Pre-operative optimisation for hip and knee arthroplasty

Minimise risk and maximise recovery

CPD

Chris Wall, Richard de Steiger

Background
Osteoarthritis of the hip and knee is a common cause of pain and reduced mobility. Arthroplasty reliably improves quality of life for most patients when non-operative measures have failed. However, hip and knee arthroplasties are major operations that carry significant risks, including the need for revision surgery.

Objective
The purpose of this article is to discuss pre-operative patient optimisation prior to arthroplasty to minimise risks and maximise recovery.

Discussion
Recent literature has identified a number of modifiable factors that increase the risk of post-operative complications following arthroplasty. These include obesity, diabetes, tobacco use, opioid use, anaemia, malnutrition, poor dentition and vitamin D deficiency. Addressing these factors prior to arthroplasty may reduce the risk of adverse outcomes. Pre-operative education and exercise, termed prehabilitation, has an important role in optimising patient outcomes following hip and knee arthroplasty. Participation in a prehabilitation program prior to arthroplasty is recommended.

OSTEOARTHRITIS affects approximately 2.2 million Australians (9.3%), causing pain, disability and reduced quality of life.[1] The incidence of hip and knee osteoarthritis is increasing, and while non-operative management should be commenced initially and is successful for many patients, surgical intervention is recommended for advancing disease when other treatments have failed.[2-5]

Total hip arthroplasty (THA) and total knee arthroplasty (TKA) are cost-effective procedures that reliably improve pain, mobility and quality of life for most patients with end-stage hip and knee osteoarthritis.[6] In 2018, >39,000 THA and >56,000 TKA procedures were performed in Australia, an increase of 125% and 156%, respectively, over the past 15 years.[7] The incidence of THA and TKA is projected to increase by 208% and 276%, respectively, by 2030.[8]

Despite their success, THA and TKA are major operations that carry significant risks, including infection, implant loosening, fracture and other complications that may require revision surgery. Although 30-day mortality after THA and TKA has declined over the past 15 years, death remains a risk, especially in older patients.[9] Recent literature has identified a number of modifiable risk factors (MRFs) that increase the risk of these complications.[10-12] These MRFs include obesity, diabetes, tobacco use, opioid use, anaemia, malnutrition, poor dentition and vitamin D deficiency (Table 1). There is a growing body of evidence that pre-operatively correcting these MRFs can reduce the incidence of post-operative complications.[13,14]

In addition to addressing MRFs, post-operative outcomes can be improved with prehabilitiation, focusing on patient education and exercise.[15]

The aim of this article is to discuss MRFs and prehabilitation to minimise risks and improve patient outcomes following THA and TKA.

Obesity

Two-thirds of Australian adults have a high body mass index (BMI), with 31.3% considered obese.[1] The incidence of obesity has increased from 18.7% since 1995. In Australia, >40% of THA and almost 60% of TKA are performed on patients with obesity.[7]

Recent systematic reviews have shown an increased risk of superficial and deep infections, dislocations, reoperations, revisions and readmissions in patients with obesity undergoing THA when comparted with non-obese patients.[16-18] Similar studies have found that the risk of revision for infection is higher in patients with obesity undergoing TKA when compared with non-obese patients.[19,20]

The American Academy of Orthopedic Surgeons (AAOS) recommends delaying THA and TKA for patients with a BMI of ≥40 kg/m^2 to allow time for weight loss.[21]

Diabetes

Approximately 1.2 million Australians live with diabetes, accounting for almost 5% of the population.[1]

Patients with diabetes are at higher risk of experiencing complications and poorer functional outcomes after arthroplasty when compared with non-diabetic patients.[22,23] However, glycaemic control appears to be an important factor. In a study of more than one million joint replacements in the USA, patients with uncontrolled diabetes were shown to have an increased risk of post-operative cerebrovascular accident (CVA), urinary tract infection, ileus, haemorrhage, transfusion, wound infection and death.[24]

The Royal Australian College of General Practitioners' (RACGP's) guidelines for management of type 2 diabetes recommend a target glycated haemoglobin (HbA1c) of ≤53 mmol/mol (≤7%).[25] This target should be achieved prior to arthroplasty, as an HbA1c >61 mmol/mol (>7.7%) has been shown to increase the risk of periprosthetic joint infection (PJI).[26]

