Measurement of Tablet Detachment and Ejection Forces Using an Instrumented Laboratory Tablet Press
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Purpose
The purpose of this study was to examine the effect of excipient and lubricant concentration on the lubrication and compression properties of model direct compression formulations, using an instrumented laboratory tablet press.

Methods
Ten gram samples of Perlitol 500SD, and Galen IQ720, were blended with lubricant at 0, 0.5, and 1.0% concentrations. Lubricants used were sodium stearyl fumarate (PRUV) and magnesium stearate. One hundred mg tablets were prepared on the Gamlen Tablet Press using a 5mm punch and die set and V-shaped compression profile at a speed of 1mm/second. Compaction force, punch position, and tablet ejection force were measured using the normal machine instrumental setup. Tablet detachment force was measured using a Mecmesin CFG+ force gauge to slide the die plate off the tablet while still on the press. The effect of compaction pressure on tablet tensile fracture stress (tabletability) was measured. Tablet detachment stress and tablet ejection stress were calculated by dividing the peak detachment or ejection force by area of contact between the punch or die and the tablet.

Results
Excipient responses to lubrication were quite different. In the case of Galen IQ720, detachment stresses exceeded the ejection stresses in all cases. The ejection stresses fell to very low levels at high compaction force. Sodium stearyl fumarate was less effective as a lubricant than magnesium stearate. In the case of Perlitol 500SD, sodium stearyl fumarate was as effective as magnesium stearate for most parameters; detachment forces for magnesium stearate at 0.5% were significantly above those for SSF at the same concentration. Lubricant effects on tabletability were also different. Lubricant increased the strength of Perlitol tablets significantly compared with the un lubricated material. Galen IQ720 tablets containing PRUV were stronger than tablets containing the same concentrations of magnesium stearate.

Conclusion
This study has shown unexpected differences in the responses of excipients to lubrication. Magnesium stearate was more effective than sodium stearyl fumarate in Galen IQ720. The two lubricants were equally effective in Perlitol 500SD. This technique shows promise in early stage formulation for formula identification, and in later development for lubricant blend time evaluation.