Evaluation of DNA backbone winding by molecular dynamics study

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The oxidative DNA lesion 7, 8-dihydro-8-oxoguanine (8oxoG) is particularly removed by the human repair enzyme 8-oxoguanine glycosylase (hOGG1). The hOGG1 has catalytic role for the rotation or cleavage of N-glycosydic linkage between the 8oxoG and ribose [1]. Besides carrying numbers, clustered or isolated of 8oxoG somehow changed the degree of the reactivity of hOGG1 [2], the mechanism of recognition has not been elucidated especially for the several 8oxoG adducted cases. The hOGG1 recognizes the single 8oxoG legion, but does not recognize for the two base pair remote tandem 8oxoG likewise the healthy DNA [3]. Hence, as shown in Fig. 1, we comprehensively compared the injured DNA helical backbones in the water organization around the DNA with those of intact one.

As shown in Fig. 2, by measuring the phosphorus position, unwinding of DNA helixes can be seen in the injured DNA compared to the intact one. Backbone dihedral angles and water orientation to the bases were analyzed for healthy, single and tandem 8oxoG damaged DNA.

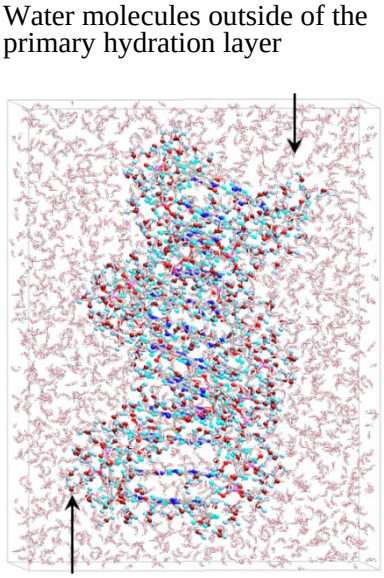

Fig.1 Stereo views of a double-stranded native DNA with water molecules.

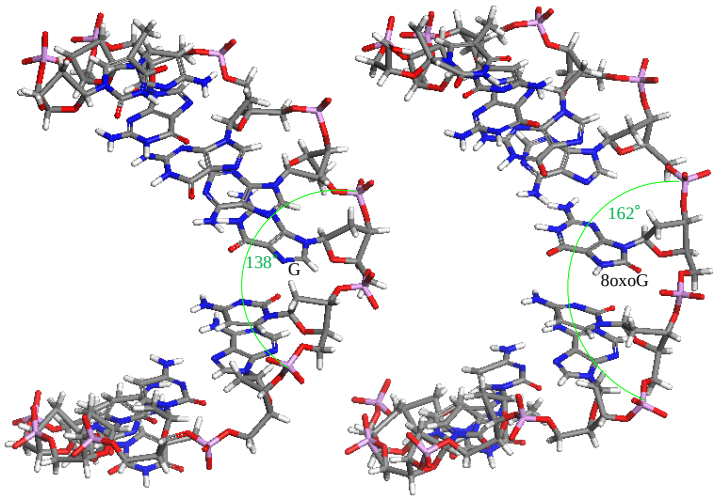

Fig. 2 Helical backbones of (a) intact DNA and (b) 8oxoG-including DNA.

References

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[3] A. Sassa, N. Kamoshita, Y. Kanemaru, M. Honma, M. Yasui, *PLOS ONE*, 1/15–15/15, 2015.