HK73: **Is there a difference in the success rate of two-stage exchange arthroplasty when static spacers versus articulating spacers are utilized?**

Yazdi Hamidreza, Haghbin Mohammadamin, Sharma Rajeev K, Cacciola Giorgio, Moojen Dirk Jan F, Sambri Andrea, Mađjarević Tomislav, Ghadi Ismail, Chen Yunsu

Response/Recommendation: Yes. Although in hip and knee two-stage exchange arthroplasty, both articulating and static spacers yield similar results in infection eradication, articulating spacers offer better functional and clinical outcomes without significantly increasing the treatment costs.

Level of evidence: Moderate

Delegate votes:

Rationale:

The periprosthetic joint infection (PJI) is a serious complication in arthroplasty (1-4) and occurs in approximately 1-3% of primary THA and TKA (2, 4-7). Two-stage revision arthroplasty (TRA) remains the preferred method for treating chronic PJI in North America (8-15), which involves prosthesis removal, antibiotic-loaded spacer placement, and then reimplantation (1, 4, 8-10).

Spacers used in two-stage exchange arthroplasty of knee and hip are typically classified into two types: static spacers that immobilize the joint and articulating spacers that allow for some range of motion (1, 3, 10-13). Some authors suggest that a static spacer facilitates infection control through immobilization (11, 14-20) and is more cost-effective than articulating spacers (3, 21-23), but may lead to adverse effects such as joint stiffness, with poor range of motion (ROM) after reimplantation (14, 18, 24, 25). Articulating spacers were introduced to address the latter issues associated with static spacers (3, 20, 26-28).

The goal of this systematic review was to assess the clinical success rates and outcomes of two-stage exchange arthroplasty for PJI of knee and hip when articulating versus static spacers were used..

A comprehensive literature search was conducted in MEDLINE, EMBASE and the Cochrane Databases to identify relevant studies using the carefully developed MESH terms in collaboration with librarians. After initial identification of the relevant studies, and screening by multiple delegates, 79 studies met the final inclusion criteria.

Infection eradication: Most studies, including meta-analyses and RCTs, show that in two-stage exchange arthroplasty of the hip and knee, antibiotic-loaded static and articulating spacers achieve similar infection eradication rates (4, 9-12, 14-17, 19, 21, 24, 25, 27, 29-61), although articulating spacers seem to provide better results in some reports (8, 13, 18,

38, 62-65). The proponents of static spacers claim that limiting soft tissue mobilization provides better antibiotic delivery (13, 16, 17, 21, 28, 37, 38, 66), which is an important principle in treatment infections(62, 64, 67), but many studies have shown that both the static and the articulating spacers have similar potential in infection eradication with the resistant germs (8, 10, 11, 14, 17, 19, 44, 47, 68, 69).

Functional Outcomes and Mobility: Articulating spacers provide significantly greater range of motion (ROM) post-reimplantation and preserve mobility during interim periods in knee tow-stages arthroplasty (4, 8, 11, 12, 14-17, 19, 23-25, 28-38, 40-42, 44, 45, 47, 49, 54-56, 59, 63, 65, 67, 70, 71).

There is no true static spacer that fully prevents hip movement (22, 23, 32, 72-75), and few studies have directly compared the use of static and articulating spacers in treating PJI following THA (9, 23, 32, 71, 74, 76). However, studies indicate that the use of articulating spacer in the hip provides a better ROM and significantly enhances patient mobility post-reimplantation (9, 12, 19, 22, 23, 30, 31, 34, 60, 65, 67, 69, 74, 77-79).

Most studies have shown superior functional outcomes (12-15, 18, 19, 21, 23, 28, 31, 33, 34, 40, 42, 47, 49, 51, 59, 60, 62-65, 67, 71, 80), improved quality of life (3, 19, 31, 38, 41, 42, 44, 47, 53, 63, 81, 82), and enhanced the level of activities (25-28, 62, 65, 82, 83), using AS in hip and knee two- stages arthroplasty, which may directly result from better ROM (9, 11, 15, 25, 37).

Although some authors suggest similar functional outcomes between articulating and static spacers (9, 13, 25, 27, 28, 32, 41, 55, 62, 82, 83), it is essential to note that confounding factors such as health conditions, pain levels, follow-up duration and nature of the measurement tools, may have influenced the functional outcome (84).

Complications: The literature highlights heterogeneous definitions of complication with varying outcomes**.** Soft tissue contractures, joint dysfunction, and especially bone loss is among the most critical and common complications (9, 30, 39), often resulting in poor outcomes. Using a static spacer for treatment of PJI in the hip and the knee frequently causes significant bone loss, joint stiffness, and soft tissue shortening (3, 8, 9, 11-15, 17, 19, 21, 24, 25, 28-32, 34-38, 42, 44, 46, 51, 55, 58-61, 65, 69, 77, 78, 85, 86), muscle weakness (3, 13, 16, 21, 22, 26, 35, 36, 39, 41, 45, 59, 62, 71, 78, 87-89) and leg-length discrepancy in revision THA (12, 19, 31, 58, 65, 78, 80, 90, 91).

Dislocation and fracture of the spacers are other common complications. It is reported more commonly with articulating spacers (8, 12, 14, 20, 22, 23, 27, 29, 31-37, 49, 54, 55, 58, 73, 78, 92), due to higher mobility, but the difference in incidence appears to be insignificant (9, 15, 25, 36, 39, 51, 61, 69). Spacer dislocation occurs mainly in 2-stage hip revision arthroplasty (27, 69, 73) and increases significantly when using an articulating spacer without acetabular augmentation (22, 31, 32, 37, 60, 73, 74, 83, 87, 89, 93-100).

The patient conditions, surgeon skills, bone and soft tissue deficiencies, construction technique, time interval until reimplantation, bias in selecting patients, and other factors may have a more significant impact on causing mechanical complications than spacer type (8, 12, 13, 20, 25, 29-31, 33, 34, 36, 42, 49, 51, 59, 60, 63, 65, 69, 73, 78, 82, 83, 86, 87, 89, 90, 92, 94, 97, 101-103).

Costs: The cost of spacers is a minor part of the total cost of managing PJI, which is more related to hospitalization and antibiotic treatment (104-106). Articulating spacers are more expensive due to their complex design and materials used (3, 9, 11, 13, 14, 21, 35, 37, 56, 103), but through reducing the hospital length of stay (4, 9, 11, 13, 14, 23, 28, 32, 44, 65, 78, 80, 91) minimizing need for extensive surgery (8, 11, 13, 14, 17, 18, 21, 28, 30, 32, 34-39, 41, 44, 45, 52, 53, 59) faster recovery of function (4, 9, 11, 14, 19, 27, 35, 42, 47, 49, 56, 61, 65, 91, 107) and less complications (13, 32, 37, 42, 61), articulating spacers may reduce the overall cost of PJI management (9-11, 13, 31, 39, 44, 51, 52, 55, 56, 80, 88, 90).

Conclusion:

Articulating spacers provide comparable results to static spacers in infection eradication , while offering superior mobility, quality of life, fewer complications, and lower overall treatment costs, making them a preferred option for PJI management.

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