Tobacco use

Although the incidence of smoking has decreased significantly, approximately 2.6 million adults in Australia (13.8%) still smoke tobacco daily.[1] Smoking increases the risk of post-operative pneumonia, CVA, PJI, revision and one-year mortality following THA and TKA.[27–29] Patients who are ex-smokers are at lower risk of these complications than patients who currently smoke, but their risk is still higher than that of patients who have never smoked.[29] Smoking cessation interventions, even four weeks prior to surgery, have been shown to reduce post-operative complications.[30] The RACGP has published evidence-based recommendations for pharmacotherapy and behavioural interventions to support smoking cessation.[31]

Opioid use

It is estimated that 1.5% of Australians take opioid medication daily.[32] There is a growing body of evidence to suggest that pre-operative opioid use worsens outcomes after THA and TKA. Studies have shown longer length of stay (LOS), lower patient-reported outcome measures, prolonged post-operative opioid use and higher revision rates in this patient group.[12,33–35] The RACGP strongly recommends against the use of oral or transdermal opioids in the management of patients with hip or knee osteoarthritis.[4]

Table 1. Summary of recommendations for modifiable risk factors

Modifiable risk factor	Recommendations
Obesity	Aim for a body mass index <40 kg/m^2 prior to arthroplasty.
Diabetes mellitus	Aim for a glycated haemoglobin of ≤53 mmol/mol (≤7%) prior to arthroplasty.
Tobacco use	Aim for smoking cessation at least four weeks prior to arthroplasty.
Opioid use	The use of opioids for osteoarthritis should be avoided.
Anaemia	Haemoglobin should be routinely checked prior to arthroplasty. Anaemia should be corrected pre-operatively.
Malnutrition	Consider checking serum albumin prior to arthroplasty. For patients with serum albumin <3.5 g/dL, consider referral to a dietitian pre-operatively.
Poor dentition	Patients with poor dentition should undergo a dental review prior to arthroplasty.
Vitamin D deficiency	Consider checking serum 25-hydroxyvitamin D (25OHD) prior to arthroplasty. For patients with low serum 25OHD, consider providing supplementation pre-operatively.

Anaemia

Anaemia is defined by the World Health Organization (WHO) as a haemoglobin level <120 g/L in non-pregnant women and <130 g/L in men.[36] In Australia, approximately 4.5% of adults are at risk of anaemia; however, this increases to 16% in those aged >75 years.[37]

A number of studies have shown that pre-operative anaemia is associated with an increased risk of PJI, longer LOS, allogeneic transfusion and cardiovascular complications after THA and TKA.[38,39] Identifying and treating anaemia is recommended prior to arthroplasty. Oral iron supplementation is an effective treatment modality for patients with anaemia on arthroplasty waiting lists.[40] Intravenous iron transfusion should be considered for patients who do not respond to oral supplementation or for whom delaying surgery is unsafe.[41]

Malnutrition

Malnutrition is common in patients undergoing THA and TKA.[42] Paradoxically, a large proportion of malnourished patients undergoing arthroplasty are obese.[43] Malnutrition has been shown to increase the risk of medical and surgical complications following arthroplasty, including PJI, revision surgery and 90-day mortality.[44]

Serum albumin <3.5 g/dL is indicative of malnutrition.[44] Other biochemical markers include total lymphocyte count <1500 cells/mm^3 and transferrin <200 mg/dL.[42] Baseline blood tests should be ordered pre-operatively, and at-risk patients referred to a dietitian prior to surgery.

Poor dentition

In Australia, almost 13% of adults have decayed, missing or filled teeth as a result of dental caries. The prevalence of moderate or severe periodontal disease is nearly 23%.[45] Poor dentition is associated with an increased risk of PJI.[11] For patients with poor dentition, a pre-operative dental review is recommended.

Vitamin D deficiency

It is estimated that 31% of Australian adults are vitamin D deficient, with serum 25-hydroxyvitamin D (25OHD) levels <50 nmol/L.[46] Studies suggest that there may be a link between vitamin D deficiency and risk of PJI and poorer patient-reported outcome measures post-arthroplasty.[47,48] Pre-operative supplementation for patients with vitamin D deficiency may be beneficial.

