Maxim (cementless)/Vanguard (cemented) Total Knee Investigation

Note: This analysis compares the Maxim (cless)/Vanguard (ctd) femoral/tibial combination with all other total knee prostheses.

This combination has been identified as having a significantly higher rate of revision. For a detailed explanation of the process used by the Registry that results in identification of prostheses that have a higher than anticipated rate of revision please refer to the Prostheses with Higher than Anticipated Rates of Revision chapter of the most recent AOANJRR Annual Report, https://aoanjrr.sahmri.com/annual-reports-2024.

Note: Procedures using prostheses with no recorded use in 2023 are excluded from the comparator.

TABLE 1

Revision Rate of Primary Total Knee Replacement

The revision rate of the Maxim (cless)/Vanguard (ctd) total knee combination is compared to all other total knee prostheses.

Table 1: Revision Rates of Primary Total Knee Replacement

Component	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
Maxim (cless)/Vanguard (ctd)	75	413	5635	1.33 (1.05, 1.67)
Other Total Knee	24931	736083	4688062	0.53 (0.53, 0.54)
TOTAL	**25006**	**736496**	**4693697**	**0.53 (0.53, 0.54)**

Note: Prostheses no longer used in 2023 are excluded from the comparator.

TABLE 2

Yearly Cumulative Percent Revision of Primary Total Knee Replacement

The yearly cumulative percent revision of the Maxim (class)/Vanguard (ctd) total knee combination is compared to all other total knee prostheses.

Table 2: Yearly Cumulative Percent Revision of Primary Total Knee Replacement

CPR	1 Yr	2 Yrs	3 Yrs	4 Yrs	5 Yrs	6 Yrs	7 Yrs	8 Yrs
Maxim (class)/Vanguard (ctd)	1.2 (0.5, 2.9)	2.9 (1.7, 5.1)	3.7 (2.2, 6.0)	4.7 (3.0, 7.2)	6.0 (4.0, 8.8)	6.2 (4.2, 9.1)	7.3 (5.1, 10.3)	7.6 (5.4, 10.7)
Other Total Knee	1.0 (0.9, 1.0)	1.8 (1.8, 1.8)	2.4 (2.3, 2.4)	2.8 (2.7, 2.8)	3.1 (3.1, 3.2)	3.4 (3.4, 3.5)	3.7 (3.7, 3.8)	4.0 (4.0, 4.1)

CPR	9 Yrs	10 Yrs	11 Yrs	12 Yrs	13 Yrs	14 Yrs	15 Yrs	16 Yrs
Maxim (class)/Vanguard (ctd)	8.2 (5.8, 11.4)	9.4 (6.9, 12.8)	10.4 (7.7, 14.0)	12.4 (9.4, 16.3)	13.8 (10.6, 17.9)	14.9 (11.5, 19.2)	16.4 (12.8, 20.9)	18.4 (14.6, 23.2)
Other Total Knee	4.3 (4.3, 4.4)	4.6 (4.6, 4.7)	4.9 (4.9, 5.0)	5.2 (5.2, 5.3)	5.5 (5.5, 5.6)	5.8 (5.7, 5.9)	6.2 (6.1, 6.3)	6.6 (6.5, 6.8)

CPR	17 Yrs	18 Yrs	19 Yrs	20 Yrs	21 Yrs	22 Yrs	23 Yrs
Maxim (class)/Vanguard (ctd)	20.7 (16.5, 25.8)	22.3 (17.9, 27.7)	23.5 (18.9, 29.1)	25.1 (20.2, 31.0)			
Other Total Knee	7.0 (6.8, 7.1)	7.3 (7.1, 7.5)	7.5 (7.3, 7.7)	7.7 (7.5, 8.0)	8.0 (7.7, 8.3)	8.2 (7.9, 8.6)	8.2 (7.9, 8.6)

Note: Prostheses no longer used in 2023 are excluded from the comparator.

