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Polyethylene liner fracture in dual mobility trapeziometacarpal joint prosthesis: Report of 17 cases

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Abstract (max 40 words)

We report 17 polyethylene liner fractures in 15 patients with dual-mobility trapeziometacarpal joint prostheses, primarily active males with high key pinch strength. Treatment involved head and liner exchange or trapeziectomy, depending on implant damage severity.

Evidence level: V

Main Text *(max 600 words and 1 table and 1 figure)*

Total joint arthroplasty has gained increasing acceptance as a surgical treatment for painful trapeziometacarpal (TMC) osteoarthritis, particularly since the introduction of dual-mobility implants. While early clinical and patient-reported outcomes are promising, concerns persist regarding implant failures such as dislocation and cup loosening, and long-term outcome data remain limited (Maling and Rooney, 2025). Another potential complication of dual-mobility designs involves polyethylene (PE) liner related issues, such as dislocation or early wear or breakage of the liner (Dremstrup et al., 2021; Maling and Rooney, 2025).

Unlike single-mobility systems, where the PE liner is fixed within the metal cup, dual-mobility implants utilize a mobile liner that articulates with both the cup and the prosthetic neck including the metal head. The PE liner has an inner diameter of 4 mm, an outer diameter of 7mm and a thickness of 2.1mm. This design improves range of motion and increases dislocation resistance but also increases articulating surface area, potentially raising wear risks. Eccentric loading—when the liner is not fully supported by the metal head—may concentrate stress and promote localized wear or failure. Nevertheless, with 90% of movement occurring between the head and liner (Dremstrup et al., 2021), and considering smaller joint surfaces generally reduce PE wear, dual-mobility surpasses single-mobility designs.

We conducted a retrospective multicenter analysis, to assess the incidence of PE liner failure in dual-mobility arthroplasties and identify potential associations with patient-specific factors. Data from 4 centers in Belgium and one orthopaedic hospital in Switzerland included 2.318 cases of dual-mobility TMC arthroplasties (Touch®, KeriMedical, Switzerland and Moovis®, Stryker). Among these, 17 fractures of the PE liner were identified in 15 patients, corresponding to an incidence of 0.7%. All but one were male, with a median age of 58 years (Table 1). Thirteen out of 17 cases were engaged in occupations or activities requiring substantial manual strain, supported by a median key pinch strength of 10 kg at the last follow-up prior to revision. In 12 cases, revision surgery involved replacement of the neck component. In 4 cases, the implant could not be saved and required conversion to trapeziectomy. One patient declined revision surgery to date (Table 1). Severe metallosis was found in several cases due to the metal-on-metal contact (Figure 1). Both metallosis and PE debris may lead to osteolysis and implant loosening. Hence, early detection of liner failure is critical to enable limited revision (neck component only), whereas delayed treatment may lead to implant removal. Similar to our findings, Lussiez et al. (2021) described two cases (1.9%) of PE insert wear at 4 years post-implantation in male patients engaged in heavy manual labor. Both were treated with trapeziectomy and ligamentoplasty. Dremstrup et al. (2021) also described PE wear and proposed joint over-tensioning during surgery as a potential contributing factor.

A limitation of our study is the lack of differentiation between liner materials, manufacturing methods, or bearing surface characteristics across implant brands—factors which may influence wear behavior. One possible approach could be to add vitamin E and a thicker polyethylene liner. Both is standard in hip joint replacement. This could enhance oxidative stability and mechanical resilience.

In summary, early PE liner failure may be a complication specific to dual-mobility TMC implants and may present a trade-off for increased joint stability. Male sex, high key pinch strength and strenuous manual activity are risk factors for early polyethylene fatigue. Careful patient selection is thus warranted. The question remains whether a single-mobility implant might be the better

choice for these patients. Further research is needed to define safe loading thresholds for these implants in active patients.

