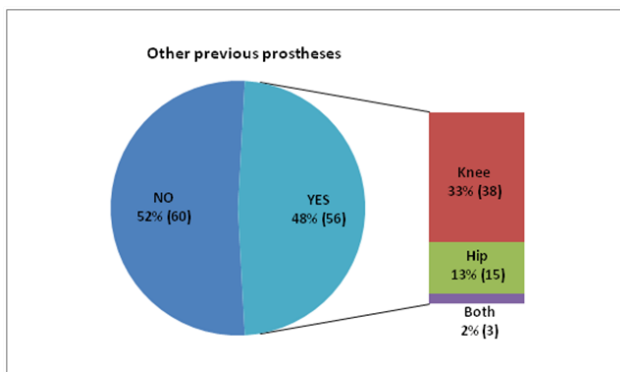
Figure 3 Existence of previous total knee arthroplasty or total hip arthroplasty surgery.
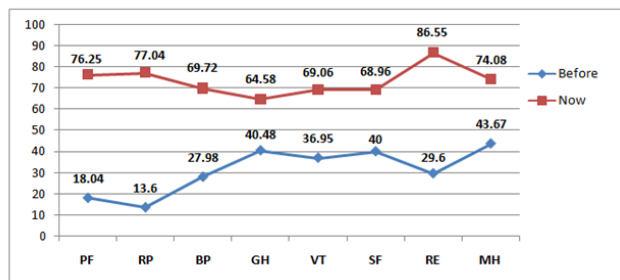

Figure 4 Average values of all the dimensions of the SF-36 survey and improvement before and after 5the operation (TKA). (PF: physical functioning; RP: Role-Physical; BP: Bodily Pain; GH: General Health; VT: Vitality; SF: Social Functioning; RE: Role-Emotional; MH: Mental Health).

As regards the relation between sex and age and the components of the SF-36 questionnaire, sex has a significant influence (p=0.004) on the Physical Functioning scale (PF) before the operation. Age also has a statistically significant influence before the intervention on the scales Bodily Pain (BP p=0.012) and Vitality (VT p=0.002). After the operation (TKA), age also influences the scale of General Health individually (GH=0.006), and the group of scales of Physical Component (PCS p=0.040) and Mental Component (MCS p=0.002) summary scores, as well as the health transition item SF-2 (p=0.009) (Table 1). However, despite Age and Sex ask risk factors, TKA improves General and Mental Health Components, on an overall basis (Figure 5).

Table 1 Association study between components of SF-36 and Sex-Age

| DIMENSION	Sex		Age	
	p value (p<0.05)			
	Before	After	Before	After
Physical Functioning (PF)	**0.044**	0.958	0.120	0.682
Role-Physical (RP)	0.973	0.761	0.499	0.959
Bodily Pain (BP)	0.147	0.133	**0.012**	0.234
General Health (GH)	0.357	0.182	0.457	**0.006**
Physical Health COMPONENT (PCS)	0.307	0.679	0.099	**0.040**
Vitality (VT)	0.591	0.689	**0.002**	0.088
Social Functioning (SF)	0.774	0.747	0.402	0.667
Role-Emotional (RE)	0.098	0.581	0.181	0.533
Mental Health (MH)	0.264	0.634	0.073	0.448
Mental Health COMPONENT (MCS)	0.436	0.278	0.716	**0.002**
Health Transition Item	0.638	0.269	0.527	**0.009**
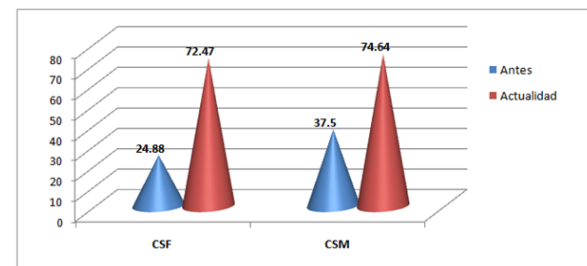
Figure 5 Mean average on Physical Health Component and Mental Health Component before and after the Intervention (TKA) and its improvement.

