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Patient Satisfaction and Function After Primary and Revision Total Hip Replacement

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This study assessed and compared satisfaction and function before and after total hip replacement as reported by 531 patients who had primary and revision surgery and 1087 patients who had primary surgery only. All operations were registered by the Norwegian Arthroplasty Register during the years 1987 to 1993, with time from last surgery to followup ranging from 0.6 to 6.4 years. Sixty-one percent of the patients who underwent revision surgery and 84% of the patients who did not undergo revision surgery rated their overall satisfaction with the hip implant as good or very good. With adjustment for primary diagnosis, gender, age, bilaterality, and time since the primary operation, a substantial benefit of total hip replacement was observed in both groups with regard to pain, walking ability, and need of help. However, improvement was less among patients who underwent revision total hip replacement than among those who did not undergo revision surgery. A deterioration was seen among patients who underwent revision surgery with regard to employment status and exercise habits.

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Total hip replacement is established as a highly successful surgical procedure,[16] with good overall short term and long term results. In addition to radiologic evaluation and survival analyses of prosthesis failure, the patient's assessment of outcome has been recognized as an important measure of success.[13] Several studies have shown considerable improvement after total hip replacement surgery regarding self reported function and quality of life.[8,40,41,43–45,56] However, many of these studies were relatively small and included few or no patients with revised implants.

This study assessed and compared satisfaction and function before and after total hip replacement as reported by 531 patients who had primary and revision surgery and 1087 patients who had primary surgery only. All operations were performed in Norway between 1987 and 1993. Information regarding satisfaction, pain, walking ability, need of help,

employment status, and regular exercise was obtained through a mail survey done a minimum of 6 months after the last surgery.

MATERIALS AND METHODS

Study Population

The study was based on data from a population register based, matched case control study,[11] with cases defined as patients with a primary total hip replacement followed by a revision, and control subjects as patients with a primary operation only. A revision was defined as an exchange or removal of a part or the whole prosthesis. Patients with total hip replacements reported to the Norwegian Arthroplasty Register[18] between 1987 and 1993 were eligible to be participants in the study. Six hundred eighty-three hips were registered as having primary and revision surgery during this period, and 26,486 hips had primary surgery only. For each patient who had undergone revision surgery, two patients were selected randomly among patients at risk for revision following the density sampling procedure.[54] Matching criteria were gender, age at the primary operation (±5 years), date of the primary operation (±30 days), and unilateral or bilateral total hip replacement. Two matching control subjects with unrevised hip prostheses were found for each of 669 cases. As complete questionnaires were received from 1618 (81%) of the 2007 cases and control subjects selected for the study, 531 patients who had primary and revision surgery (cases) and 1087 patients who had primary surgery only (control subjects), were included in the study.

Questionnaire

Information was obtained through a mail survey, with a reminder sent after 1 month to those who had failed to respond to the questionnaire. The form included questions regarding patient satisfaction and function. Satisfaction at followup regarding usefulness of the hip implant was obtained through a 5-level score (1 = very poor, 2 = poor, 3 = neither, 4 = good, 5 = very good). Level of pain and walking ability was reported by the patient according to the Merle d'Aubigné and Postel scale[37] as modified by Charnley.[9] The highest level (equal to 6) represented no impairment, and the lowest level (equal to 1) represented the most severe impairment. Patients were asked whether they needed help from others (living at home with no help; living at home with help from spouse, cohabitant, or relatives; living at home with help from home help [assistance with home work] or home nurse [registered nurse]; living in home for the aged; living in nursing home; other) and whether they performed weekly exercise (no, yes). Patients also were asked about their employment status, with the following alternatives available: full time salaried work, part time salaried work, unsalaried work, sick leave, disability pension, age retirement pension, unemployment, and other. In Norway, the general age of retirement is 67 years.

In addition to information at followup, patients gave retrospective information regarding the period just before the primary operation. Patients with a revised implant answered additional questions regarding the period immediately before their second operation. However, information on regular exercise was obtained for the time before the first symptoms associated with the hip, at followup, and when relevant, between primary and revision surgery. Length of followup was calculated as the interval between the date of primary surgery and mailing of the questionnaire.

