MODEL STUDY OF STRESSES IN GROOVED TABLETS UNDER DIAMETRAL COMPRESSION

J.M. Newton*, P. Stanley,** & C.S. Tan**, Departments of Pharmacy* and Mechanical Engineering**, Nottingham University, Nottingham, NG7 2RD

The tensile fracture stress of plane-faced cylindrical tablets can be derived from the results of diametral compression tests using the standard stress solution (Den Hartog, 1952). Commercial pharmaceutical tablets, however, are seldom of the simple plane-faced cylindrical form; the effects of departures from this form on the stress distribution and fracture characteristics are largely unknown and fracture stress values cannot therefore be readily derived from the results of diametral compression tests. A 'break-line', in the form of a diametral groove, is a common feature of pharmaceutical tablets; the effects of such a groove on the stresses in a series of cylindrical 'tablets' subjected to diametral compression have been studied using the three-dimensional 'frozen stress' photoelastic technique (Durelli & Riley, 1965). The model material was Araldite CT200; the manufacturing, loading, slicing and analysis of the models (diameter 5.08 cm, thickness 0.635 cm) were as described by Stanley (1968). Each model contained a diametral groove on one face, with a tip radius of 0.038 cm and a 90^{o} included angle. The groove depth was varied. The models were orientated with the groove either coincident with the loaded diameter (groove vertical) or perpendicular to it (groove horizontal); a plane-faced model was also tested. To facilitate comparison, results were expressed in the form of dimensionless 'stress factors' i.e. stress $\div 2P/\pi dt$ (P, load : d, diameter : t, thickness); surface values at the centre of each model (i.e. at the groove tip and the central point on the plane face), in a direction perpendicular to the applied load, are tabulated below.

The considerable effect of the groove on the stress at the centre of the tablet is evident; the occurrence of compressive stresses (indicated by the minus sign) along the tip of the deeper horizontal grooves and the associated increase in the tensile stress on the plane face, are of particular interest in the interpretation of fracture test results for grooved tablets.

Table. Maximum stress factors, perpendicular to the applied load, at centre of grooved tablet models subjected to diametral compression.

Groove depth cm	Maximum stress factor			
	Groove vertical		Groove horizontal	
	At groove tip	On plane face	At groove tip	On plane face
No groove	1.00	1.00	1.00	1.00
0.051	1.24	0.99	0.63	1.05
0.102	2.51	0.89	0.09	1.17
0.153	3.51	0.77	-0.31	1.39
0.203	4.26	0.60	-0.93	1.93

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