CSF (Componente de Salud Física): Physical Health Component

CSM (Componente de Salud Mental): Mental Health Component

Antes: Before

Actualidad: After

The association study of HRQOL-SF-36 before and after the operation shows a statistically significant improvement in the scales Bodily Pain (BP p=0.000), General health (GH p=0.000), Vitality (VT p=0.005), Social Functioning (SF p=0.000), Role-Emotional (RE p=0.050), and Mental Health (MH p=0.000). One significant aspect is that the operation (TKA) causes no improvement in Physical Functioning (PF p=0.295) and in Role-Physical (RP p=0.385) (Table 2). We have also observed that having a prior knee or hip prosthesis improves Physical Functioning (PF p=0.021) and Mental Health (MH p=0.036).

Table 2 Association HRQOL-SF36 Before and After

Items And Dimensions	Before		After		Parametric Test
	Average	St. Dev	Average	St. Dev	P
Sf-3	10.40	25.63	67.74	39.91	**0.004**
Sf-4	19.20	30.96	78.63	31.34	0.385
Sf-5	22.00	33.23	75.20	30.95	0.285
Sf-6	7.60	20.13	63.64	36.51	0.217
Sf-7	21.77	31.39	79.84	30.52	0.219
Sf-8	8.74	21.82	63.71	36.81	0.241
Sf-9	13.20	28.50	79.03	35.55	0.500
Sf-10	20.80	31.22	79.03	31.94	0.159
Sf-11	32.40	37.70	87.50	26.76	0.098
Sf-12	30.40	40.60	87.50	26.76	0.149
Dimension Physical Functioning (PF)	**18.04**	**22.12**	**76.25**	**24.73**	**0.295**
Sf-13	16.80	37.53	79.67	40.40	0.064
Sf-14	12.80	33.54	75.00	43.47	0.064
Sf-15	15.20	36.04	77.42	41.98	0.211
Sf-16	9.60	29.57	77.24	42.10	0.599
Dimension Role-Physical (RP)	**13.60**	**29.70**	**77.04**	**37.42**	**0.385**
Sf-21	27.36	21.33	69.44	23.35	0.247
Sf-22	28.60	18.97	70.00	23.54	0.734
Dimension Bodily Pain (BP)	**27.98**	**17.35**	**69.72**	**20.83**	**0.000**
Sf-1	24.80	19.69	55.08	23.07	**0.001**
Sf-33	49.40	28.41	72.38	19.60	**0.000**
Sf-34	46.57	27.66	67.94	19.27	**0.000**
Sf-35	41.53	21.82	62.70	20.53	**0.000**
Sf-36	39.92	24.47	64.43	21.94	**0.001**

Table Continued...

Items And Dimensions	Before Average	St. Dev	After Average	St. Dev.	Parametric Test P
Dimension General Health (GH)	**40.48**	**19.05**	**64.58**	**15.28**	**0.000**
Sf-23	37.76	25.68	65.60	22.66	**0.345**
Sf-27	38.21	27.22	69.35	20.94	**0.000**
Sf-29	35.45	28.03	72.26	19.20	**0.000**
Sf-31	36.29	25.16	68.55	21.66	**0.099**
Dimension Vitality (VT)	**36.95**	**21.84**	**69.06**	**17.11**	**0.005**
Sf-20	45.00	30.94	77.62	22.27	**0.000**
Sf-32	34.84	22.93	60.32	15.71	**0.000**
Dimension Social Functioning (SF)	**40.00**	**25.45**	**68.96**	**16.58**	**0.000**
Sf-17	28.80	45.46	87.90	32.74	**0.008**
Sf-18	28.00	45.01	85.48	35.36	**0.005**
Sf-19	32.00	46.83	86.29	34.53	**0.014**
Dimension Role-Emotional (RE)	**29.60**	**43.62**	**86.55**	**32.06**	**0.050**
Sf-24	45.00	31.19	76.64	17.54	**0.000**
Sf-25	46.34	32.11	79.52	16.55	**0.000**
Sf-26	38.70	25.44	68.16	22.01	**0.000**
Sf-28	47.32	30.75	76.13	17.42	**0.000**
Sf-30	41.77	28.17	70.00	21.86	**0.000**
Dimension Mental Health (MH)	**43.67**	**26.15**	**74.08**	**14.35**	**0.000**
Health Transition Item Sf-2	**35.04**	**27.01**	**68.13**	**22.67**	**0.041**

The multivariate analysis of the determining variable Age vs. the dimensions and components of the SF-36 questionnaire reveals that age has a statistically significant influence before the intervention (TKA) on the scales Vitality (VT p=0.013), Social Functioning (SF p=0.002) and Mental Health (MH p=0.017). It has a general influence in the Mental Component summary score (MCS p=0.019). After the operation (TKA), age has an individual influence in the scale of General Health (GH p=0.025), Social Functioning (SF p=0.021) and Role-Emotional (RE p=0.004), and a general effect on the Mental Component summary score (MCS p=0.050). In sum, age has an influence on the Mental Component summary score (MCS) before and after the operation (TKA); and on General Health (GH) after the operation (TKA) (Table 3).

