

# Assessing ChatGPT Responses to Common Patient Questions Regarding Total Hip Arthroplasty

Aleksander P. Mika, MD, J. Ryan Martin, MD, Stephen M. Engstrom, MD, MBA, Gregory G. Polkowski, MD, MSc, and Jacob M. Wilson, MD

*Investigation performed at Vanderbilt University Medical Center, Nashville, Tennessee*

**Background:** The contemporary patient has access to numerous resources on common orthopaedic procedures before ever presenting for a clinical evaluation. Recently, artificial intelligence (AI)-driven chatbots have become mainstream, allowing patients to engage with interfaces that supply convincing, human-like responses to prompts. ChatGPT (OpenAI), a recently developed AI-based chat technology, is one such application that has garnered rapid growth in popularity. Given the likelihood that patients may soon call on this technology for preoperative education, we sought to determine whether ChatGPT could appropriately answer frequently asked questions regarding total hip arthroplasty (THA).

**Methods:** Ten frequently asked questions regarding total hip arthroplasty were posed to the chatbot during a conversation thread, with no follow-up questions or repetition. Each response was analyzed for accuracy with use of an evidence-based approach. Responses were rated as “excellent response not requiring clarification,” “satisfactory requiring minimal clarification,” “satisfactory requiring moderate clarification,” or “unsatisfactory requiring substantial clarification.”

**Results:** Of the responses given by the chatbot, only 1 received an “unsatisfactory” rating; 2 did not require any correction, and the majority required either minimal (4 of 10) or moderate (3 of 10) clarification. Although several responses required nuanced clarification, the chatbot’s responses were generally unbiased and evidence-based, even for controversial topics.

**Conclusions:** The chatbot effectively provided evidence-based responses to questions commonly asked by patients prior to THA. The chatbot presented information in a way that most patients would be able to understand. This resource may serve as a valuable clinical tool for patient education and understanding prior to orthopaedic consultation in the future.

ChatGPT (OpenAI) is an online chatbot that utilizes artificial intelligence (AI) to respond to user-supplied prompts. With its wide-ranging applications<sup>1</sup>, ChatGPT has experienced remarkable growth in popularity, attracting almost 100 million users within a month of release. The versatility of the technology suggests unlimited potential for use in various fields, including health care.

The impact of search engines such as Google<sup>2,3</sup> on patient encounters has already been observed clinically. Although ChatGPT provides well-written and conversational responses, it is possible that some of its statements may be inaccurate. With its increasing mainstream use, patients may turn to ChatGPT or similar programs when researching orthopaedic procedures. Therefore, we investigated whether ChatGPT could answer frequently asked questions related to total hip arthroplasty (THA).

## Materials and Methods

We reviewed the ‘Frequently Asked Questions’ sections of 10 websites of well-known health-care institutions and

created a list of 26 common questions asked by patients prior to THA. Two authors reviewed this curated list and jointly selected 10 questions that were the most relevant and frequently asked in contemporary practice. In cases of disagreement, a consensus was reached between the authors. These questions were then posed to the AI chatbot with use of its free online interface (<https://chat.openai.com/chat>) on February 1, 2023<sup>1</sup>.

ChatGPT responses were recorded after the initial query, and no follow-up or repeat queries were conducted. Each response provided by ChatGPT was then critically analyzed for accuracy with use of an evidence-based approach. A rating system was developed to grade the responses (Table I). Responses were rated as “excellent response not requiring clarification,” “satisfactory requiring minimal clarification,” “satisfactory requiring moderate clarification,” or “unsatisfactory requiring substantial clarification.” Satisfactory responses provided fundamentally factual information and were generally free of inaccuracy but did require some clarification. Responses requiring “minimal clarification” made correct statements but were either lacking additional

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**TABLE 1 ChatGPT Response Rating System**

Response Accuracy Score	Response Accuracy Description
1	Excellent response not requiring clarification
2	Satisfactory requiring minimal clarification
3	Satisfactory requiring moderate clarification
4	Unsatisfactory requiring substantial clarification

information or were not detailed enough to identify some of the finer points in the literature. Responses requiring “moderate clarification” provided outdated information or information that was not relevant to the question posed. A response was considered unsatisfactory if it contained information that was incorrect in contemporary practice or was overly generalized such that the response could be conceivably misinterpreted.

This study did not require institutional review board approval.

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No external funding was received for this study.

