



## CORR Insights

**CORR Insights®: What Is the Frequency of Noise Generation in Modern Knee Arthroplasty and Is It Associated With Residual Symptoms?**

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**Where Are We Now?**

Although knee arthroplasty is a generally successful intervention for patients with advanced knee arthritis, a large proportion of patients who undergo it remain dissatisfied with their replaced knees.

*This CORR Insights® is a commentary on the article “What Is the Frequency of Noise Generation in Modern Knee Arthroplasty and Is It Associated With Residual Symptoms?” by Nam and colleagues available at: DOI: 10.1007/s11999-016-4701-y.*

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Unresolved pain, residual symptoms, functional limitations, any of a number of postoperative complications, overlapping pain from spine or hip disease, and varying patient pain thresholds all may contribute to lingering dissatisfaction [2, 9]. Of the various culprits, unmet patient expectations have been reported to be the most important [2]. Noise generation from the joint itself can be disturbing, and can lead to unmet expectations, even though it rarely generates any functional problems.

Most previous studies on joint noises after TKA have focused on patellar crepitus or patellar clunk syndrome [1, 3–8, 11, 12, 15, 16]; to my knowledge, there are only two previous studies looking more-generally at noise generation after TKA. One study of 49 patients found that 69% of the patients reported noise production, which continued to worsen even after 6

months [14]. A larger study (465 patients, 930 knees) evaluated noise after bilateral TKA and reported that noise-related symptoms differed by prosthesis type; it was less common among TKAs that used a medial pivot design (12%) or an ACL-PCL retaining prosthesis (4%) than in PCL retaining (31%), PCL substituting (33%), and mobile bearing prostheses (42%). The authors also found that occasionally patients were concerned or dissatisfied because of the noise-related symptoms [13].

Two studies is relatively little to go on. Certainly the topic seems important, and in order to better understand how it might influence patients' perceptions about their results, we need more detail. Does it vary by arthroplasty type (TKA or UKA)? What other prosthesis-related risk factors might contribute? And, perhaps most importantly, to what degree does noise generation influence residual symptoms or persistent functional limitation symptoms after knee arthroplasty?

The current study by Nam et al. addresses many of these questions. In short summary, they found that overall

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27% of all patients with knee arthroplasty continue to experience joint noise after full recovery, it is more common after TKA than UKA, male gender and younger age were identified as factors associated with noise generation. Other prosthesis-related factors also came up, with cruciate-retaining implants seemingly resulting in less joint noises than other designs. And, importantly, the authors did associate residual noises with persistent functional limitations. These findings led the authors to propose that surgeons should inform patients before surgery of the possibility of noise generation after knee arthroplasty to decrease the likelihood that it might result in unmet patient expectations.

## Where Do We Need To Go?

The current study is robust in many important respects: It was a multicenter collaborative effort, it enrolled many patients (more than 2000) according to well-defined criteria, and assessment bias was minimized by using a standardized questionnaire administered by a third-party call center. But like many good studies, it raises many questions that call for further inquiry. For example, the finding that certain types of prostheses are more associated with noise generation than others may suggest that noise

generation can be reduced with modifications in prosthesis design or surgical technique. Although the issue of noise generation should not be the first criterion in prosthesis selection, a recent study comparing the incidence of noise generation in patients with 5 different prosthesis types found that patients with medial pivot knees and ACL-PCL retaining designs had fewer noise-related symptoms than did patients who received other designs [13].

Also, the current study did not distinguish patellar crepitus or clunk from other types of noise. Patellar clunk is especially important because it is known to result directly in functional impairment, and it can result in reoperations [3, 5].

Finally, and importantly, is the question of association and causation. Do gender and age (which may be surrogates for activity levels) cause the problem, or are they mere associations? And most important of all, does the lingering presence of noise in the knee cause the functional limitations, or is it rather that patients with functional limitations are more sensitive to perceived abnormalities—such as noises—coming from the joint, and so are more likely to report them? These questions of association and causation is critically important to answer before we choose different implants to try to minimize the frequency of noises,

since we do not know that these noises really cause any functional problems. Generally speaking, patients who do not respond to surveys tend to have inferior functional outcomes to those who respond [10], and so further studies indeed must get at the cause-effect question some other way.

## How Do We Get There?

Future studies might supplement the cross-sectional design employed here by choosing other approaches to answering important questions. Patients want to know how the noises (and, importantly, the functional limitations associated with them) might change over time. To address questions related to prognosis, we will need longitudinal study designs that follow patients over a span of months or years.

We also need to determine which kinds of noises are more likely to result in severe limitations or reoperations. While in general noise generation is not known to decrease the longevity of a knee arthroplasty, some kinds of noises—again, such as patellar clunk—do result in reoperation, and so should be separated out from other kinds of noises in future studies, and if design issues can be linked to this problem, perhaps these designs can be modified.

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The study by Nam et al. documents that noise generation is common and is associated with adverse effects on function after knee arthroplasty. Future researchers should endeavor to determine if a causal relationship exists between noise generation and residual symptoms or functional limitations. Furthermore, subsequent investigations should focus on modifications in surgical technique or implant designs to prevent noise generation after knee arthroplasty.

Nam and colleagues have provided a good start to an important conversation, and a roadmap that future studies might follow to elucidate temporal patterns of the incidence and severity of noise generation, its etiology and prognosis, the effects on residual symptoms, functional limitations, and patient satisfaction, and most importantly, good remedies to prevent it. Meanwhile, I concur with the authors that surgeons should inform patients before surgery about the possibility of noise generation after knee arthroplasty to decrease the likelihood of dissatisfaction.

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