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Figures and tables

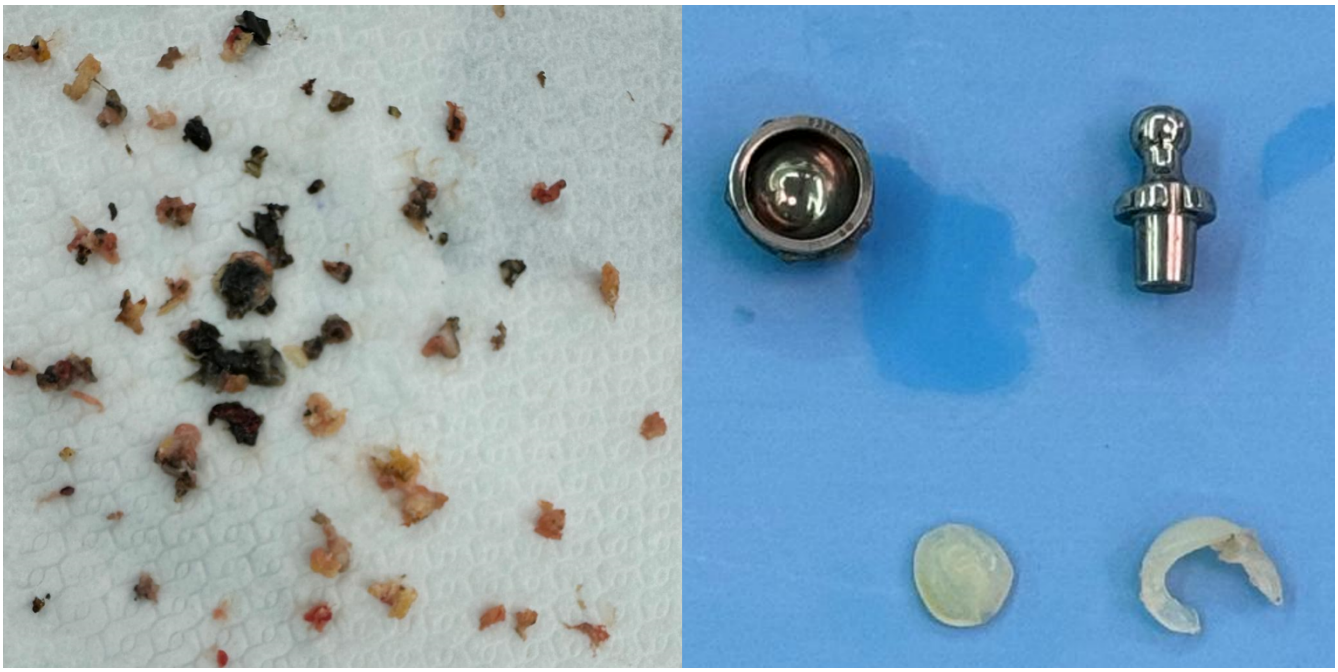

Figure 1. Severe metallosis (left) and broken polyethylene liner (right) 2.6 years after primary implantation in a 48-year-old male manual worker.

Table 1: Characteristics of 15 patients with 17 polyethylene (PE) liner fractures

ID	Age (years)[a]	Sex	Occupation / Hobby	Dominant hand affected	Prosthesis	PE	Key pinch (kg)[b]	Grip strength (kg)[b]	Onset of complication (months)	Trauma / heavy load	Revision procedure
BEL-1	57	female	cleaning lady	yes	Touch	CL	4	25	4	yes	PE liner and neck/head exchange
BEL-2-1	54	male	teacher / gardening	no	Touch	CL	4	25	16	yes	PE liner and neck/head exchange
BEL-2-2	54	male	teacher / gardening	no	Touch	HCL	10		6	yes	PE liner and neck/head exchange
BEL-3	62	male	hospital volunteer	no	Moovis	CL	10	32	6	no	PE liner and neck/head exchange
BEL-4	56	male	manual worker	no	Touch	CL	9	30	11	no	PE liner and neck/head exchange
BEL-5	62	male	manual worker	yes	Touch	HCL	8	38	16	no	trapeziectomy
BEL-6	68	male	retired / gardening	no	Touch	HCL	10	24	13	no	PE liner and neck/head exchange, larger cup
BEL-7	55	male	butcher	yes	Touch	HCL	3	15	18	no	trapeziectomy
BEL-8-1	54	male	invalid / handicraft	yes	Touch	HCL	15	48	3	yes	PE liner and neck/head exchange
BEL-8-2	54	male	invalid / handicraft	yes	Touch	HCL	15	48	2	yes	PE liner and neck/head exchange
BEL-9	58	male	manual worker	no	Touch	CL			1	yes	PE liner and neck/head exchange
BEL-10	59	male	assembly line worker	yes	Touch	HCL			12	no	Patient declines revision
BEL-11	60	male	manual worker	yes	Touch	HCL	11	55	6	no	PE liner and neck/head exchange
CH-1	73	male	retired /golf	yes	Touch	HCL	6.5	28	42	no	trapeziectomy
CH-2	48	male	removal staff	yes	Touch	HCL	4.5	18	31	no	trapeziectomy
CH-3	65	male	flutist / flute maker	yes	Touch	HCL	10	47	14	no	PE liner and neck/head exchange
CH-4	70	male	retired	yes	Touch	HCL	11	58	6	no	PE liner and neck/head exchange
Median	**58**						**10**	**31**	**11**		

[a] Age at initial surgery; [b] Values of last follow-up before revision; CL: cross-linked; HCL: highly cross-linked