#### Results

Below are the responses provided by ChatGPT when prompted with the 10 THA-related patient questions chosen by our authors. Responses marked with an asterisk are those that included a statement deferring to the patient’s surgeon; these statements were removed from the text below for brevity. Each question and its corresponding response can be seen in their entirety in the Appendix.

#### Question 1: When Should I Get a Hip Replacement?

ChatGPT response\*: “A hip replacement is usually recommended when conservative treatments, such as physical therapy, pain medication, and cortisone injections, no longer provide relief from chronic hip pain and limited mobility.”

#### Analysis: Satisfactory Response Requiring Minimal Clarification

The chatbot correctly recognized the indication for THA: failure of conservative treatments to relieve hip pain. According to the latest American Academy of Orthopaedic Surgeons Clinical Practice Guideline for Osteoarthritis of the Hip, physical therapy, non-narcotic pain management, and intra-articular injections are the most strongly recommended interventions<sup>4</sup>. However, hip pain can be present for many reasons, not all of which are addressed appropriately with THA. When responding to this prompt, the chatbot neglected to address the importance of an accurate diagnosis.

#### Question 2: How Long Does Hip Replacement Surgery Take?

ChatGPT response: “Hip replacement surgery typically takes about 1 to 2 hours. The exact time may vary based on the type

of hip replacement and the individual patient’s anatomy and medical history. After the surgery, the patient will typically need to stay in the hospital for 2 to 5 days to recover and undergo physical therapy. The total recovery time can take several months, depending on the patient’s progress and the type of hip replacement they received.”

#### Analysis: Unsatisfactory Requiring Substantial Clarification

The chatbot correctly identified the typical duration of a THA procedure as well as the possible variance as a result of surgical techniques<sup>5-9</sup>, surgeon experience<sup>10-14</sup>, and patient characteristics. For instance, operative time is significantly affected by patient body mass index<sup>13-16</sup>. However, the chatbot incorrectly suggested that patients typically require extended recovery following THA. In this instance, the chatbot may be leaning more heavily on prior data suggesting a postoperative hospital stay in the 2 to 5-day range<sup>17,18</sup> for total joint replacement. More contemporary data have demonstrated a rapid shift to outpatient surgery<sup>19</sup>, resulting in a much shorter average length of stay for THA patients. Please see the analysis for Question 4 (“Is outpatient total hip replacement safe?”) for further discussion regarding outpatient surgery.

#### Question 3: Which Approach Is Better for Hip Replacement? Anterior or Posterior?

ChatGPT response\*: “The choice between an anterior (front) or posterior (back) approach for hip replacement depends on several factors, including the patient’s anatomy, medical history, and the surgeon’s preference and experience. Both approaches have their own benefits and risks, and the best approach for an individual patient depends on their specific needs and goals.

- Anterior approach: This approach involves making an incision in the front of the hip, which allows the surgeon to access the hip joint without disturbing the muscles and tendons that attach to the hip joint. This approach may result in a quicker recovery, as the hip muscles are not as affected by the surgery.
- Posterior approach: This approach involves making an incision in the back of the hip, which allows the surgeon to access the hip joint through the gluteal muscles. The posterior approach is a more traditional approach and may be a better option for patients who have a history of hip problems or for those who require a more complex hip replacement.”

#### Analysis: Excellent Response Not Requiring Clarification

Despite typically strong surgeon preference and bias, the chatbot does an excellent job of providing an unbiased, albeit ambiguous response. More specifically, the chatbot identifies that each approach has its own set of risks and benefits. The anterior approach is often cited as being muscle-sparing, leading to lower postoperative pain scores and improved short-term patient-reported outcomes<sup>20-22</sup>. Several systematic reviews and meta-analyses, however, have found no significant differences between approaches and generally recommend that the choice for approach be made on

the basis of patient characteristics, surgeon experience<sup>10-14,23,24</sup>, and patient and surgeon preference<sup>20,25,26</sup>.

#### **Question 4: Is Outpatient Total Hip Replacement Safe?**

ChatGPT response\*: “Outpatient total hip replacement can be safe for some patients, as long as they meet certain criteria and are closely monitored. Outpatient hip replacement typically involves a quicker and less invasive procedure, allowing the patient to go home the same day as the surgery.

However, the safety of an outpatient hip replacement depends on several factors, including the patient’s overall health, the type of hip replacement being performed, and the patient’s ability to comply with postoperative care instructions. Patients who are in good health, have a relatively straightforward hip replacement, and have a support system at home may be good candidates for outpatient hip replacement.”

