Supporting Information

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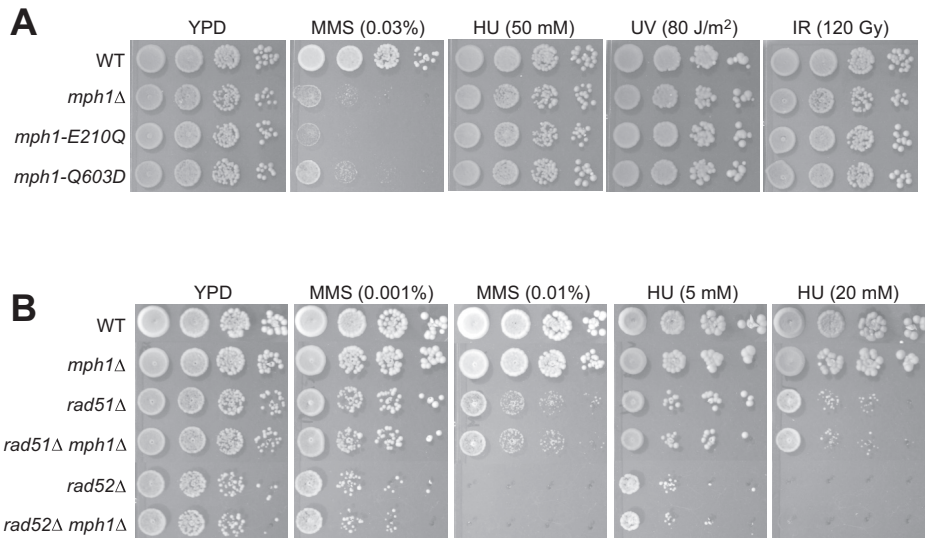

Fig. S1. Sensitivity to DNA damage caused by *mph1* mutations in WT, *rad51*Δ, and *rad52*Δ backgrounds. Experiments were carried out as described in Fig. 2*A*.

