



## ■ RESEARCH: ARTHROPLASTY

## Noise from total hip replacements

## A CASE-CONTROLLED STUDY

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**Objectives**

Our study aimed to examine not only the incidence but also the impact of noise from two types of total hip replacement articulations: ceramic-on-ceramic and ceramic-on-polyethylene.

**Methods**

We performed a case-controlled study comparing subjective and objective questionnaire scores of patients receiving a ceramic-on-ceramic or a ceramic-on-polyethylene total hip replacement by a single surgeon.

**Results**

There was a threefold higher incidence of noise from patients in the ceramic-on-ceramic group compared with the control group. The impact of this noise was significant for patients both subjectively and objectively.

**Conclusions**

This study reports a high patient impact of noise from ceramic-on-ceramic total hip replacements. This has led to a change in practice by the principal author.

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**Keywords:** Noise, Total hip replacement, Ceramic

**Article focus**

- To investigate the incidence and impact of noise from ceramic-on-ceramic compared with ceramic-on-polyethylene total hip replacements.

**Key messages**

- Noise from ceramic-on-ceramic total hip replacements is not only more common than in ceramic-on-polyethylene articulations, but it is also particularly troublesome for the patient.

**Strengths and limitations**

- Strengths: This study is a single-surgeon series and 179 patients were evaluated.
- We used a validated questionnaire method.
- Limitation: There is very little data published on this issue.

**Introduction**

Total hip replacement (THR) has evolved with the improved application of tribological

technology. Polyethylene wear and osteolysis, leading to early aseptic loosening in young active patients, has been prolific in the rise in interest in ceramic bearings. Ceramic bearings are smooth, hard, scratch-resistant, have high wettability and very low rates of wear, and excellent survivorship which has been observed with their use.<sup>1,2</sup> However, concern remains over ceramic fracture and squeaking.

Squeaking and noise from ceramic bearing THRs is well recognised, with a reported incidence of 0% to 35%.<sup>3–6</sup> The precise aetiology is unknown, but is believed to be multifactorial. The likely culprits include component design and combination,<sup>4,7</sup> cup malposition,<sup>5</sup> abnormal wear pattern, patient weight, soft-tissue crepitus and insert *versus* shell movement.<sup>8</sup> Therefore, squeaking is not merely a nuisance but may indicate an insidious biomechanical problem.

Given the potentially serious biomechanical causes of squeaking, there have been numerous studies in this area, but few have

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**Questionnaire:**

*Objective assessment:*

**(1) Does your hip replacement make a noise?**  
Never/Rarely/Once a week/Once a month/Always/It used to but it has stopped

**(2) When the noise starts how long does it last for?**  
A few seconds/A few minutes/A few hours/A few days/Constant

**(3) When did the hip noise start following the hip replacement?**  
<3 months/3-6 months/9-12 months/>12 months

**(4) With which activity is the noise most experienced?**  
Walking on the flat/Walking upstairs/Walking downstairs/Rising from a chair/Bending over to pick up something

*Subjective assessment:*

**(5) Is the noise a nuisance?**  
Not at all/Slightly/Moderately/Very severe

**(6) Do other people comment on the noise from your hip?**  
Never/Sometimes/Quite often/All the time

**(7) Are you reluctant to be around other people because of the noise?**  
Never/Sometimes/Quite a lot/All the time

**(8) Does the noise affect your work or recreation?**  
No/Yes it affects my work/Yes it affects my recreation/Yes it affects both

Fig. 1

Questionnaire for assessment of subjective and objective impact of noise.

examined the direct impact of this intriguing phenomenon on the patient. The aim of this study was to discern the impact of such noise on the patient's quality of life.

### Patients and Methods

We identified 112 patients from hospital records of theatre lists who had received 36 mm ceramic-on-ceramic (CoC) THRs, and compared them with 159 patient controls who had received a 28 mm ceramic-on-polyethylene (CoP) component within two years of this study. We used the New Zealand Joint Registry to identify an age-matched control group from the senior author's practice (GH). All patients had identical cemented femoral components (Zimmer, Warsaw, Indiana) and either Mathys (Bettlach, Switzerland) classic polyethylene cups or Mathys SeleXys uncemented cup, which were inserted through a posterior approach. All operations were performed by the senior author (JGH).