#### **Analysis: Excellent Response Not Requiring Clarification**

The chatbot focused on patient selection as the key factor for successful outpatient surgery<sup>27</sup>. Despite some patients’ safety concerns<sup>28</sup> and prior reports of higher rates of adverse outcomes<sup>29</sup>, contemporary evidence supports the safety and efficacy of outpatient surgery in appropriate patient populations<sup>30-32</sup>. Retrospective reviews of outpatient procedures<sup>33-35</sup> and development of patient-selection models<sup>36-38</sup> have assisted with patient selection. Ultimately, the chatbot recommends that the patient’s surgeon make the decision regarding individual suitability for outpatient surgery.

#### **Question 5: What Are the Risks of Total Hip Replacement?**

ChatGPT response\*: “Total hip replacement is generally a safe and effective procedure, but like any surgery, it carries some risks. Some of the potential risks of total hip replacement include:

- Infection: Although rare, an infection can occur after hip replacement surgery.
- Blood clots: Blood clots can form in the legs or lungs after surgery and can be life-threatening if left untreated.
- Dislocation: The artificial joint can dislocate, which is a relatively uncommon but potentially serious complication of hip replacement surgery.
- Wear and tear: The artificial joint can wear out over time, which may require revision surgery.
- Nerve or blood vessel injury: There is a risk of injury to nerves and blood vessels near the hip joint during surgery.
- Bone fractures: There is a risk of the bone breaking during or after the surgery.
- Implant loosening: The artificial joint may loosen over time, which may cause pain and instability.”

#### **Analysis: Satisfactory Response Requiring Moderate Clarification**

The chatbot correctly identified common complications following THA and further identified some as being typically chronic, such as loosening, implant wear, and implant failure.

However, the chatbot provided little information regarding the exact incidence of each complication, instead describing them as rare or uncommon. Although such descriptions are generally true<sup>39</sup>, complication rates can vary according to numerous patient and surgical factors<sup>40-42</sup>, which the chatbot did not acknowledge. Additionally, the chatbot only suggested that revision may be required in cases of implant failure, whereas in actuality infection, dislocation, implant loosening, implant wear, and even nerve or blood-vessel injury could result in reoperation and/or revision. Several other complications, including leg-length discrepancy and various perioperative medical complications, were also not addressed<sup>43</sup>. The latter omission is important to note as leg-length discrepancy is a leading cause of patient dissatisfaction and litigation following THA<sup>44-48</sup>.

#### **Question 6: How Common Is Infection After Hip Replacement Surgery?**

ChatGPT response\*: “Infection after hip replacement surgery is a relatively uncommon but serious complication. The exact incidence of infection after hip replacement surgery varies, but it is estimated to occur in 1 to 2% of cases. Risk factors for infection include obesity, smoking, diabetes, and having a weakened immune system.

To reduce the risk of infection after hip replacement surgery, it is important to follow the surgeon’s instructions for wound care, physical therapy, and medications.”

#### **Analysis: Satisfactory Response Requiring Minimal Clarification**

The chatbot correctly identified the most commonly cited infection rate<sup>49</sup>, identified that this rate can differ in certain populations<sup>50,51</sup>, and provided several patient characteristics that modify the risk of infection<sup>52</sup>. Although a history of infection may seem obvious to patients, they may be unaware that they have a “weakened immune system.” This includes patients on immunosuppressive drugs<sup>53</sup> or with immunosuppressive comorbidities such as diabetes<sup>54</sup>, renal disease<sup>55</sup>, malnutrition<sup>56</sup>, or HIV/AIDS (human immunodeficiency virus/acquired immunodeficiency syndrome)<sup>57</sup>. The chatbot provided additional value in recommending strict compliance with preoperative and postoperative protocols<sup>50,51,58-62</sup>.

#### **Question 7: How Common Is Dislocation After Hip Replacement Surgery?**

ChatGPT response\*: “Dislocation after hip replacement surgery is a relatively uncommon but potentially serious complication. The exact incidence of dislocation varies, but it is estimated to occur in 1 to 5% of cases. The risk of dislocation is higher in the first few months after surgery, but it can occur at any time after the procedure.

Risk factors for dislocation after hip replacement surgery include having a previous hip dislocation, having a more active lifestyle, and having a specific type of hip implant.”