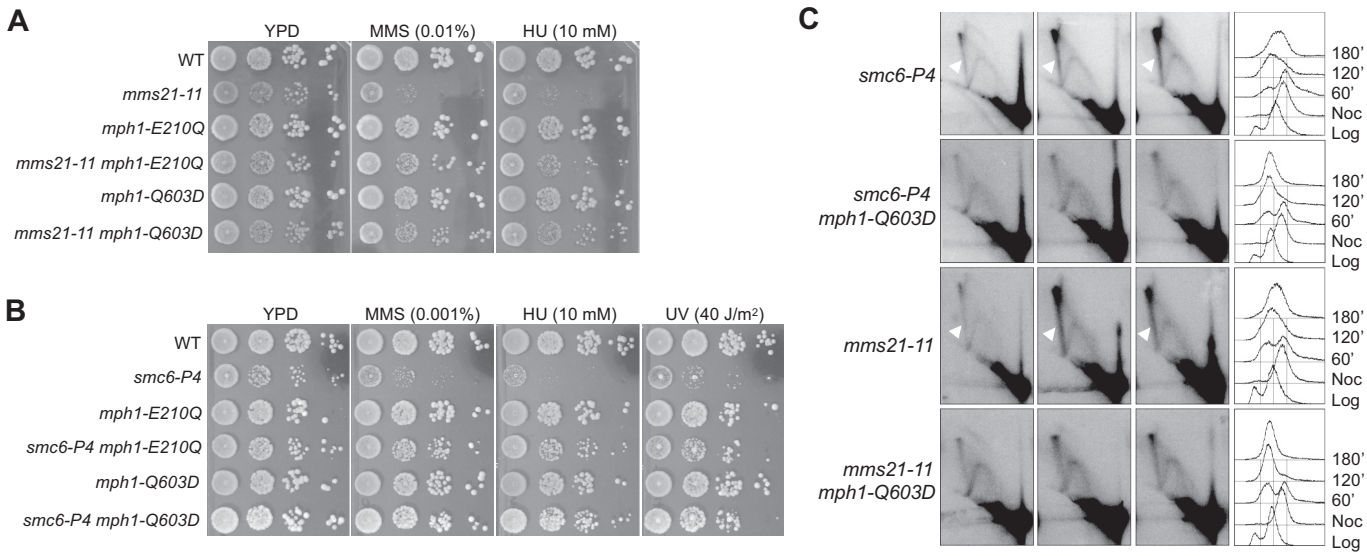

Fig. S2. Helicase mutations of *mph1* suppress the sensitivity to DNA damage and the accumulation of recombination intermediates in *mms21–11* and *smc6-P4* cells. (*A* and *B*) *mph1-E210Q* and *-Q603D* suppress the sensitivity to DNA damage of *mms21–11* cells (*A*) and *smc6-P4* cells (*B*). Experiments were carried out as described in Fig. 2*A*. (*C*) *mph1-Q603D* suppresses the accumulation of X-shaped recombination intermediates in *mms21–11* and *smc6-P4* cells. Experiments were carried out as described in Fig. 4.

Table S1. The levels of Mph1, Rad52, and Pol30 foci in WT cells

% Cells containing foci of these proteins	Normal growth	MMS treatment*
Mph1	6% (50/789)**	13% (72/578)**
Rad52	33% (264/789)	44% (254/578)
Pol30	19% (152/789)	32% (183/578)
% Mph1 foci co-localized with		
Rad52 foci	76% (38/50)	81% (58/72)
Pol30 foci	30% (15/50)	32% (23/72)
Both Rad52 and Pol30 foci	22% (11/50)	21% (15/72)

*Cells were treated with 0.03% MMS for 2 h.
**$P \leq 0.025\%$.