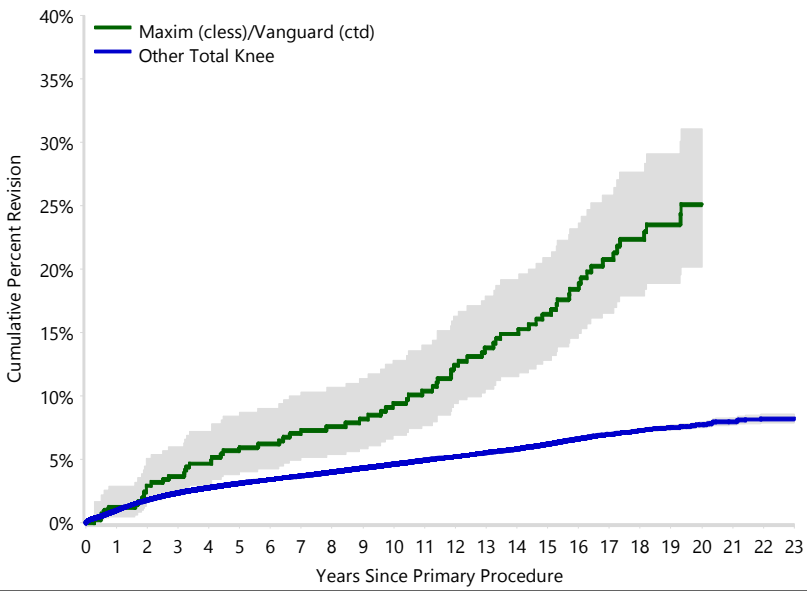
FIGURE 1

Yearly Cumulative Percent Revision of Primary Total Knee Replacement

The yearly cumulative percent revision of the Maxim (class)/Vanguard (ctd) total knee combination is compared to all other total knee prostheses. In addition, hazard ratios are reported.

Hazard ratios are reported for specific time periods during which the hazard ratio is constant. This is done to enable more specific and valid comparisons of the risk of revision over time. The pattern of variation in risk has important implications with respect to the underlying reasons for any difference.

Figure 1: Cumulative Percent Revision of Primary Total Knee Replacement



HR - adjusted for age and gender

Maxim (class)/Vanguard (ctd) vs Other Total Knee

0 - 2Yr: HR=1.60 (0.91, 2.81), p=0.105

2Yr - 3Yr: HR=1.30 (0.42, 4.02), p=0.652

3Yr - 4.5Yr: HR=3.53 (1.76, 7.06), p<0.001

4.5Yr - 6Yr: HR=1.11 (0.28, 4.44), p=0.881

6Yr - 9.5Yr: HR=2.20 (1.10, 4.41), p=0.025

9.5Yr+: HR=5.58 (4.10, 7.58), p<0.001

Number at Risk	0 Yr	1 Yr	2 Yrs	3 Yrs	4 Yrs	5 Yrs	6 Yrs	7 Yrs	8 Yrs	9 Yrs	10 Yrs	11 Yrs
Maxim (class)/Vanguard (ctd)	413	406	395	388	375	365	351	339	324	301	287	271
Other Total Knee	736083	656472	589710	522768	463050	402400	344698	290547	241598	196807	158427	125444

Number at Risk	12 Yrs	13 Yrs	14 Yrs	15 Yrs	16 Yrs	17 Yrs	18 Yrs	19 Yrs	20 Yrs	21 Yrs	22 Yrs	23 Yrs
Maxim (class)/Vanguard (ctd)	258	242	225	216	190	153	133	100	61	26	15	1
Other Total Knee	96689	72841	53727	38715	27059	18808	12662	7866	4467	2602	1229	297

Note: Prostheses no longer used in 2023 are excluded from the comparator.

TABLE 3

Primary Diagnosis for Revised Primary Total Knee Replacement

This table identifies the diagnosis of the primary procedure which was subsequently revised. This information is provided as there is a variation on outcome depending on the primary diagnosis. It is therefore important when considering the reasons for a higher than anticipated rate of revision that there is identification of the primary diagnosis. This information should be compared to the primary diagnosis for the revisions of all other total knee prostheses.

Table 3: Primary Diagnosis for Revised Primary Total Knee Replacement

	Maxim (cless)/Vanguard (ctd)		Other Total Knee	
Primary Diagnosis	Number	Percent	Number	Percent
Osteoarthritis	73	97.3	24126	96.8
Rheumatoid Arthritis	1	1.3	313	1.3
Tumour			178	0.7
Other Inflammatory Arthritis	1	1.3	153	0.6
Osteonecrosis			89	0.4
Fracture			48	0.2
Other			23	0.1
Chondrocalcinosis			1	0.0
TOTAL	**75**	**100.0**	**24931**	**100.0**

Note: Prostheses no longer used in 2023 are excluded from the comparator.

TABLE 4

Reasons for Revision

This is reported in two ways: a percentage of primary procedures revised and as a percentage of all revision procedures.