#### **Analysis: Satisfactory Response Requiring Moderate Clarification**

The chatbot correctly identified the most commonly cited statistics for postoperative hip dislocation incidence<sup>63-65</sup> and timing<sup>64,66,67</sup>. A recent database study of 155,185 primary THAs

found a dislocation incidence of 2.3%, with 52% of dislocations occurring within the first 3 months postoperatively, 71% within 6 months, and 81% within 12 months<sup>68</sup>. Next, the chatbot identified several risk factors for hip dislocation—although its first suggestion, prior dislocation, is less relevant to patients undergoing primary THA. Patient activity, including following movement restrictions, can play a substantial role in dislocation risk and may contribute to higher dislocation rates in younger patients<sup>68</sup>. In terms of implant choice, larger femoral head diameters, elevated acetabular liners, and dual mobility cups have all been shown to decrease the dislocation rate<sup>65,69,70</sup>.

#### **Question 8: What Is the Success Rate of Hip Replacement?**

ChatGPT response\*: “The success rate of hip replacement is generally high and the procedure is considered one of the most effective orthopedic procedures available. The success of the surgery is measured by several factors, including pain relief, improvement in hip function, and longevity of the implant.

According to studies, the success rate of hip replacement is typically around 90% to 95% over a 10 to 20-year period. With proper care and maintenance, the artificial hip joint can last for 20 to 30 years or more. The success of the procedure depends on several factors, including the patient’s age, health, activity level, and the type of hip replacement performed.”

#### **Analysis: Satisfactory Response Requiring Minimal Clarification**

The chatbot showed notable insight by reporting that success can be interpreted according to both patient-reported outcomes and surgical success (i.e., implant survival). This response is supported by the ubiquitous use of patient-reported outcome measures in contemporary clinical research, rather than a reliance on only traditional clinical measures like implant survivorship<sup>71</sup>. THA has an overall high satisfaction rate that is strongly correlated with postoperative functional scores, relief of pain, and restoration of function<sup>72,73</sup>. Despite traditional positive outcomes, it cannot be overstated that patient expectations directly affect postoperative satisfaction, and patients should be individually counseled on the potential for deviation from a perceived normal recovery<sup>74</sup>.

The chatbot also identified important considerations when evaluating success as measured by implant survivorship. Recent data have suggested 96% survivorship at 10 years<sup>75</sup> and 90% to 95% survivorship at ≥15 years<sup>76,77</sup>, with the potential for >30-year survivorship<sup>78-80</sup>. When considering patient health, there is an endless number of patient conditions or comorbidities that might contribute to early failure. Commonly cited factors include obesity, activity level, and smoking status<sup>81</sup>.

#### **Question 9: How Long Does Recovery Take After Total Hip Replacement Surgery and How Long Will I Be Out of Work?**

ChatGPT response\*: “The length of recovery after total hip replacement surgery varies for each individual and depends on several factors, including age, overall health, and the type of procedure performed. Most patients can expect to be in the hospital for 2 to 5 days and to need physical therapy for 4 to 6 weeks to regain strength and mobility in the hip.

As for returning to work, the length of time can also vary depending on the type of work the patient does, their overall health, and the recovery process. Most patients are able to return to work in 4 to 12 weeks, although some may require more time off. Light-duty jobs may allow for a quicker return, while more physically demanding jobs may require more time off.”

#### **Analysis: Satisfactory Response Requiring Moderate Clarification**

The chatbot provided an optimistic but reasonable timeline for the patient to return to normal levels of strength and mobility. Once again, the chatbot suggested that most patients undergo THA in the inpatient setting and require extended inpatient recovery periods before discharge (see Question 4 for further discussion). The chatbot better assessed the ability to return to work, which is important because a growing number of patients are undergoing THA at a working age<sup>82</sup>. Close to 90% of THA patients return to work within 1 year, with a mean of 14 weeks; however, this outcome has been shown to be significantly influenced by preoperative intent to return to work<sup>83</sup>. The chatbot correctly identified the work environment and physical requirements as the most important factors when trying to predict the time to return to work<sup>83-86</sup>.

The chatbot identified physical therapy as an essential component of THA recovery, with an emphasis on range of motion, strength training, and swelling reduction<sup>87</sup>. Numerous studies, however, have demonstrated the efficacy of unsupervised home-based programs as compared with in-person programs<sup>88-90</sup>, with telemedicine being an additional viable alternative<sup>91</sup>. Bias may lead patients to expect in-person rehabilitation, which can be addressed preoperatively.