Prehabilitation

Pre-operative patient education is vital to set appropriate expectations and ensure patient engagement with the treatment process. Similarly, pre-operative cardiovascular exercise and joint strengthening exercises are important to maximise post-operative recovery. A recent meta-analysis of randomised controlled trials showed that prehabilitation, including education and exercise, improved outcomes after THA and TKA.[15] For THA, patients who underwent prehabilitation had less post-operative pain, improved post-operative function and shorter LOS. For TKA, patients who underwent prehabilitation had improved post-operative function, greater quadriceps strength and shorter LOS.

Many health services provide prehabilitation programs for patients undergoing arthroplasty. In the absence of such programs, pre-operative referral to a musculoskeletal physiotherapist should be considered.

Conclusion

THA and TKA offer longstanding improvement in pain, function and quality of life for patients with end-stage hip and knee osteoarthritis when non-operative treatments have failed. Patient optimisation prior to surgery is important to minimise risks and maximise recovery.

Obesity, diabetes, tobacco use, opioid use, anaemia, malnutrition, poor dentition and vitamin D deficiency have all been identified as MRFs that should be addressed prior to arthroplasty. Several studies have shown improvements in short-term outcomes when MRFs are addressed, including shorter LOS, fewer emergency department visits, and lower 30-day and 90-day readmission rates.[13,14,49] Prehabilitation, in the form of education and exercise, is also important to maximise outcomes after THA and TKA. Further research is needed to determine the optimal timing of pre-operative intervention and to assess the longer-term effects of addressing MRFs.

CASE

A woman aged 62 years presented with symptomatic medial compartment osteoarthritis of the right knee (Figure 1A). Her medical comorbidities included morbid