% Primaries Revised: This shows the proportional contribution of each revision diagnosis as a percentage of the total number of primary procedures. This percentage can be used to approximate the risk of being revised for that diagnosis. Differing percentages between groups, with the same distribution of follow up time, may identify problems of concern.

% Revisions: The number of revisions for each diagnosis is expressed as a percentage of the total number of revisions. This shows the distribution of reasons for revision within a group but cannot be used as a comparison between groups.

Table 4: Primary Total Knee Replacement - Reason for Revision

Revision Diagnosis	Maxim (cless)/Vanguard (ctd)			Other Total Knee		
	Number	% Primaries Revised	% Revisions	Number	% Primaries Revised	% Revisions
Infection	14	3.4	18.7	7004	1.0	28.1
Loosening	25	6.1	33.3	5304	0.7	21.3
Instability	4	1.0	5.3	2562	0.3	10.3
Pain	4	1.0	5.3	1833	0.2	7.4
Patella Erosion	1	0.2	1.3	1793	0.2	7.2
Patellofemoral Pain	3	0.7	4.0	1632	0.2	6.5
Arthrofibrosis				1019	0.1	4.1
Fracture	1	0.2	1.3	993	0.1	4.0
Malalignment				525	0.1	2.1
Wear Tibial Insert	3	0.7	4.0	343	0.0	1.4
Lysis	9	2.2	12.0	282	0.0	1.1
Incorrect Sizing				229	0.0	0.9
Implant Breakage Tibial Insert	1	0.2	1.3	182	0.0	0.7
Patella Maltracking				180	0.0	0.7
Bearing Dislocation	1	0.2	1.3	141	0.0	0.6
Implant Breakage Patella	1	0.2	1.3	130	0.0	0.5
Metal Related Pathology	7	1.7	9.3	101	0.0	0.4
Prosthesis Dislocation				80	0.0	0.3
Synovitis				64	0.0	0.3
Osteonecrosis				50	0.0	0.2
Implant Breakage Femoral				45	0.0	0.2
Wear Patella				42	0.0	0.2
Implant Breakage Tibial	1	0.2	1.3	34	0.0	0.1
Tumour				31	0.0	0.1
Heterotopic Bone				14	0.0	0.1
Progression Of Disease				7	0.0	0.0
Wear Tibial				5	0.0	0.0
Patella Dislocation				2	0.0	0.0
Incorrect Side				1	0.0	0.0
Wear Femoral				1	0.0	0.0
Other				302	0.0	1.2
N Revision	**75**	**18.2**	**100.0**	**24931**	**3.4**	**100.0**
N Primary	**413**			**736083**		

Note: Prostheses no longer used in 2023 are excluded from the comparator.

FIGURE 2

Cumulative Incidence Revision Diagnosis of Primary Total Knee Replacement

This figure details the cumulative incidence of the most common reasons for revision. The five most common reasons for revision are included as long as each of these reasons account for more than 10 procedures or at least 5% of all revisions for the Maxim (cless)/Vanguard (ctd) total knee combination. A comparative graph is provided of the cumulative incidence for the same reasons for revisions for all other total knee prostheses.

Figure 2: Cumulative Incidence Revision Diagnosis for Primary Total Knee Replacement