Statistical Analyses

Multivariate analyses were conducted by Gaussian regression for pain score and walk score as response variables, and by logistic regression for satisfaction, need of help (help needed, no help needed), employment status (not salaried, salaried), and weekly exercise (no, yes) as binary response variables. Patients with a satisfaction score equal to 4 or 5 were defined as satisfied. Because of the matched study design and repeated measures for each individual, results from standard regression models might be questionable. Thus, a procedure based on the generalized estimating equations method[58] was used to account for dependencies introduced by the design. All matching factors were represented in the regression models, although with a coarser categorization than was used in the matching procedure. The statistical software GEE by Vincent Carey (Harvard University, Boston, MA) available in the S archive of StatLib (Carnegie Mellon University, Pittsburgh, PA), which supports the generalized estimating equations method, was run in connection with the statistical program package S-PLUS (Statistical Sciences Inc, Seattle, WA).[49] The program package

SPSS (SPSS Inc, Chicago, IL)[48] also was applied in the statistical analyses.

Explanatory factors in the regression analyses were revision status (revised, unrevised), primary diagnosis (coxarthrosis, rheumatoid arthritis, femoral neck fracture, sequelae after congenital dysplasia, other), gender, age at the primary operation (younger than 56 years, 56–65 years, 66–70 years, 71–75 years, or older than 75 years), bilaterality (no, yes), and time since the primary operation (<1.6 years, 1.6–2 years, 2.1–4 years, >4 years). Because information on each patient from two different occasions was used in the statistical models, an indicator variable was included in the model to distinguish between preprimary and followup data. An interaction term between revision status and the indicator of preprimary or followup data was included to study whether an effect of total hip replacement surgery differed between patients with revised and those with unrevised hip implants. A possible effect modification of gender, age, and primary diagnosis on satisfaction and improvement also was investigated.

RESULTS

Complete questionnaires were received from 81% of the 2007 individual cases and control subjects selected for the study. Thus, the study included 531 patients who had primary and revision surgery and 1087 patients who had primary surgery only. Only small variations in response percentages were found across age and gender groups.

Patient characteristics are given in Table 1. Male patients constituted 42% of the material, and median age at the primary opera-

TABLE 1. Patient Characteristics Among 1618 Hips With Revised and Unrevised Total Hip Replacements

Characteristic	n	%*	Median (range)
Males	687	42	
Age at primary operation (years)			67 (22–88)
Followup since primary operation (years)			5.2 (0.9–6.9)
Followup since revision (years)			2.3 (0.6–6.4)
Bilateral**	471	29	
Primary diagnosis			
Coxarthrosis	1071	67	
Rheumatoid arthritis	58	3.6	
Femoral neck fracture	145	9.1	
Sequelae after congenital dysplasia	189	12	
Cement use in primary operation			
Both components cemented	1127	71	
High viscosity	870	91	
Low viscosity	38	4.0	
Boneloc	43	4.5	
Both components uncemented	364	23	
Hybrids	90	5.7	
Primary prosthesis brand			
Charnley	702	44	
Exeter	139	8.6	
Titan	144	8.9	
Ti-fit (acetabular)/Bio-fit (femoral)	71	4.4	
Antibiotic prophylaxis in primary operation			
Systemic	1482	92	
In cement (both components)	344	23	
Systemic + in cement	308	21	

*Missing values not included.

**Sixteen patients with data on both hips.

tion was 67 years. Median followup after primary surgery was 5.2 years (range, 0.9–6.9 years) and after revision surgery was 2.3 years (range, 0.6–6.4 years) (Table 1). Among the patients who underwent revision surgery, the median interval between primary and revision surgery was 2 years. The median interval between the first symptoms associated with the hip and primary surgery was 4 years among patients with revised hip implants and among patients with unrevised hip implants. Seventy-one percent of all revisions were performed because of aseptic loosening of one or both components, 13% because of deep infection, and 10% because of dislocation of the hip.

Satisfaction

The adjusted odds of rating satisfaction at followup as good or very good was 3.7 ($p < 0.001$) times higher among patients with unrevised hip implants than among those with revised hip implants. Table 2 shows that satisfaction was lower among female and older patients (Fig 1) with revision surgery but was unaffected by age and gender among patients who did not undergo revision surgery. In addition, irrespective of revision status, patients surgically treated because of femoral neck fracture had lower satisfaction scores than did patients with other diagnoses (Table 2). Exclusion of patients with femoral neck fracture from the analyses did not affect the results for age and gender.