Discussion

Knee osteoarthritis is one of the diseases with the highest impact regarding the functional disability, and one which greatly affects the personal autonomy of patients. Also, its incidence increases with age, and it affects more than 33% of people over 70 years in Spain.[16] The average age in our series at the time of operation is 77 years, and the age distribution shows a normal curve, in accordance with national studies which have shown average ages of 66.5±6.2 years.[17,18] and 74±2.3 years.[19-21] with a progressive ageing in the population. International studies have reported ages of 68 years.[21] and 72 years.[22] Consequently, the average age of the patients who were operated and monitored in our series is higher, due to the social and demographic characteristics of the general population of reference, which corresponds to the area of the city and province of Salamanca, part of the Autonomous Community of Castile and León, which has one of the highest indexes of population ageing in Spain.

Table 3 Multivariate Analysis between Age and Dimensions and components of SF-36

	Dependent Variable: Dimension and Component	Independent variable: AGE Type III sum of squares	DF	Quadratic mean	F	Sig. (p<0.05)
Before	**Physical Functioning-PF**	17911.248	30	597.042	1.349	0.148
	Role-Physical-RP	24020.745	30	800.691	.843	0.694
	Bodily Pain-BP	10970.918	30	365.697	1.372	0.135
	General Health-GH	13554.765	30	451.825	1.398	0.122
	Physical component-PCS	**10648.756**	**30**	**354.959**	**1.215**	**0.244**
	Vitality-VT	21055.038	30	701.835	1.890	0.013
	Social Functioning-SF	31495.059	30	1049.835	2.267	0.002
	Role-Emotional-RE	69426.059	30	2314.202	1.422	0.110
	Mental Health-SM	29294.345	30	976.478	1.837	0.017
	Mental component-MCS	**28946.089**	**30**	**964.870**	**1.820**	**0.019**
	Health Transition Item	22290.452	30	743.015	.960	0.535
After	**Physical Functioning-PF**	21769.718	30	725.657	1.340	0.153
	Role-Physical-RP	50900.339	30	1696.678	1.416	0.113
	Bodily Pain-BP	13317.352	30	443.912	1.229	0.232
	General Health-GH	9963.148	30	332.105	1.754	0.025
	Physical component-PCS	**16148.388**	**30**	**538.280**	**1.452**	**0.097**
	Vitality-VT	8898.696	30	296.623	1.271	0.199
	Social Functioning-SF	11883.479	30	396.116	1.764	0.024
	Role-Emotional-RE	48879.460	30	1629.315	2.125	0.004
	Mental Health-SM	5833.176	30	194.439	1.069	0.396
	Mental component-MCS	**9344.806**	**30**	**311.494**	**1.567**	**0.050**
	Health Transition Item	12631.048	30	421.035	.876	0.649

Osteoarthritis usually affects the knee, and its incidence increases exponentially with age, with a clear predominance on women. The observed women/men ratio is 1.6:1, in accordance with other national studies, with ratios of 2.7:1.[15] 3:1.[17,19] 4:1.[16] 4.9:1.[20] and with international studies, with ratios of 1.5:1.[22] 1.6:1.[23] and 2.2:1.[21]

Adult and symptomatic patients with osteoarthritis generally have more than one affected weight bearing joint, be it the knee, the hip or a similar contralateral joint.[24] Some experts also report that 90% of the patients with knee pain report bilateral symptoms. With regard to the presence of previous joint prostheses, all the studies report

an orthoprosthetic history. In our series, 33% of the patients had a previous prosthesis in the knee, 13% in the hips and 2% in both. National studies have revealed contralateral surgery in 24.6% of the patients <75 years old and 33% in patients >75 years old.[20] and other international studies have found contralateral surgery of the knee in 17%.[25] of the patients; in 20% of the patients <80 years old and in 54% of the patients >80 years old, and 35% of the patients showed THA.[26] These results prove that osteoarthritis is a bilateral condition that particularly affects weight bearing joints. All the studies reveal orthoprosthetic records similar to those of our series, and these records are higher in older groups. The results observed in patients with previous prosthesis of the knee or the hips are associated with a faster and steadier improvement of Physical Functioning and Mental Health, and this improvement may be due to the better mental predisposition of the patients caused by the previous surgical experiences and by the process of adaptation to living with prosthesis.