Patients were invited to participate, and received a specific validated questionnaire by post for both subjective and objective assessments (Fig. 1).

**Statistical analysis.** Results were compared between the study and control groups using the chi-square or Mann-Whitney U tests.

### Results

The response rate was 61.6% in the study group (69/112) and 69.2% in the control group (110/159).

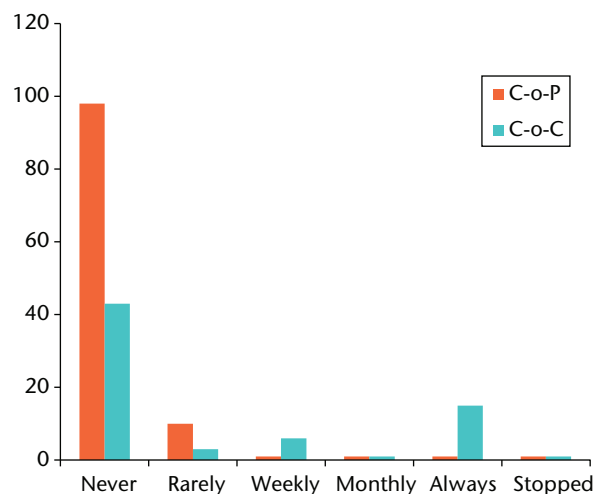


Fig. 2

Graph showing results of both ceramic-on-ceramic (CoC) and ceramic-on-polyethylene (CoP) groups for the question 'Does your hip make a noise?'

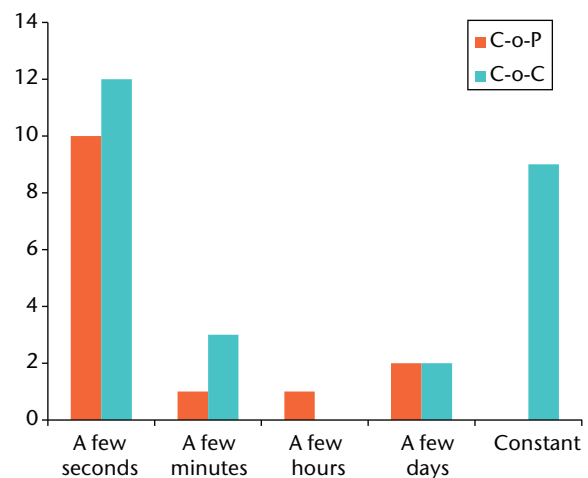


Fig. 3

Graph showing results of both ceramic-on-ceramic (CoC) and ceramic-on-polyethylene (CoP) groups for the question 'How long does the noise last?'

**Subjective assessment.** Overall, we found that 37.7% (26/69) of CoC THRs reported noise compared with 12.7% (14/110) of the control CoP group, which is significant ( $p < 0.001$ ). In addition, the patients within the control group were significantly more likely never to report any noise, while the study group were significantly more likely always to perceive noise ( $p < 0.001$ ) (Fig. 2). Patients in the study group were significantly more likely to have constant noise compared with the control group ( $p < 0.01$ ) (Fig. 3). There were no significant differences in the incidence of shorter noise occurrences between groups. CoC patients were significantly more likely to report noise after a year compared with controls

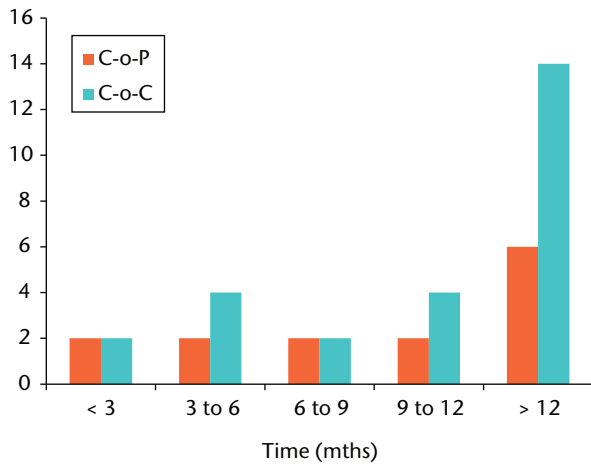


Fig. 4

Graph showing results of both ceramic-on-ceramic (CoC) and ceramic-on-polyethylene (CoP) groups for the question 'When did the noise start?'