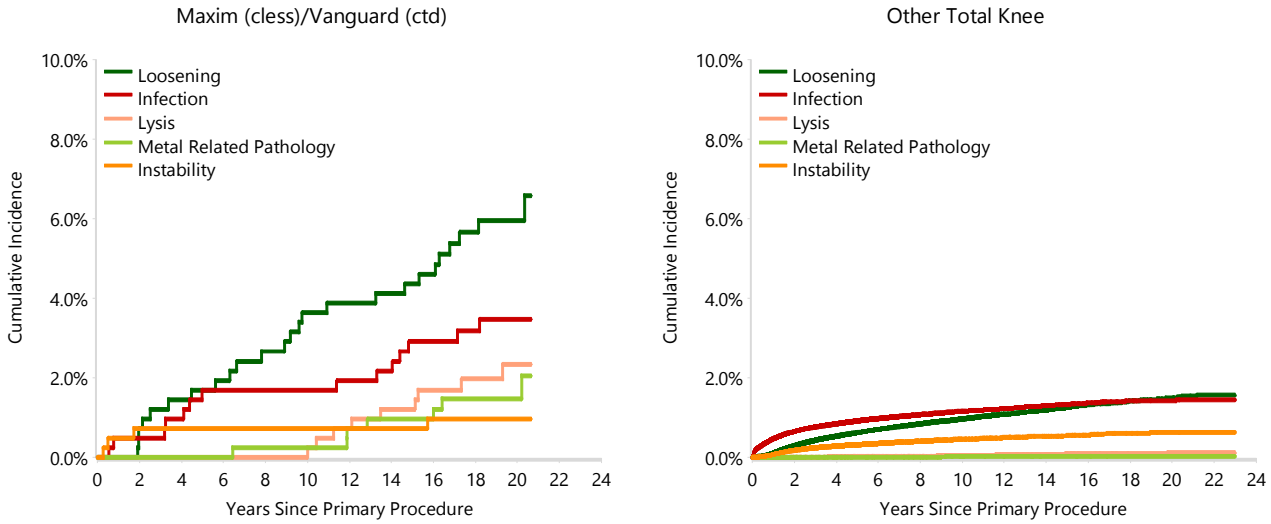


TABLE 5

Type of Revision Performed for Primary Total Knee Replacement

This analysis identifies the components used in the revision of the Maxim (cless)/Vanguard (ctd) total knee combination and compares it to the components used in the revision of all other total knee prostheses.

The reason this analysis is undertaken is to identify whether there is one or more components which are being replaced that differ from the components replaced for revisions of all other total knee prostheses i.e. is there a difference in the type of revision undertaken for the Maxim (cless)/Vanguard (ctd) total knee combination compared to all other total knee prostheses.

Table 5: Primary Total Knee Replacement - Type of Revision

	Maxim (cless)/Vanguard (ctd)		Other Total Knee	
Type of Revision	Number	Percent	Number	Percent
TKR (Tibial/Femoral)	38	50.7	5972	24.0
Tibial Component	4	5.3	1857	7.4
Femoral Component	3	4.0	1259	5.0
Cement Spacer	5	6.7	1174	4.7
Removal of Prostheses			131	0.5
Total Femoral			22	0.1
Reinsertion of Components			7	0.0
N Major	**50**	**66.7**	**10422**	**41.8**
Insert Only	11	14.7	7464	29.9
Patella Only	4	5.3	4325	17.3
Insert/Patella	10	13.3	2654	10.6
Minor Components			57	0.2
Cement Only			9	0.0
N Minor	**25**	**33.3**	**14509**	**58.2**
TOTAL	**75**	**100.0**	**24931**	**100.0**

Note: Prostheses no longer used in 2023 are excluded from the comparator.

TABLE 6

Revision Rates of Maxim (class)/Vanguard (ctd) Primary Total Knee Replacement by Fixation

This analysis is provided as some prostheses have more than one fixation option. Additionally there are prostheses where an alternative to the recommended approach to fixation was used e.g. a cementless prosthesis that has been cemented or vice-versa.

Table 6: Revised Number of Maxim (class)/Vanguard (ctd) Primary Total Knee Replacement by Fixation

Fixation	N Revised	N Total
Cemented	10	72
Hybrid (Tibial Cemented)	65	340
Hybrid (Tibial Cementless)	0	1
TOTAL	**75**	**413**

TABLE 7

Revision Rates of Maxim (class)/Vanguard (ctd) Primary Total Knee Replacement by Bearing Surface

This analysis is provided as some prostheses are combined with a variety of bearing surfaces. All bearing surfaces used with this combination are listed.

Table 7: Revised Number of Maxim (class)/Vanguard (ctd) Primary Total Knee Replacement by Bearing Surface

Bearing Surface	N Revised	N Total
Non XLPE	75	413
TOTAL	**75**	**413**

TABLE 8

Revision Rates of Maxim (class)/Vanguard (ctd) Primary Total Knee Replacement by Bearing Mobility

This analysis is provided as some prostheses are combined with a variety of bearing mobilities. All bearing mobilities used with this combination are listed.

Table 8: Revised Number of Maxim (class)/Vanguard (ctd) Primary Total Knee Replacement by Bearing Mobility

Bearing Mobility	N Revised	N Total
Fixed	75	413
TOTAL	**75**	**413**

TABLE 9

Revision Rates of Maxim (class)/Vanguard (ctd) Primary Total Knee Replacement by Stability

This analysis is provided as some prostheses are combined with a variety of stabilities. All stabilities used with this combination are listed.

Table 9: Revised Number of Maxim (class)/Vanguard (ctd) Primary Total Knee Replacement by Stability

Stability	N Revised	N Total
Minimally Stabilised	62	318
Posterior Stabilised	13	95
TOTAL	**75**	**413**

TABLE 10

Revision Rates of Primary Total Knee Replacement by State

This enables a state by state variation to be identified for the Maxim (cless)/Vanguard (ctd) total knee combination and provides the comparative data for each of the states for all other total knee prostheses.