The relation between satisfaction at followup and postoperative measures of pain, walking ability, regular exercise, and self support was investigated in separate analyses. Pain, poor walking ability, and need of help were associated with less satisfaction in both revision groups. At followup, less satisfaction also was observed among patients who had undergone revision surgery and did not exercise regularly. With adjustment for postoperative pain, walking ability, and the ability to be self supporting, the relationship between satisfaction and the factors of gender and age was weaker and no longer statistically significant. In addition, among patients with unrevised hip implants, the

TABLE 2. Odds Ratios of Satisfaction at Followup for Selected Predictors in Hips With Revised and Unrevised Total Hip Replacements

	Revised Hips (n = 503)			Unrevised Hips (n = 1050)			
Predictor of Satisfaction	*% Satisfied*	*OR**	*p*	*% Satisfied*	*OR**	*p*	*p***
Gender							
Males (reference)	65	1		84	1		
Females	55	0.6	0.02	84	1.0	0.91	0.09
Age at primary operation†	63/46	0.7	<0.001	80/79	1.0	0.84	0.01
Primary diagnosis							
Coxarthrosis (reference)	59	1		83	1		
Rheumatoid arthritis	68	1.3	0.63	86	1.3	0.61	0.99
Femoral neck fracture	41	0.5	0.04	74	0.6	0.08	0.53
Sequelae dysplasia	62	0.7	0.32	87	1.3	0.42	0.18
Other	69	1.0	0.92	88	1.4	0.33	0.45

*Odds ratios of satisfaction at followup based on a logistic regression model for dependent data (generalized estimating equations method) including revision status, gender, age, primary diagnosis, bilaterality, and time since the primary operation as explanatory factors. Compared with patients in the reference category, an odds ratio <1 means less satisfaction, whereas an odds ratio >1 means more satisfaction.

**Test for homogeneity in estimated differences between patients who underwent revision surgery and patients who did not undergo revision surgery.

†Linear trend with age categorized as follows: <56, 56–65, 66–70, 71–75, >75 years. Percent satisfied patients were given for the youngest and the oldest age group.

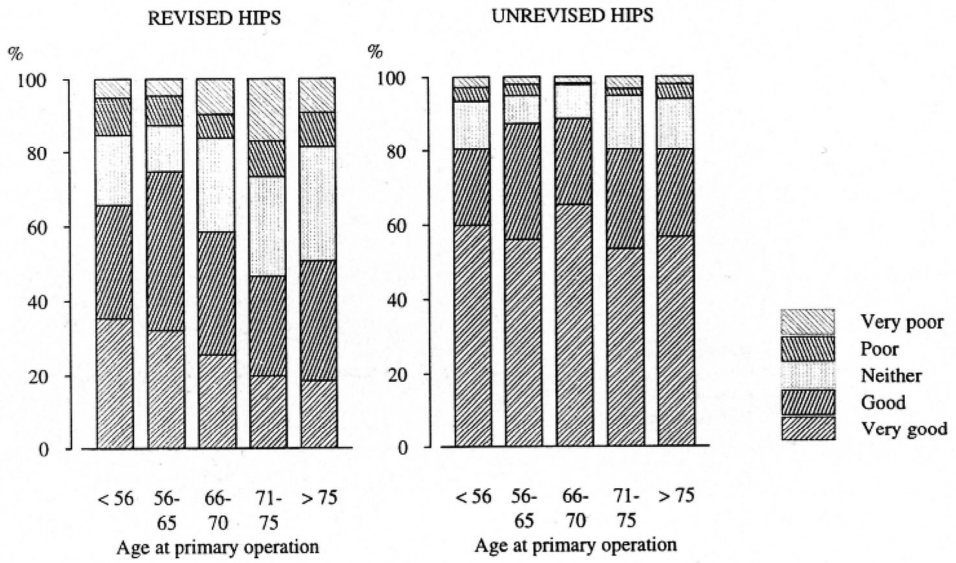

Fig 1. Crude distribution of patient satisfaction at followup by age among patients with revised and unrevised total hip replacements.

adjusted odds for being satisfied was 0.4 ($p = 0.001$) times lower if the primary prosthesis was uncemented, rather than cemented.

Satisfaction at followup also was investigated in relation to preoperative measures of pain, walking ability, regular exercise, and self support. Only poor preoperative walking ability ($p = 0.06$) was related to poorer satisfaction at followup among patients who underwent revision surgery and among patients who did not.