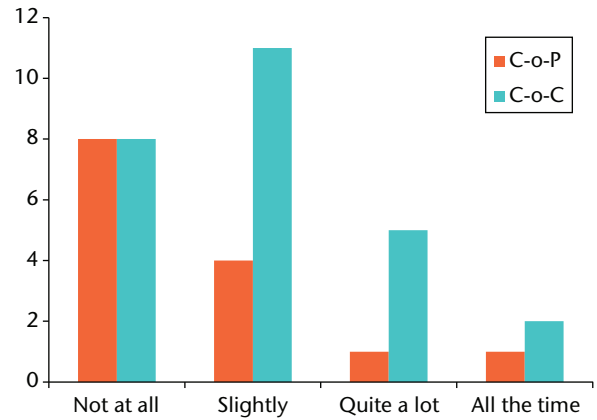


Fig. 6

Graph showing results of both ceramic-on-ceramic (CoC) and ceramic-on-polyethylene (CoP) groups for the question 'Is the noise a nuisance?'

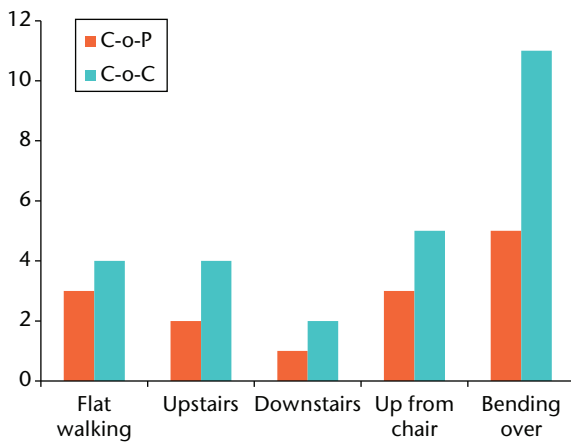


Fig. 5

Graph showing results of both ceramic-on-ceramic (CoC) and ceramic-on-polyethylene (CoP) groups for the question 'What activity brings about the noise?'

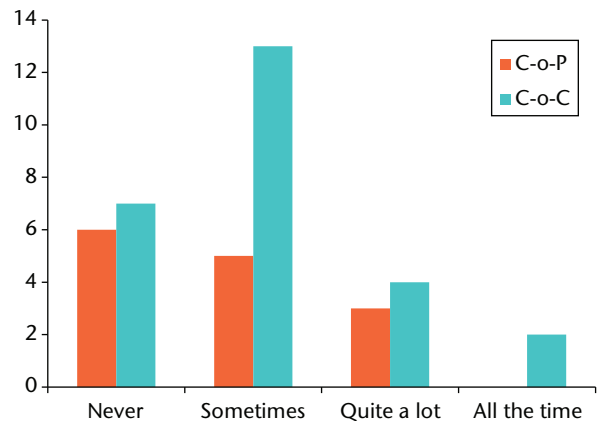


Fig. 7

Graph showing results of both ceramic-on-ceramic (CoC) and ceramic-on-polyethylene (CoP) groups for the question 'Do other people comment?'

( $p < 0.01$ ) (Fig. 4) whereas the timing of noise commencing prior to one year following surgery was similar in both groups. Patients with a CoC THR tended to notice noise significantly more when bending over (Fig. 5) ( $p < 0.01$ ). Other physical activities did not discriminate between groups in terms of noise perceived.