#### **Question 10: What Limitations Will I Have After Hip Replacement Surgery? Can I Do Any Activity I Want?**

ChatGPT response\*: “After hip replacement surgery, there may be some limitations on physical activity and movement, but most patients are able to return to most of their normal activities within a few months. However, it is important to follow the surgeon’s instructions for physical therapy and activity restrictions to ensure a successful recovery and to reduce the risk of complications.

Some activities, such as high-impact sports and activities that put excessive stress on the hip joint, may need to be limited or avoided after hip replacement surgery. Additionally, it is important to avoid activities that put excessive stress on the hip joint, such as crossing the legs or bending the hip more than a 90-degree angle.”

#### **Analysis: Satisfactory Response Requiring Minimal Clarification**

The chatbot correctly identified activities that are generally acceptable or recommended against following surgery. Although some activities may be permitted and a prior study showed that >50% of patients could start playing golf within 6 months, as many as 75% of patients will not return to the same level of sport<sup>92</sup>. Furthermore, it is unlikely for patients who did not participate in a particular sport before THA to start playing that sport postoperatively<sup>93</sup>. Studies on high-impact sports (e.g., judo,

TABLE II Summary of ChatGPT Response Accuracy

Question	Response Accuracy Score
1. When should I get a hip replacement?	2
2. How long does hip replacement surgery take?	4
3. Which approach is better for hip replacement? Anterior or posterior?	1
4. Is outpatient total hip replacement safe?	1
5. What are the risks of total hip replacement?	3
6. How common is infection after hip replacement surgery?	2
7. How common is dislocation after hip replacement?	3
8. What is the success rate of hip replacement?	2
9. How long does recovery take after total hip replacement surgery and how long will I be out of work?	3
10. What limitations will I have after hip replacement surgery? Can I do any activity I want?	2


tennis, squash, skiing, and running) are rare in the literature<sup>94</sup>, but some surgeons have recommended against these activities<sup>95</sup>. Additionally, the chatbot suggested maintaining hip precautions, such as trying not to cross the legs or perform hyperflexion. Although these precautions are common, there is evidence that few patients actually follow such restrictions<sup>96</sup> and as such, relaxing these precautions does not lead to a higher dislocation rate<sup>97-99</sup>. Finally, the chatbot correctly recommended that the patient should discuss precautions and activity modification with their surgeon as there is substantial variation in practice according to approach, implant choice, and surgeon experience<sup>100</sup>.

## Discussion

ChatGPT is a versatile technology with potential applications in various fields, including health care. Our primary

investigation aimed to determine the educational potential of ChatGPT in the preoperative THA setting. AI has been of growing interest among arthroplasty surgeons but has been primarily utilized for either image interpretation or outcome prediction<sup>101-103</sup>. However, AI-enabled decision aids or similar education systems have previously been shown to improve shared decision-making while maintaining clinical efficiency (e.g., consultation length and number of preoperative visits)<sup>104,105</sup>. With the introduction of ChatGPT, AI chatbots are now widely available and easily accessible by patients. We evaluated ChatGPT's responses to common patient questions related to primary THA and found that most responses required only minimal to moderate clarifications (Table II), suggesting that the chatbot has the potential to act as a patient-education adjunct. This conclusion does not come without notable caveats, including the evolving nature of ChatGPT and similar programs. Additionally, our evaluation of the responses given by the program was subjective and could be debated. Given the rapidly increasing popularity of ChatGPT, patients may soon turn to AI-enabled chatbots for education before seeking medical care. Reassuringly, the chatbot frequently suggested discussing questions with a surgeon before making a final decision. The present findings suggest that AI-based platforms may serve as a useful supplement to informed and shared decision-making with qualified orthopaedic surgeons.

## Appendix

 Supporting material provided by the authors is posted with the online version of this article as a data supplement at [jbjs.org \(http://links.lww.com/JBJS/H617\)](http://links.lww.com/JBJS/H617). ■

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Aleksander P. Mika, MD<sup>1</sup>  
J. Ryan Martin, MD<sup>1</sup>  
Stephen M. Engstrom, MD, MBA<sup>1</sup>  
Gregory G. Polkowski, MD, MSc<sup>1</sup>  
Jacob M. Wilson, MD<sup>1</sup>

<sup>1</sup>Department of Orthopedic Surgery, Vanderbilt University Medical Center, Nashville, Tennessee

Email for corresponding author: [jacobmwilson12@gmail.com](mailto:jacobmwilson12@gmail.com)

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