Pain and Walking Ability

Figure 2 shows the observed modified Merle d'Aubigné pain and walk scores preoperatively and at followup by age among patients with revised and unrevised hip prostheses. Overall, the adjusted improvement in pain score was 2.1 ($p < 0.001$) points among patients who underwent revision surgery and 2.9 ($p < 0.001$) points among patients who did not undergo revision surgery. The corresponding improvement in walking ability was 0.7 ($p < 0.001$) and 1.4 ($p < 0.001$) points. Thus, among patients who did not undergo revision surgery, improvement was more pronounced for pain ($p < 0.001$) and for walking ability ($p < 0.001$). Figure 2, Table 3, and Table 4 show that improvement decreased with age.

Analyses of postoperative pain and walking ability by preoperative status showed that patients with poor preoperative scores did not reach the same level of success after surgery as did patients with higher scores. Among patients with revised hip implants, the adjusted mean walk score at followup was 1.7 ($p < 0.001$) points higher for patients with a prerevision score equal to 4 or 5 compared with those with a prerevision score equal to 1. Among patients who did not undergo revision surgery, a 0.8 ($p < 0.001$) points higher postoperative score was observed for patients with a preprimary score of 4 or 5 compared with a preprimary score of 1. Likewise, pain score at followup was 0.8 ($p = 0.004$) and 0.4 ($p = 0.03$) points higher for patients with high preoperative scores compared with patients with low preoperative scores among those with revised and unrevised hips, respectively.

As shown in Figure 2, patients with revised hip implants had less pain before the revision than before the primary operation (adjusted difference of 0.2 points, $p < 0.001$). However, walking ability had worsened by 0.6 ($p < 0.001$) points at revision in comparison with the score before the primary operation (Fig 2).

Need of Help

The proportion of patients who underwent revision surgery and who were self supportive had increased from 33% preoperatively to 38% at followup, which corresponded to an adjusted 1.3 ($p = 0.01$) times higher odds for being self sup-

