infection. In 2013, Lee et al. [6] reported the results of 17 two-stage reconstructions retaining well-fixed cementless femoral stems in the treatment of PJI. At 2- to 8-year follow-up, 15 patients (88%) had no recurrence of infection and had satisfactory radiological and clinical outcomes. More recently, Ekpo et al. [7] reported on 19 patients with chronic infection whose femoral component was considered to be well-fixed and its removal would result in a marked femoral bone loss. Only two patients (11%), who additionally had failed a prior two-stage exchange, failed their secondary procedure due to recurrence of infection at a minimum of 2-year follow-up. Similar results have been published by Lombardi et al. [7] who had a series of 19 patients. At a mean follow-up of 4 years, 89% were considered to be infection-free. Two more recent publications have looked at results of this procedure with longer follow-up periods [8,9]. In a study by El-Husseiny et al. [8], 18 patients who had partial component retention were evaluated. These were carefully selected cases out of all the 293 patients who were surgically treated for PJIs at their institution. The selection criteria and indications for this approach were those who had complex total hip arthroplasties with ingrown femoral stems or complex acetabular components that were well-fixed [8]. Their reported success rate was 83%. Also, Ji et al. [9] retrospectively analyzed 31 patients. In his series patients underwent retention of components in what they called partial single-stage revision. Either the acetabular or femoral component was retained given that there was evidence of good fixation. Of the 31 patients, 27 were considered to have a good outcome (87.1%) at latest follow-up.

Results of sub-radical resection arthroplasty have shown acceptable success rates ranging from 87-89%. These can be compared to published results of two-stage results, although there is a high variability of reported success rates [10-12]. Only one study reports on one-stage sub-radical resection and retention of well-fixed components with also promising success rates of 87% [9]. We consider that a careful selection of patients with adequate evaluation of fixation is the key to determine if retention of components is a viable option. Although there is a lack of strong evidence, a partial exchange may present a better alternative than complete resection performed in two-stage revision of chronic PJIs when the stem is well-fixed with bone-ingrown stability. We therefore support the use of partial exchange in the treatment of chronic PJIs in selected cases.

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QUESTION 5: Is it possible to have an isolated infection of only a portion of the joint (for example the femur and not the acetabulum, or tibia and not the femur)?

RECOMMENDATION: Unknown. Infection of a prosthetic joint is likely to involve biofilm formation on surfaces of all foreign material. However, there may be rare circumstances when infective organisms may not be able to reach the surface of a well-fixed implant and form a biofilm.

LEVEL OF EVIDENCE: Limited

DELEGATE VOTE: Agree: 75%, Disagree: 19%, Abstain: 6% (Super Majority, Strong Consensus)

RATIONALE

Using a standardized study search protocol, we performed a comprehensive review and analysis of the literature related to this subject matter. There were no specific studies examining the issue of partial infection of an implant. As a proxy, we examined the literature related to the outcome of surgical treatment of chronic periprosthetic joint infections (PJIs) when partial retention of an implant was deemed appropriate. The primary outcome measure was success of treatment at a minimum of two years, defined as infection-free retention of the implant. The search strategy and inclusion criteria were chronic PJI, total hip arthroplasty (THA), total knee arthroplasty (TKA) and partial retention. Subsequently, our search strategy yielded 9 articles for analysis, including 130 revisions (Table 1). The follow-up period was 2-8 years (mean 4.1 years) or less if failure occurred. We also recorded the types of bacteria and the success rates reported in each study.

There were no studies related to partial retention of TKA components. The overall success rates of eradication of infection ranged from 80-100% (mean 90%). There were 113 acetabulum-only revisions

TABLE 1.List of publications

Author	Year	Journal	Study Period	Country	Population Size
Faroug [1]	2009	Hip International	2004-2009	United Kingdom	2
Anagnostakos [2]	2010	Hip International	1999-2008	Germany	12
Lee [3]	2013	Acta Orthopaedica	2005-2010	South Korea	19
Ekpo[4]	2013	Clin Orthop.	2000-2011	USA	19
Lombardi [5]	2014	Bone and Joint	2011-	USA	7
Fukui [6]	2015	Journal of Orthopaedics	2009-2014	Japan	5
El-Husseiny [7]	2016	Clin Orthop.	2000-2010	United Kingdom	18
Ji [8]	2016	International Orthopaedics	2000-2013	China	31
Chen [9]	2017	International Orthopaedics	2004-2013	China	16

and 17 femur-only revisions. There were 11 failures in the acetabulum-only group (9.7%) and 2 failures in the femur-only group (11.7%). There was no statistically significant difference between the groups. The offending bacteria in the studies are similar to what is expected to be seen in PJIs.

In conclusion, given that in THA and TKA the surfaces of prosthetic material are in contact with bone and knowing the fact that infective organisms are capable of attaching to foreign material surfaces and forming biofilms, we are inclined to believe that partial infection of a prosthesis does not exist. Infective organisms are capable of accessing the effective joint space in the hip and the knee and infecting the entire prosthesis. However, there may be rare circumstances when an implant is well-fixed, either by cement or through osseointegration, and the infective agents are not able to access the prosthesis-bone interface. There were no studies to prove or disprove this assumption. If such a situation existed, then a resolute approach for radical resection of all implants could plausibly lead to an overtreatment and unnecessary morbidity.

Based on the scant data available, it appears that partial retention of well-fixed implants in patients with reconstructive challenges may be a viable option. Such surgical options should only be reserved for patients in whom removal of well-fixed implants are likely to compromise or prevent a later reconstruction. The basic principles of aggressive soft-tissue debridement and complete removal of infected implants should still be obeyed for the majority of patients.

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QUESTION 6: Should heterotopic ossification (HO) be removed during resection arthroplasty of an infected prosthetic joint?

RECOMMENDATION: We recommend that surgeons give strong consideration to removal of accessible HO in an infected prosthetic joint that will not compromise future reconstruction.

LEVEL OF EVIDENCE: Consensus

DELEGATE VOTE: Agree: 80%, Disagree: 10%, Abstain: 10% (Super Majority, Strong Consensus)