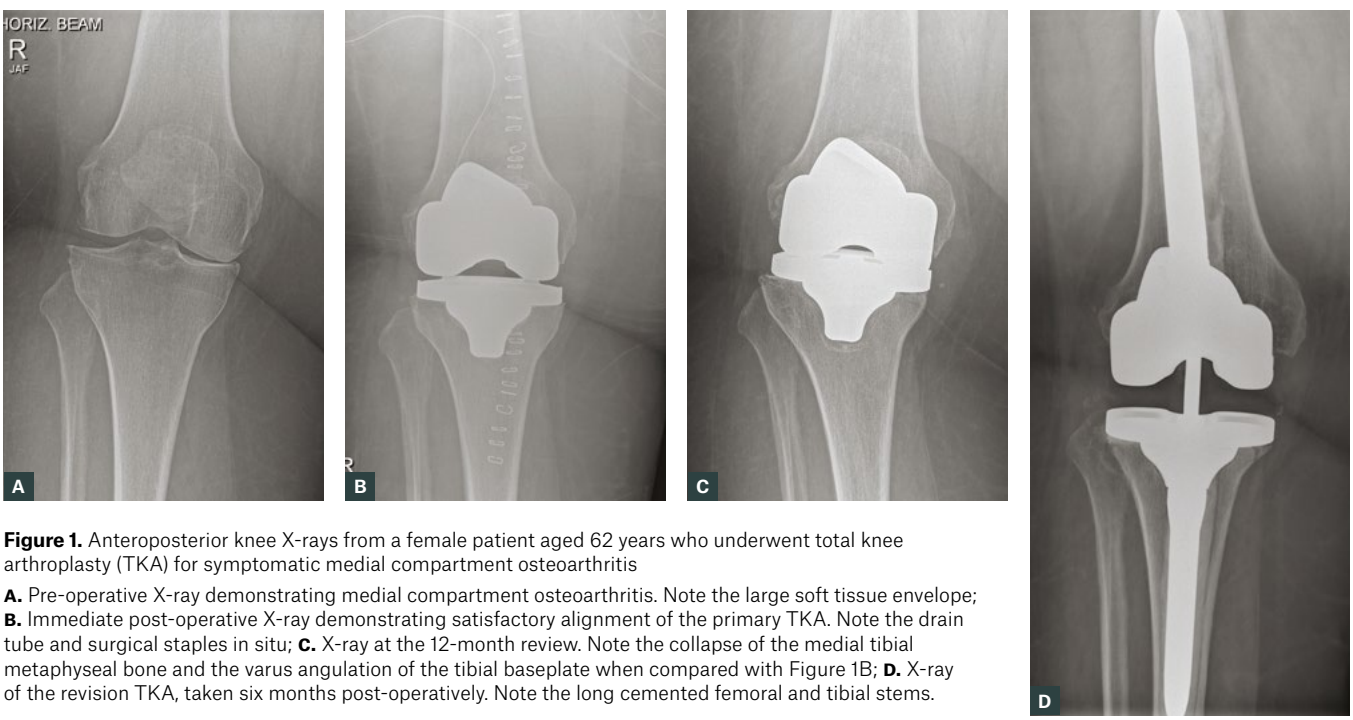

Figure 1. Anteroposterior knee X-rays from a female patient aged 62 years who underwent total knee arthroplasty (TKA) for symptomatic medial compartment osteoarthritis

A. Pre-operative X-ray demonstrating medial compartment osteoarthritis. Note the large soft tissue envelope; **B.** Immediate post-operative X-ray demonstrating satisfactory alignment of the primary TKA. Note the drain tube and surgical staples in situ; **C.** X-ray at the 12-month review. Note the collapse of the medial tibial metaphyseal bone and the varus angulation of the tibial baseplate when compared with Figure 1B; **D.** X-ray of the revision TKA, taken six months post-operatively. Note the long cemented femoral and tibial stems.

obesity (BMI 52.5 kg/m²), obstructive sleep apnoea, gastro-oesophageal reflux disease and hypothyroidism. She had undergone a successful left TKA five years prior.

The patient underwent a right TKA and made an uneventful recovery (Figure 1B). At her six-week and three-month post-operative reviews, she described satisfactory improvement in pain and function. Following her three-month review, she began experiencing gradually worsening pain in her right knee, and X-rays taken at her 12-month review showed loosening of the tibial baseplate (Figure 1C).

There was no evidence of infection clinically, and her serum inflammatory markers were low. The patient underwent a revision right TKA (Figure 1D). At the time of the revision surgery, her BMI was 54.2 kg/m². Multiple tissue specimens taken intra-operatively were all culture negative. She made an uneventful recovery and remained symptom free four years later.

The key learning points of this case study include the following:

- Aseptic loosening of the tibial baseplate generally requires revision surgery.
- Morbid obesity has been linked to aseptic tibial baseplate loosening.[50]
- Revision arthroplasty carries a significant psychosocial burden to the patient and a large economic cost to the healthcare system.
- On the basis of AAOS guidelines, this patient's TKA should have been delayed until her BMI was <40 kg/m².[21]
- Non-operative management should have been optimised.[5]
- Strategies for weight loss should have been explored.

Authors

Chris Wall MBBS, BMedSc, FRACS, FAOrthA, Deputy Director, Department of Orthopaedics, Toowoomba Hospital, Qld; Senior Lecturer, School of Medicine, Rural Clinical School, University of Queensland, Qld. Chris.Wall@health.qld.gov.au

Richard de Steiger MBBS, PhD, Dip Biomech, FRACS, FAOrthA, Epworth Victor Smorgon Chair of Surgery, The University of Melbourne, Vic; Deputy Director, Australian Orthopaedic Association National Joint Replacement Registry, SA