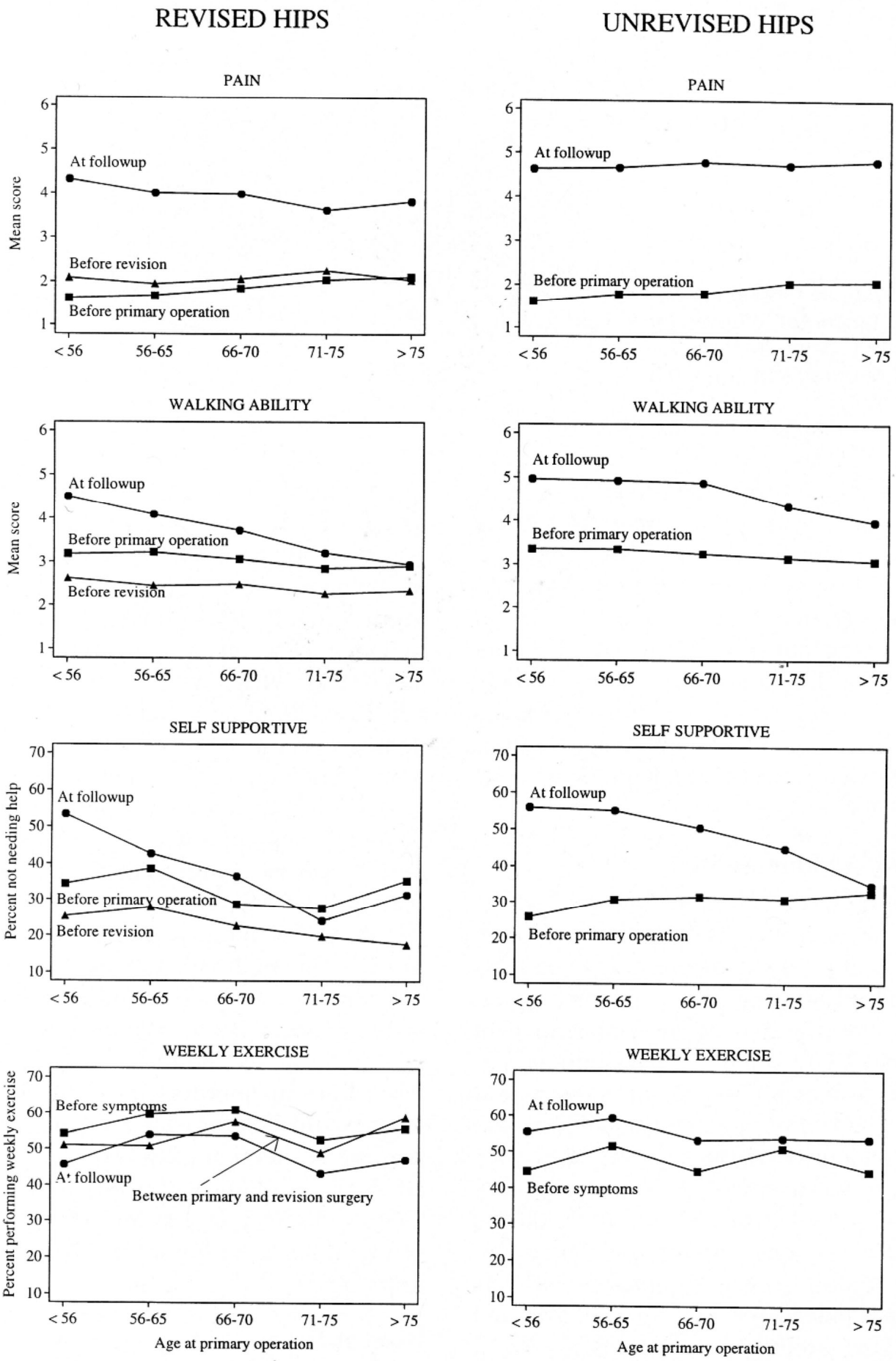

Fig 2. Crude preoperative and at followup mean values of the modified Merle d'Aubigné pain and walk score, proportions of patients not needing help, and proportions of patients performing weekly exercise by age among patients with revised and unrevised total hip replacements.

TABLE 3. Differences in Improvement in Charnley Pain Score for Selected Predictors in Hips With Revised and Unrevised Total Hip Replacements

	Pain Score				
	Revised Hips (n = 495)		*Unrevised Hips (n = 1028)*		
Predictor of Improvement	Difference*	p	Difference*	p	p**
Gender					
Males (reference)	0		0		
Females	–0.22	0.18	–0.18	0.10	0.86
Age at primary operation†	–0.28	<0.001	–0.08	0.06	0.01
Primary diagnosis					
Coxarthrosis (reference)	0		0		
Rheumatoid arthritis	–0.13	0.74	–0.11	0.71	0.96
Femoral neck fracture	–0.94	0.01	–0.62	0.002	0.44
Sequelae dysplasia	0.11	0.68	0.28	0.05	0.57
Other	0.29	0.29	–0.29	0.12	0.09

*Estimated differences in improvement in pain score (1 = most severe to 6 = normal) based on a Gaussian regression model for dependent data (generalized estimating equations method) including revision status, indicator of preprimary or at followup data, gender, age, primary diagnosis, bilaterality, and time since the primary operation as explanatory factors. Compared with patients in the reference category, a negative estimate means less improvement, whereas a positive estimate means more improvement.

**Test for homogeneity in estimated differences between patients who underwent revision surgery and patients who did not undergo revision surgery.

†Linear trend with age categorized as follows: <56, 56–65, 66–70, 71–75, >75 years.

portive at followup than before the primary operation. Among patients who did not undergo revision surgery, 31% were self supportive before surgery, compared with 49% at followup (adjusted odds ratio = 2.2, $p < 0.001$). The difference in improvement between the revision groups was statistically significant ($p < 0.001$). As Figure 2 and Table 5 show, improvement was less among older patients and female patients.

The higher proportion of patients being able to take care of themselves after surgery was related to a decrease in patients needing help from spouses, cohabitants, or relatives. However, compared with no help needed, the proportion of patients needing help from a home help or a home nurse had increased in all except the youngest age group. Among patients with unrevised hip prostheses, statistical significance was reached only among patients older than 75 years at the primary operation (adjusted odds ratio = 2.0, $p = 0.02$).

An overall decrease in self supportive patients was found when comparing status before the primary operation with status before revision among patients with revised hips (adjusted odds ratio = 0.6, $p < 0.001$) (Fig 2).

Regular Exercise

When comparing preoperative and followup proportions of patients doing weekly exercise, there was a decrease from 57% to 49% (adjusted odds ratio = 0.7, $p = 0.003$) among patients with revised implants, and an increase from 48% to 55% (adjusted odds ratio = 1.4, $p < 0.001$) among patients with unrevised implants (Fig 2). This difference was statistically significant ($p < 0.001$). Otherwise, the effect of total hip replacement surgery on regular exercise was relatively constant over patient groups defined by age (Fig 2), gender, and primary diagnosis.