Table S2. Strains and plasmids used in this study

Name	Genotype	Sources
W1588-4C	*MATa ade2–1 can1–100 his3–11,15 leu2–3,112 trp1–1 ura3-1 RAD5+*	R. Rothstein
X2240–8C	*MATa smc6–56–13myc::HIS3 rad51Δ ::LEU2*	This study
T294–11B	*MATa SMC5-13Myc::HIS3*	Lab collection
X1996–12B	*MATα SMC5-13Myc::HIS3 MPH1-3Flag::HIS3*	This study
X1546–12B	*MATa MPH1–13myc::HIS3*	This study
T538–2	*MATa MPH1–3Flag::HIS3*	This study
T497–1	*MATa MPH1-YFP::HIS3*	This study
1483-2Ca	*MATa mph1Δ::KAN*	H. Klein
W3111-1C	*MATa rad51Δ::LEU2*	R. Rothstein
X1958–1C	*MATα mph1Δ::KAN rad51Δ::LEU2*	This study
T80–14	*MATα mms21–11::URA3*	(1)
X2007–3D	*MATa mph1Δ::KAN mms21–11::URA3*	This study
T382-P4	*MATa smc6-P4–13myc::HIS3*	This study
X1787–4A	*MATa mph1Δ::Kan smc6-P4–13myc::HIS3*	This study
X2020–10B	*MATα smc6-P4-13myc::HIS3 rad51Δ::LEU2*	This study
X2123–2A	*MATa smc6–56–13myc::HIS3*	This study
X2123–3C	*MATa mph1Δ::KAN smc6–56–13myc::HIS3*	This study
W1958-4D	*MATα sgs1Δ::HIS3*	R. Rothstein
X1907–2D	*MATα mph1Δ::KAN sgs1Δ:HIS3*	This study
X2489–9C	*MATa MPH1-YFP::HIS3 RAD52-RFP CFP-POL30*	This study
X1991–1A	*MATa lys2Δ his3–11::pCUP1-GFP12-lacI12::HIS trp1–1::LacO::TRP1 MCD1:3XHA:URA3:3XHA*	This study
X2359–7A	*MATa lys2Δ his3–11::pCUP1-GFP12-lacI12::HIS trp1–1::LacO::TRP1 mph1Δ::KAN*	This study
X2006–31C	*MATa lys2Δ his3–11::pCUP1-GFP12-lacI12::HIS smc6–56–13myc-HIS3MX6 trp1–1::LacO::TRP1*	This study
X2358–14A	*MATa lys2Δ his3–11::pCUP1-GFP12-lacI12::HIS3 smc6–56–13myc-HIS3MX6 trp1–1::LacO::TRP1 mph1Δ::KAN*	This study
pXZ 216	*pOAD-MPH1*	This study
pXZ 194	*pOBD-SMC5*	This study
pXZ 198	*pOBD-NSE1*	This study
pXZ 55	*pOBD-MMS21*	This study
pXZ 191	*pOBD-NSE3*	This study
pXZ 196	*pOBD-NSE4*	This study
pXZ 199	*pOBD-NSE5*	This study
pXZ 193	*pOBD-NSE6*	This study
pXZ 195	*pOBD-SMC6*	This study
P134	*pGAL-MPH1*	OpenBiosystem
X700–10D	*MATa SMC6-YFP::KAN*	This study
T597–1	*MATα mph1-Q603D-YFP::HIS5*	This study
T617	*MATα mph1-E210Q-YFP::HIS5*	This study
X2183–1B	*MATa mms21–11::URA3 mph1-Q603D-YFP::HIS5*	This study
X2170–4A	*MATα mms21–11::URA3 mph1-E210Q-YFP::HIS5*	This study
X2176–1C	*MATa smc6-P4–13myc::KAN mph1-Q603D-YFP::HIS5*	This study
X2171–14B	*MATa smc6-P4–13myc::KAN mph1-E210Q-YFP::HIS5*	This study
X2217–14C	*MATa smc6–56–13myc::KAN mph1-Q603D-YFP::HIS5*	This study
X2212–12A	*MATa smc6–56–13myc::KAN mph1-E210Q-YFP::HIS5*	This study
X2233–15A	*MATa SMC5–13myc::HIS3 mph1-Q603D-YFP::HIS5*	This study
T295–3C	*MATa SMC6–13myc::HIS3*	This study
X2452–7B	*MATα SMC6–13myc::HIS3 MPH1–3Flag::HIS3*	This study
T130–4B	*MATα NSE6–13myc::KAN*	This study
X2453–16A	*MATα NSE6–13myc::KAN MPH1–3Flag::HIS3*	This study
X707–8B	*MATa srs2Δ::HIS3*	This study
X1804–20D	*MATα srs2Δ::HIS3 mph1Δ::KAN*	This study
X795–4B	*MATα srs2Δ::TRP1 mms21-11-3HA::KAN*	This study
X801	*MATa/α sgs1Δ::HIS3/+ mms21-11HA::KAN/+ rad51Δ::LEU2/+*	This study
pXZ115	*pET28a-Smc5*	(1)
Mph10	*pGEX4T3-Mph1*	This study
X532	*MATa/α mms21–11::URA3/+ SMC6-YFP/+ ade3Δ*	This study
T733	*MATa/α mms21Δ::KAN/+ mph1Δ::URA3/+*	This study
T732-2	*MATa/α smc6Δ::KAN/+ mph1Δ::URA3/+*	This study

Strains in this study are derivatives of W1588–4C, a *RAD5* derivative of W303 (*MATa ade2–1 can1–100 ura3–1 his3–11,15 leu2–3,112 trp1–1 rad5–535*) (2). When applicable, a single representative of each genotype is listed. Strains containing WT proteins fused with various tags exhibit normal cell growth or resistance to DNA damaging agents, suggesting that the fusion constructs are fully functional.

1. Zhao X, Blobel G (2005) A SUMO ligase is part of a nuclear multiprotein complex that affects DNA repair and chromosomal organization. *Proc Natl Acad Sci USA* 102:4777–4782.
2. Thomas BJ, Rothstein R (1989) Elevated recombination rates in transcriptionally active DNA. *Cell* 56:619–630.