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References

1. Australian Bureau of Statistics. National health survey: First results, 2017–18. Belconnen, ACT: ABS, 2018. Available at www.abs.gov.au/ausstats/abs@.nsf/mf/4364.0.55.001 [Accessed 20 August 2020].
2. Cross M, Smith E, Hoy D, et al. The global burden of hip and knee osteoarthritis: Estimates from the global burden of disease 2010 study. Ann Rheum Dis 2014;73(7):1323–30. doi: 10.1136/annrheumdis-2013-204763.
3. Australian Commission on Safety and Quality in Health Care. Osteoarthritis of the knee clinical care standard. Sydney, NSW: ACSQHC, 2017.
4. The Royal Australian College of General Practitioners. Guideline for the management of knee and hip osteoarthritis. 2nd edn. East Melbourne, Vic: RACGP, 2018.
5. Wall C, Johnson T, de Steiger R. Symptom management for patients awaiting joint replacement surgery. Aust J Gen Pract 2020;49(7):444–46. doi: 10.31128/AJGP-03-20-5286.
6. Daigle ME, Weinstein AM, Katz JN, Losina E. The cost-effectiveness of total joint arthroplasty: A systematic review of published literature. Best Pract Res Clin Rheumatol 2012;26(5):649–58. doi: 10.1016/j.berh.2012.07.013.
7. Australian Orthopaedic Association National Joint Replacement Registry (AOANJRR). Hip, knee & shoulder arthroplasty: 2019 annual report. Adelaide, SA: AOA, 2019.
8. Ackerman IN, Bohensky MA, Zomer E, et al. The projected burden of primary total knee and hip replacement for osteoarthritis in Australia to the year 2030. BMC Musculoskelet Disord 2019;20(1):90. doi: 10.1186/s12891-019-2411-9.
9. Harris IA, Hatton A, de Steiger R, Lewis P, Graves S. Declining early mortality after hip and knee arthroplasty. ANZ J Surg 2020;90(1-2):119–22. doi: 10.1111/ans.15529.
10. Alamanda VK, Springer BD. The prevention of infection: 12 modifiable risk factors. Bone Joint J 2019;101-B(1_Supple_A):3–9. doi: 10.1302/0301-620X.101B1.BJJ-2018-0233.R1.
11. Kee JR, Mears SC, Edwards PK, Barnes CL. Modifiable risk factors are common in early revision hip and knee arthroplasty. J Arthroplasty 2017;32(12):3689–92. doi: 10.1016/j.arth.2017.07.005.
12. Schroer WC, Diesfeld PJ, LeMarr AR, Morton DJ, Reedy ME. Modifiable risk factors in primary joint arthroplasty increase 90-day cost of care. J Arthroplasty 2018;33(9):2740–44. doi: 10.1016/j.arth.2018.04.018.
13. Bernstein DN, Liu TC, Winegar AL, et al. Evaluation of a preoperative optimization protocol for primary hip and knee arthroplasty patients. J Arthroplasty 2018;33(12):3642–48. doi: 10.1016/j.arth.2018.08.018.
14. Dlott CC, Moore A, Nelson C, et al. Preoperative risk factor optimization lowers hospital length of stay and postoperative emergency department visits in primary total hip and knee arthroplasty patients. J Arthroplasty 2020;35(6):1508–15.e2. doi: 10.1016/j.arth.2020.01.083.
15. Moyer R, Ikert K, Long K, Marsh J. The value of preoperative exercise and education for patients undergoing total hip and knee arthroplasty: A systematic review and meta-analysis. JBJS Rev 2017;5(12):e2. doi: 10.2106/JBJS.RVW.17.00015.
16. Barrett M, Prasad A, Boyce L, et al. Total hip arthroplasty outcomes in morbidly obese patients: A systematic review. EFORT Open Rev 2018;3(9):507–12. doi: 10.1302/2058-5241.3.180011.