Employment Status

Among patients of working age at followup, the proportion of patients working in salaried positions was higher before the primary opera-

TABLE 4. Differences in Improvement in Charnley Walk Score for Selected Predictors in Hips With Revised and Unrevised Total Hip Replacements

	Walk Score				
	Revised Hips (n = 483)		*Unrevised Hips (n = 1011)*		
Predictor of Improvement	Difference*	p	Difference*	p	p**
Gender					
Males (reference)	0		0		
Females	–0.31	0.09	0.22	0.06	0.02
Age at primary operation†	–0.31	<0.001	–0.20	<0.001	0.23
Primary diagnosis					
Coxarthrosis (reference)	0		0		
Rheumatoid arthritis	0.43	0.34	–0.38	0.25	0.14
Femoral neck fracture	–0.33	0.36	0.25	0.26	0.18
Sequelae dysplasia	0.14	0.66	–0.16	0.36	0.41
Other	–0.39	0.23	–0.37	0.09	0.96

*Estimated differences in improvement in walk score (1 = most severe to 6 = normal) based on a Gaussian regression model for dependent data (generalized estimating equations method) including revision status, indicator of preprimary or at followup data, gender, age, primary diagnosis, bilaterality, and time since the primary operation as explanatory factors. Compared with patients in the reference category, a negative estimate means less improvement, whereas a positive estimate means more improvement.

**Test for homogeneity in estimated differences between patients who underwent revision surgery and patients who did not undergo revision surgery.

†Linear trend with age categorized as follows: <56, 56–65, 66–70, 71–75, >75 years.

tion (44%) than at followup (31%) among patients who underwent revision surgery (adjusted odds ratio = 0.6, p = 0.002), whereas no change was observed among patients who did not undergo revision surgery (adjusted odds ratio = 1.0, p = 0.90) (Table 6, Fig 3). In both revision groups, the proportion of patients on sick leave had decreased substantially, although the proportion of patients receiving disability pension had increased (Table 6, Fig 3).

Table 6 shows that among patients who had salaried positions before surgery, 53% of the patients who had revision surgery and 66% of the patients who did not have revision surgery remained in salaried positions at the time of followup. The highest proportion of patients receiving disability pension at followup was found among patients who underwent revision surgery (Table 6).

DISCUSSION

Several studies have reported substantial improvement in function and quality of life after total hip replacement.[8,40,41,43–45,56] However, these studies were performed among relatively small groups of patients with mainly unrevised hip implants. In the current study, improvement after total hip replacement surgery was seen in patients who had primary and revision surgery. However, improvement was considerably poorer among patients who underwent revision surgery than among patients with primary surgery only.

Pain and Walking Ability

Many methods have been developed to measure pain and mobility, often in combination with other measures of health and function.[3,4,9,12,15,20,21,24,27,36,37,47,51,55] This has made comparisons among studies difficult. However, irrespective of the method used, all studies have reported a substantial improvement in pain and walking ability for most patients who have total hip replacements.[16] In the current study, results among patients who did not undergo revision surgery were compa-

TABLE 5. Odds Ratios of Improvement in Self Supportiveness for Selected Predictors in Hips With Revised and Unrevised Total Hip Replacements

	Self Supportive				
	Revised Hips (n = 498)		*Unrevised Hips (n = 1041)*		
Predictor of Improvement	OR*	p	OR*	p	p**
Gender					
Males (reference)	1		1		
Females	0.6	0.02	0.7	0.05	0.52
Age at primary operation†	0.8	0.002	0.7	<0.001	0.86
Primary diagnosis					
Coxarthrosis (reference)	1		1		
Rheumatoid arthritis	0.7	0.57	0.4	0.06	0.52
Femoral neck fracture	0.5	0.18	0.8	0.59	0.43
Sequelae dysplasia	0.9	0.82	0.9	0.49	0.80
Other	0.9	0.78	1.2	0.62	0.60

*Odds ratios of improvement in self support based on a logistic regression model for dependent data (generalized estimating equations method) including revision status, indicator of preprimary or at followup data, gender, age, primary diagnosis, bilaterality, and time since the primary operation, as explanatory factors. Compared with patients in the reference category, an odds ratio <1 means less improvement, whereas an odds ratio >1 means more improvement.