**Objective assessment.** The noise experienced by patients in the study group generally tended to be more troublesome and remarked upon more by other people than was the noise experienced in the control group, the latter significantly so ( $p < 0.01$ ) (Figs 6 and 7). The noise from patients with a CoC THR tended to be more embarrassing to those patients than noise experienced by patients from the control group (Fig. 8). The noise in both groups did

not tend to be restrictive on work or recreational activity in the majority of patients, however, any restriction that was encountered tended to be in those with a CoC THR ( $p < 0.01$ ) (Fig. 9).

**Discussion**

In our study, noise emanating from CoC bearing THRs was more than three times more common than from CoP. Furthermore, this noise has a significant impact on patients both subjectively and objectively. In another series of 306 patients (336 CoC hips) the incidence of noise was 17%, and 92% were otherwise symptom free.<sup>9</sup> The findings from our study were more striking given a 37% incidence and greater reported symptoms.

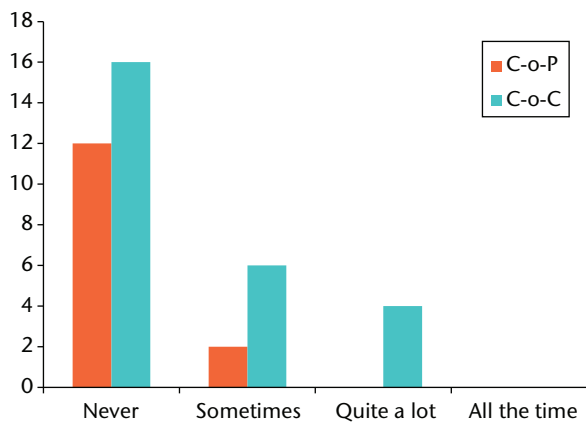


Fig. 8

Graph showing results of both ceramic-on-ceramic (CoC) and ceramic-on-polyethylene (CoP) groups for the question 'Are you reluctant to be around other people because of the noise?'

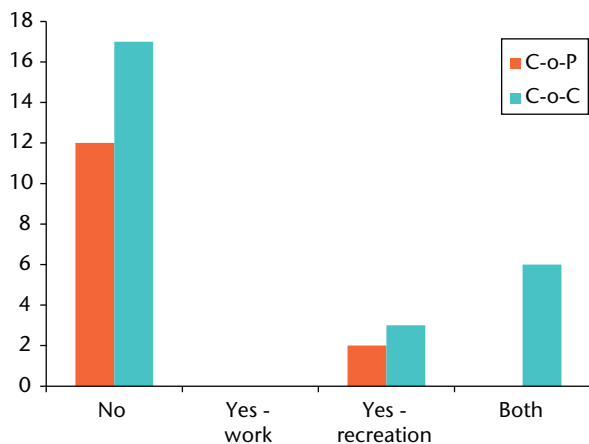


Fig. 9

Graph showing results of both ceramic-on-ceramic (CoC) and ceramic-on-polyethylene (CoP) groups for the question 'Does the noise affect your work or recreation?'

Squeaking after CoC THR has been characterised by Sariali et al.<sup>10</sup> Interestingly, two distinct noise frequencies were observed: one at 2.4 kHz when walking and the other at 1.4 kHz when rising from a flexed position. *In vitro* simulation showed that a third body particle produced a sound similar to that observed in the walking squeakers. It may be that the lower frequency sound in rising from a chair was more troublesome for our patient group.

In a prospective multicentre trial comparing CoC or CoP bearing combinations, there was no significant difference in clinical outcome scores or revision rates between the two groups, yet there was much less linear wear in the first group. However, the CoC group had a 3% incidence of audible noise and a 2.6% ceramic fracture risk.<sup>11</sup> Following this study, the senior author (JGH) has dramatically reduced his use of CoC bearings in THR: CoC bearings are now only used by the senior author (JGH) if the patient makes a specific request after an appropriate discussion.

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### Author contributions:

- M. C. Wyatt: Data analysis, Writing the paper
- S. Jesani: Data collection
- C. Frampton: Data analysis
- P. Devane: Writing the paper
- J. G. Horne: Writing the paper

### ICMJE Conflict of Interest:

- None declared

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