17. Onggo JR, Onggo JD, de Steiger R, Hau R. Greater risks of complications, infections, and revisions in the obese versus non-obese total hip arthroplasty population of 2,190,824 patients: A meta-analysis and systematic review. Osteoarthritis Cartilage 2020;28(1):31–44. doi: 10.1016/j.joca.2019.10.005.
18. Ponnusamy KE, Somerville L, McCalden RW, Marsh J, Vasarhelyi EM. Revision rates and functional outcome scores for severely, morbidly, and super-obese patients undergoing primary total hip arthroplasty: A systematic review and meta-analysis. JBJS Rev 2019;7(4):e11. doi: 10.2106/JBJS.RVW.18.00118.
19. Boyce L, Prasad A, Barrett M, et al. The outcomes of total knee arthroplasty in morbidly obese patients: A systematic review of the literature. Arch Orthop Trauma Surg 2019;139(4):553–60. doi: 10.1007/s00402-019-03127-5.
20. Chaudhry H, Ponnusamy K, Somerville L, McCalden RW, Marsh J, Vasarhelyi EM. Revision rates and functional outcomes among severely, morbidly, and super-obese patients following primary total knee arthroplasty: A systematic review and meta-analysis. JBJS Rev 2019;7(7):e9. doi: 10.2106/JBJS.RVW.18.00184.
21. AAOS Workgroup on Obesity. Position statement: The impact of obesity on bone and joint health. Rosemont, IL: American Academy of Orthopaedic Surgeons, 2015.
22. Tsang ST, Gaston P. Adverse peri-operative outcomes following elective total hip replacement in diabetes mellitus: A systematic review and meta-analysis of cohort studies. Bone Joint J 2013;95-B(11):1474–79. doi: 10.1302/0301-620X.95B11.31716.
23. Yang Z, Liu H, Xie X, Tan Z, Qin T, Kang P. The influence of diabetes mellitus on the post-operative outcome of elective primary total knee replacement: A systematic review and meta-analysis. Bone Joint J 2014;96-B(12):1637–43. doi: 10.1302/0301-620X.96B12.34378.
24. Marchant MH Jr, Viens NA, Cook C, Vail TP, Bolognesi MP. The impact of glycemic control and diabetes mellitus on perioperative outcomes after total joint arthroplasty. J Bone Joint Surg Am 2009;91(7):1621–29. doi: 10.2106/JBJS.H.00116.
25. The Royal Australian College of General Practitioners. Management of type 2 diabetes: A handbook for general practice. East Melbourne, Vic: RACGP, 2020.
26. Tarabichi M, Shohat N, Kheir MM, et al. Determining the threshold for HbA1c as a predictor for adverse outcomes after total joint arthroplasty: A multicenter, retrospective study. J Arthroplasty 2017;32(9S):S263–S67. doi: 10.1016/j.arth.2017.04.065.
27. Kapadia BH, Johnson AJ, Naziri Q, Mont MA, Delanois RE, Bonutti PM. Increased revision rates after total knee arthroplasty in patients who smoke. J Arthroplasty 2012;27(9):1690–95.e1. doi: 10.1016/j.arth.2012.03.057.
28. Kunutsor SK, Whitehouse MR, Blom AW, Beswick AD. Patient-related risk factors for periprosthetic joint infection after total joint arthroplasty: A systematic review and meta-analysis. PLoS One 2016;11(3):e0150866. doi: 10.1371/journal.pone.0150866.
29. Singh JA, Houston TK, Ponce BA, et al. Smoking as a risk factor for short-term outcomes following primary total hip and total knee replacement