**Test for homogeneity in estimated differences between patients who underwent revision surgery and patients who did not undergo revision surgery.

†Linear trend with age categorized as follows: <56, 56–65, 66–70, 71–75, >75 years.

rable with those of other reports using the modified Merle d'Aubigné score.[52,57] Several recent studies[10,56] also have applied this score but did not provide detailed information on pain and walking ability. In addition, the original Merle d'Aubigné scoring system has been used in numerous new studies.[30,45]

Previous studies have asserted that it is more cost effective to treat patients with lower preoperative health scores because postopera-

TABLE 6. Employment Status at Followup by Employment Status at the Primary Operation Among 504 Total Hip Replacements in Patients Who Were of Working Age at Followup

	Employment Status at Followup				
Employment Status at the Primary Operation	*n*	*% Salaried*	*% Sick Leave*	*% Disability Pension*	*% Other*
Revised hips					
Salaried	77	53	9.1	30	7.8
Sick leave	43	28	4.7	60	7.0
Disability pension	45	0.0	0.0	98	2.2
Other	12	17	0.0	33	50
Total	177	31	5.1	55	9.0
Unrevised hips					
Salaried	145	66	4.8	21	8.3
Sick leave	84	45	7.1	37	11
Disability pension	65	3.1	0.0	92	4.6
Other	33	18	0.0	18	64
Total	327	43	4.0	39	14

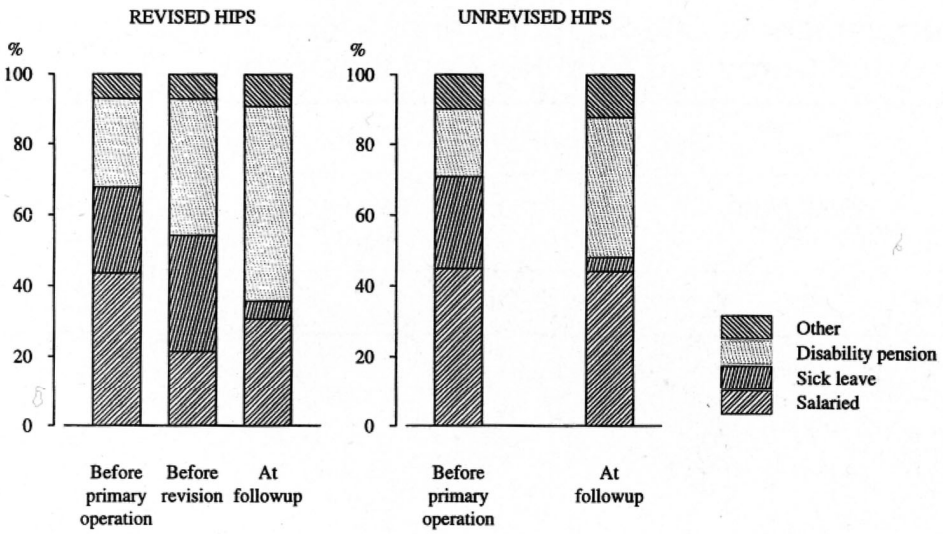

Fig 3. Crude distribution of employment status before surgery and at followup among patients of working age with revised and unrevised total hip replacements.

tive scores are effectively identical.[31] Although improvement in pain and walking ability was more pronounced among patients with the poorest preoperative scores, these patients did not reach the same level of success after surgery as did patients with higher preoperative scores. In addition, a previous report based on the current material indicated that patients with poor preoperative walking ability had an increased risk for reoperation.[11] Poor preoperative walking ability also has been associated with inferior postoperative occupational capacity.[23]

Need of Help

The proportion of self supportive patients who did not undergo revision surgery compared well with the results of another recent prospective study reporting a preoperative rate of 30% and a postoperative rate of 46% of patients who did not need help with indoor activities.[43] It has been argued that a possible cost benefit of total hip replacement surgery would relate to a reduced number of patients needing help from health and welfare services after surgery.[43,57] Although the current study showed a decrease in patients needing help from spouses or relatives, more patients needed help from a home help or a home nurse after the operation than before the operation. No reduction in community expenses has been reported for welfare services after total hip replacement surgery among elderly patients.[22]