The purpose of this analysis is to determine if the higher than anticipated rate of revision has widespread distribution between states. If there is widespread distribution then the reason for the higher than anticipated rate of revision is unlikely to be surgeon specific. If the prosthesis has been used in only a small number of states it is not possible to distinguish if the higher than anticipated rate of revision is related to the prosthesis, surgeon, technique or patient.

Table 10: Revised Number of Primary Total Knee Replacement by State

Component	State	N Revised	N Total
Maxim (cless)/Vanguard (ctd)	NSW	44	270
	VIC	12	40
	SA	19	103
Other Total Knee	NSW	7326	251259
	VIC	5374	148666
	QLD	5361	153657
	WA	3064	80125
	SA	2756	64011
	TAS	458	18786
	ACT/NT	592	19579
TOTAL		**25006**	**736496**

Note: Prostheses no longer used in 2023 are excluded from the comparator.

TABLE 11

Number of Revisions of Maxim (class)/Vanguard (ctd) Primary Total Knee Replacement by Year of Implant

This analysis details the number of prostheses reported each year to the Registry for the Maxim (class)/Vanguard (ctd) total knee combination. It also provides the subsequent number of revisions of the primaries reported in that year.

Primary procedures performed in later years have had less follow up time therefore the number revised is expected to be less than the number revised in earlier years. For example, a primary procedure performed in 2023 has a maximum of one year to be revised, whereas a primary procedure performed in 2021 has a maximum of three years to be revised.

Table 11: Number of Revisions of Maxim (class)/Vanguard (ctd) Primary Total Knee Replacement by Year of Implant

Year of Implant	Number Revised	Total Number
2000	0	8
2001	6	34
2002	10	44
2003	23	94
2004	23	106
2005	4	64
2006	6	23
2007	2	30
2008	1	10
TOTAL	**75**	**413**

TABLE 12

Revision Rates of Maxim (class)/Vanguard (ctd) Primary Total Knee Replacement by Catalogue Number Range

Many prostheses have a number of catalogue ranges. The catalogue range is specific to particular design features; more than one catalogue range usually indicates a minor difference in design in a particular Maxim (class)/Vanguard (ctd) prosthesis.

This analysis has been undertaken to determine if the revision rate varies according to the catalogue number range.

Model	Catalogue Range	Catalogue Description	Cement	Material	Fixation
Femoral					
Maxim	140050-140075	FEMORAL COMPONENT - ANATOMIC PRIMARY POROUS	NO		POROUS
Maxim	145110-145135	PS INTERLOK RAISED FLANGE COCR	EITHER		MATT
Maxim	145410-145435	PS POROUS FEMORAL COMPONENT	NO		POROUS
Tibial					
Vanguard	141210-141219	TITANIUM PRIMARY INTERLOK TIBIAL TRAY	YES	METAL	MATT
Vanguard	141221-141227	COCR I-BEAM MODULAR INTERLOK TIBIAL TRAY	YES		MATT
Vanguard	141230-141238	COCR FINNED MODULAR INTERLOK TIBIAL TRAY W/LOCKING BAR	YES		MATT
Vanguard	141241-141247	COCR I-BEAM MODULAR POLISHED INTERLOK TIBIAL TRAY	YES	METAL	POLISHED
Vanguard	141250-141258	COCR FINNED MODULAR POLISHED INTERLOK TIBIAL TRAY	YES	METAL	POLISHED
Vanguard	141480-141488	TITANIUM OFFSET INTERLOK TIBIAL TRAY	YES		
Vanguard	141510-141518	TITANIUM MODULAR STEMMED INTERLOK TIBIAL TRAY	YES		MATT

Table 12: Revised Number of Maxim (class)/Vanguard (ctd) Primary Total Knee Replacement by Catalogue Number Range

Femoral Range	Tibial Range	N Revised	N Total
140050-140075	141210-141219	56	233
	141221-141227	0	1
	141230-141238	5	62
	141250-141258	1	20
	141480-141488	0	2
145110-145135	141210-141219	12	80
	141230-141238	0	1
	141241-141247	0	2
	141480-141488	0	2
	141510-141518	0	3
145410-145435	141210-141219	1	5
	141230-141238	0	1
	141510-141518	0	1
TOTAL		**75**	**413**