The average in-hospital stay in our study is 8.2 days, with a range between 4 and 17 days. All the studies that have been carried out, both national.[16,20] and international.[27,28] show similar periods of average in-hospital stay, and they all report a decreasing evolution of this factor. This decrease has been made possible thanks to the improvements in the surgical techniques and the program for immediate postoperative rehabilitation treatment which has been implemented in the medical-surgical protocols in order to improve the quality of the care process, its effectiveness and efficiency.

Regarding HRQOL, we have observed a clinical improvement in all the dimensions of the SF-36, and this improvement is significant in all sections except for Role-Physical and Physical Functioning. This result may seem in conflict with what was reported by other experts on TKA, who state that it substantially improves Physical Functioning, as published by some researchers.[21] and it is only observed in patients with a previous prosthesis. Nevertheless, it may be due to the conditioning of age and comorbidity, which are variables that affect the immediate postoperative period in which the HRQOL questionnaires were filled out. This means that patients need more time to notice a significant clinical improvement with regard to Physical Functioning (PF). Some authors state that a previous joint prosthesis does not lead to worse results after the operation, as was observed in our series.[20] Other researchers have observed that preoperative factors are predictors for mobility and results.[27,29,30]

For its part, age has an influence on Bodily Pain (BP) and Vitality (VT) before the intervention, and it leads to worse tolerance and causes higher functioning disability and dependence in these patients. Of course, and according to what has been published, the main predictor for comorbidity, postoperative complications and mortality is age .[16,30] That is, the age of patients is associated to comorbidity and/or chronic multiple pathologies, which leads to lower autonomy, higher disability and physical, emotional and social dependence associated to ageing. Patients >60 years with osteoarthritis, such as those in our series, present with more limitations in Activities of Daily Life than patients of the same age without osteoarthritis.[31] In line with what was observed in our series, most of the studies.[14,16,21,22,24,26] report that total replacement arthroplasty improves pain, Physical Functioning, Mental Health, Social Activity and HRQOL. Knee osteoarthritis produces limitations in ADLs and therefore limits social functioning, and although after the operation there is an improvement in all other dimensions, and particularly pain and physical functioning, it is difficult for older patients to recover the lost social functioning due to their advanced age and the fact that they have comorbidities, as has already been shown by other studies.[32]

On the other hand, when the results from the different components of HRQOL in SF-36 in our series are compared with the general population in Spain.[11] which is our standard population of reference, only Social Functioning is lower, while five of them show similar levels and two of them, Role-Emotional and Mental Health, show an improvement. Consequently, we can state that the operation of total knee arthroplasty is justified according to the perception of clinical improvement and the improvement of HRQOL reported by the patients.

Conclusion

According to what was observed in this study, we can state that TKA significantly improves HRQOL in all its dimensions and components, except for Physical Functioning and Physical-Role; although they also improve over time after the intervention. Sex affects Physical Function in Knee OA. Age has an impact on Bodily Pain and Vitality on knee OA. Age influences on General Health and Physical and Mental Components after TKA.

Conflicts of interest

Each author certifies that he or she has no commercial associations that might pose a conflict of interest in connection with the submitted article. No benefits in any form have been received or will be received from a commercial party related directly or indirectly to the subject of this article.

Authors´ contributions

ME Fernández-Cuadros participated in acquisition of patients' data, drafting and designed of the article and analysis and interpretation of results. OS Pérez-Moro, participated in acquisition of patients' data. Montserrat Alonso-Sardón and Helena Iglesias-de-Sena supervised, analysed and interpreted the results. JA Mirón-Canelo participated in the conception and design of the study, designed the manuscript, supervised and interpretation of results. All authors read and approved the final version of the manuscript.

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