Employment Status

Only a few studies have investigated occupational capacity before and after total hip replacement surgery. Again, these questions were studied among patients with successful prostheses. Reported proportions of patients who continue to work after surgery have varied from 50% to 92%,[23,39,42,46] which compares well with the 66% observed in the current study among working age patients who did not undergo revision surgery. Although it was difficult to establish an adequate control group, these patients most likely would not have been working in salaried positions at followup without undergoing the hip implant operation. For patients who were on sick leave before surgery and working after surgery, figures have varied from 65% to 70%.[19,23,26,39] In the current study, the numbers were somewhat lower, 45% and 28% for patients with unrevised and revised hip implants, respectively. Several studies have shown that a short preoperative sick leave of less than 6 months will decrease the risk of early retirement or a long postoperative sick leave.[19,26] In accordance with previous studies,[23,39,42,46] few patients in the current study returned to work after receiving disability pension before surgery. However, numbers from different studies must be interpreted with caution because regulations for retirement, sick leave, and disability pension differ considerably among countries and for different periods.

Regular Exercise

An increase has been reported in patients engaging in regular exercise after the operation, in particular walking and cycling.[53] In the current study, the proportion of patients performing weekly exercise increased among patients who did not undergo revision surgery but decreased among patients who underwent revision surgery. A similar decrease also was observed among working age patients with revision surgery when comparing preoperative and postoperative proportions of patients in salaried positions. These were the only instances in which a deterioration in functional status was seen after total hip replacement surgery.

Gender and Age

Patients of greater age (older than 75 years) and female gender normally are not associated with an increased risk of revision.[2,17,34] However, improvement was considerably less among older patients and in some instances among female patients. This might indicate a group of patients who need revision or rerevision surgery, but the patient may refuse the operation, or the procedure cannot be performed, or the procedure has low priority. These patients also were not satisfied at the time of followup because of postoperative pain, poor walking ability, or because they were not self supportive. With a median followup of 5.2 years after primary surgery, a deterioration might be expected among patients of greater age, irrespective of surgery. A marginally greater improvement in functional status has been reported for men who underwent total hip replacement surgery.[29]

Followup

Some studies report that the hip function after a successful hip replacement will reach a steady state within 2 years.[38] Pain and functional ability also have been shown to be improved 50 days after total hip replacement surgery,[1] and several studies have reported that most of the improvement occurred within 3 or 6 months after surgery.[30,43] This suggests that with a median followup after primary surgery of 5.2 years and after revision surgery of 2.3 years, the followup was sufficient in the current study.

Questionnaire

Although patients and surgeons may differ in their evaluation of total hip replacement outcome,[33] few studies have examined improvement in function and quality of life after total hip replacement using standard patient questionnaires.[5,14,30,43,44] However, there are many questionnaires designed for this purpose that have been tested extensively against each other,[7,28,32,50] and new questionnaires are introduced frequently.[6,10,25,41] Most standard questionnaires are extensive and thus probably not applicable in mail survey studies comprising large numbers of mostly elderly patients. In the current study, completed questionnaires were received from 81% of the 2007 patients selected for the study. Although these patients may be considered as being highly motivated, the high rate of compliance also might be ascribed to the simplicity of the questionnaire.

Study Design

In this study, patients who did not undergo revision surgery were matched to patients who underwent revision surgery with respect to gender and age. Thus, the control group included relatively more young patients and male patients than would an unmatched study of patients with unrevised hip prostheses. Thus, because young age and male gender are risk factors for revision,[2,10,34] the results regarding improvement after total hip replacement might be poorer among the studied patients than in the total population of patients with primary surgery. However, practically all patients who underwent primary and revision surgery during the study period were included as cases. Thus, these patients were representative of all patients with early revision surgery.

Previous studies have shown that patients are more likely to report a worse preopera-

tive situation when information is retrieved after surgery than when obtained prospectively.[35] Thus, recall bias might have led to an overestimation of improvement after surgery, and also may have influenced the differences observed between the revision groups. However, to enhance memory, questions with general and poorly defined responses were avoided in the questionnaire.

An important strength of this study is the large number of patients with prosthesis failure who were studied. This made it possible to assess and compare satisfaction and function among patients with revised prostheses and patients with primary prostheses only. Although not as marked as for patients with unrevised total hip implants, a substantial improvement after total hip replacement was observed among patients with revised hip implants with regard to pain, walking ability, and need of help. However, in comparison with patients with an initially successful prosthesis, patients who underwent revision surgery did not have an improved situation after surgery with regard to employment status and exercise habits.

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