in veterans. Arthritis Care Res (Hoboken) 2011;63(10):1365–74. doi: 10.1002/acr.20555.
30. Lindström D, Sadr Azodi O, Wladis A, et al. Effects of a perioperative smoking cessation intervention on postoperative complications: A randomized trial. Ann Surg 2008;248(5):739–45. doi: 10.1097/SLA.0b013e3181889d0d.
31. The Royal Australian College of General Practitioners. Supporting smoking cessation: A guide for health professionals. 2nd edn. East Melbourne, Vic: RACGP, 2019.
32. Australian Commission on Safety and Quality in Health Care and Australian Institute of Health and Welfare. The third Australian atlas of healthcare variation. Sydney, NSW: ACSQHC, 2018.
33. Ben-Ari A, Chansky H, Rozet I. Preoperative opioid use is associated with early revision after total knee arthroplasty: A study of male patients treated in the Veterans Affairs system. J Bone Joint Surg Am 2017;99(1):1–9. doi: 10.2106/JBJS.16.00167.
34. Pivec R, Issa K, Naziri Q, Kapadia BH, Bonutti PM, Mont MA. Opioid use prior to total hip arthroplasty leads to worse clinical outcomes. Int Orthop 2014;38(6):1159–65. doi: 10.1007/s00264-014-2298-x.
35. Prentice HA, Inacio MCS, Singh A, Namba RS, Paxton EW. Preoperative risk factors for opioid utilization after total hip arthroplasty. J Bone Joint Surg Am 2019;101(18):1670–78. doi: 10.2106/JBJS.18.01005.
36. World Health Organization. Haemoglobin concentrations for the diagnosis of anaemia and assessment of severity. Vitamin and Mineral Nutrition Information System. Geneva, CH: WHO, 2011.
37. Australian Bureau of Statistics. Australian health survey: Biomedical results for chronic diseases, 2011–12. Belconnen, ACT: ABS, 2013. Available at www.abs.gov.au/ausstats/abs@.nsf/mf/4364.0.55.005 [Accessed 20 August 2020].
38. Greenky M, Gandhi K, Pulido L, Restrepo C, Parvizi J. Preoperative anemia in total joint arthroplasty: Is it associated with periprosthetic joint infection? Clin Orthop Relat Res 2012;470(10):2695–701. doi: 10.1007/s11999-012-2435-z.
39. Viola J, Gomez MM, Restrepo C, Maltenfort MG, Parvizi J. Preoperative anemia increases postoperative complications and mortality following total joint arthroplasty. J Arthroplasty 2015;30(5):846–48. doi: 10.1016/j.arth.2014.12.026.
40. Petis SM, Lanting BA, Vasarhelyi EM, Naudie DDR, Ralley FE, Howard JL. Is there a role for preoperative iron supplementation in patients preparing for a total hip or total knee arthroplasty? J Arthroplasty 2017;32(9):2688–93. doi: 10.1016/j.arth.2017.04.029.
41. Munoz M, Acheson AG, Auerbach M, et al. International consensus statement on the peri-operative management of anaemia and iron deficiency. Anaesthesia 2017;72(2):233–47. doi: 10.1111/anae.13773.
42. Gu A, Malahias MA, Strigelli V, Nocon AA, Sculco TP, Sculco PK. Preoperative malnutrition negatively correlates with postoperative wound complications and infection after total joint arthroplasty: A systematic review and meta-analysis. J Arthroplasty 2019;34(5):1013–24. doi: 10.1016/j.arth.2019.01.005.
43. Huang R, Greenky M, Kerr GJ, Austin MS, Parvizi J. The effect of malnutrition on patients undergoing elective joint arthroplasty. J Arthroplasty 2013;28(8 Suppl):21–24. doi: 10.1016/j.arth.2013.05.038.
44. Bala A, Ivanov DV, Huddleston JI 3rd, Goodman SB, Maloney WJ, Amanatullah DF. The cost of malnutrition in total joint arthroplasty. J Arthroplasty 2020;35(4):926–32.e1. doi: 10.1016/j.arth.2019.11.018.
45. Chrisopoulos S, Harford J, Ellershaw A. Oral health and dental care in Australia: Key facts and figures 2015. Cat. no. DEN 229. Canberra, ACT: AIHW, 2016.
46. Daly RM, Gagnon C, Lu ZX, et al. Prevalence of vitamin D deficiency and its determinants in Australian adults aged 25 years and older: A national, population-based study. Clin Endocrinol (Oxf) 2012;77(1):26–35. doi: 10.1111/j.1365-2265.2011.04320.x.
47. Lavernia CJ, Villa JM, Iacobelli DA, Rossi MD. Vitamin D insufficiency in patients with THA: Prevalence and effects on outcome. Clin Orthop Relat Res 2014;472(2):681–86. doi: 10.1007/s11999-013-3172-7.
48. Maier GS, Horas K, Seeger JB, Roth KE, Kurth AA, Maus U. Is there an association between periprosthetic joint infection and low vitamin D levels? Int Orthop 2014;38(7):1499–504. doi: 10.1007/s00264-014-2338-6.
49. Kim KY, Anoushiravani AA, Chen KK, et al. Perioperative orthopedic surgical home: Optimizing total joint arthroplasty candidates and preventing readmission. J Arthroplasty 2019;34(7S):S91–S6. doi: 10.1016/j.arth.2019.01.020.
50. Abdel MP, Bonadurer GF 3rd, Jennings MT, Hanssen AD. Increased aseptic tibial failures in patients with a BMI ≥35 and well-aligned total knee arthroplasties. J Arthroplasty 2015;30(12):2181–84. doi: 10.1016/j.arth.2015.06.057.

correspondence **ajgp@racgp.org.au**