A study of lubricants on the dissolution of acetaminophen tablets using the analysis of available surface area

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In solid pharmaceutical formulations, magnesium stearate (Mg-St), which is widely used as a hydrophobic lubricant, is considered to cause certain manufacturing problems such as reduction in tablet hardness, prolonged disintegration time. Recently, we demonstrated that using glycerin fatty acid ester (Poem TR-FB®, abbreviated as TR-FB) as lubricant, products with uniform quality could be produced without the pharmaceutical problems associated with Mg-St. However, aside from the advantages of TR-FB with respect to tablet hardness and disintegration time, the effects of TR-FB on drug dissolution rate, which is involved in drug bioavailability in vivo, have not yet been clarified. Therefore, in order to study the effect of TR-FB concentrations on the dissolution rate of acetaminophen (APAP), the dissolution and disintegration behaviors of APAP tablets formulated using various lubricants were examined. The change over time in the available surface area of APAP (S(t)), which is in direct contact with solvent, was also analyzed using these dissolution data.

In the dissolution tests, a retarded dissolution of APAP was not observed with TR-FB, Mg-St retarded the dissolution. However, no significant difference in the disintegration time between the two lubricants was observed. With regard to the time course of the S(t), Mg-St at 0.1% gave a maximum surface area value at 9.19 min (peak time); however, the profiles for APAP with Mg-St at greater than 0.5% showed downward curvature indicating a gradual decrease in surface area over time. Conversely, with TR-FB, even when its concentration was increased, the S(t) profile for APAP had a maximum value that was more than twice that of APAP with that of 0.5–3.0% of Mg-St. Scanning electron microscopy (SEM) observations showed that the differences in the dissolution rate and S(t) patterns between Mg-St and TR-FB could be explained by differences in extensibility deriving from their morphology. Therefore, it was concluded that TR-FB does not cause retardation of drug dissolution and may prove to be a superior alternative lubricant to Mg-St.