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Analytical study on influence of super disintegrants and lubricants on the dissolution rate of atenolol tablets

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Abstract
Atenolol is a selective β_1 receptor antagonist, a drug belonging to the group of beta blockers. It is a relatively polar hydrophilic compound with water solubility. In the present study, the influence of nature and concentration of selected super disintegrants and lubricants on the hardness. Dissolution kinetics of all the formulations was determined. Due to variation in the physicochemical properties of the super disintegrant and lubricants, variation was observed in the dissolution rate of the drug from tablet to tablet. Sodium starch glycolate at 6% w/w concentration significantly improved the dissolution rate of Atenolol when compared with the other super disintegrants studied. Among the three lubricants used, magnesium stearate at 1.25% w/ w concentration showed rapid drug release.

Keywords: Atenolol, β_1 receptor antagonist

Introduction
Currently more than 60% of new drugs under new development today are considered poorly soluble. To achieve maximum therapeutic efficacy, selection of formulation ingredients that enhance the dissolution of poorly soluble drugs has become increasingly important. A drugs dissolution rate and extent of release from solid dosage form is determined by the solubility properties of the drug alone or combination with that of the formulation ingredients. The ultimate dissolution characteristics of the formulation of a poorly soluble drug are determined mainly by other ingredients like super disintegrants and lubricants [1].
Super disintegrants are now frequently used in tablet formulations to improve the rate and extent of tablet disintegration and thus improve the rate of drug dissolution. Commonly used super disintegrants such as crospovidone, croscarmellose sodium, and sodium starch glycolate are highly efficient at low concentration levels (2-5% w/w). The choice of a super disintegrant for a tablet formulation depends largely on the nature of the drug being used. Water soluble materials tends to dissolve rather than disintegrate, while insoluble materials tend to disintegrate if an appropriate amount of disintegrant is included in the formulation the correlation between tablet disintegration and the drug dissolution, however, is not always observable [2].
Lubricants are the agents that act by reducing friction by interposing an intermediate layer between the tablet constituents and the die wall during compression and ejection. Lubricants are classified according to their water solubility i.e. water insoluble lubricants and water soluble lubricants. Water soluble lubricants are used when a tablet is completely soluble or when unique disintegration and dissolution characters are required. Water insoluble lubricants are most effective and used at lower concentration than water soluble lubricants [3]. They tend to retard drug dissolution as they decrease the effective drug solvent interfacial area by changing the surface characteristics of the tablets. However it must be noted that if the amount of lubricant is used very small, they retarding effect may be negligible [4]. The type of lubricant its concentration and the method of incorporation should be optimized during formulation department. The method of incorporating the lubricant can influence solvent penetration into the tablet there by disintegration and dissolution of the dosage form [5]. The effect of lubricant on dissolution depends on the aqueous solubility of the drug.

Atenolol, a competitive beta (1)-selective adrenergic antagonist, has the lowest lipid solubility of this drug class. Although it is similar to metoprolol, Atenolol is used for a number of conditions including: hypertension, angina, acute myocardial infarction, supraventricular tachycardia, ventricular tachycardia. It belongs to class III under biopharmaceutical system i.e., drug with high solubility and low permeability. It shows dissolution rate limited absorption. It is a relatively hydrophilic compound with water solubility of 26.5 mg/ml at 37 ºC. It is an odourless white to white to off white crystalline powder [6].

Materials and Method

Materials used

Atenolol, crospovidone, croscarmellose sodium, sodium starch glycolate, magnesium stearate, polyethylene glycol 6000, stearic acid and dicalcium phosphate were the different chemicals used in this study.

Preparation of Atenolol Tablets

Tablets containing 20 mg of Atenolol were prepared by direct compression method. Drug was passed through sieve no. 200. The drug, diluent and super disintegrant was mixed in a motor. The resulting blend was lubricated with magnesium stearate and compressed into tablets using the cadmach single punch (round shaped, 7 mm thick) machine. The composition of the different tablets formulated was shown in Table 1.

Evaluation of Atenolol Tablets

a) Average weight [7]: Twenty tablets were taken and were weighed collectively and individually. Average weight and maximum percentage of deviation was collected.

b) Drug content [8]: Twenty tablets were taken weighed and powdered. The powder equivalent to 20 mg of drug was weighed accurately, dissolved in 100 ml of methanol. The solution was filtered, suitably diluted and analysed at 275 nm.

c) Disintegration time: six tablets were taken and disintegration time was determined in distilled water maintained at 37±0.5 ºC using thermionic tablet disintegration test apparatus. Average value was calculated.

d) Friability: Roche friability test apparatus was used to determine the friability. Ten tablets were taken and weighed. Then they were placed in the friabilator and rotated for 100 times. Then tablets were dedusted and reweighed.

e) Hardness [9]: The test was performed on ten tablets using Monsanto hardness tester. The result was expressed as an average of the ten readings.

f) Wetting time and water absorption ratio: 5 ml of water was poured into a clean Petri plate. A tissue paper which was folded twice was kept in the Petri plate and the tablet whose weight was noted as w_0 was placed over the tissue paper. The time period in which the tablet got completely wetted was noted as wetting time. The final weight of the tablet was noted as Wf water absorption ratio was calculated. (Table no: 2)

$$\text{Water Absorption Ratio} = 100X\ Wf - W_0 / W_0$$

g) Dissolution studies: Dissolution studies were conducted by different tablets by employing paddle method. The temperature was maintained at 37±0.5 ºC and paddle was set at 50 rpm. The dissolution medium used was 0.1N HCL and about 5 ml of sample was withdrawn at time intervals of 10 min 20 min and 30 min and sample was replenished with fresh dissolution medium. The collected samples were analysed at 275 nm. (Table No: 3) and Figure No: 1)

Results and Discussion

Three different super disintegrants *viz*, crospovidone, croscarmellose sodium, sodium starch glycolate, and three different lubricants *viz*, magnesium stearate, polyethylene glycol 6000, Stearic acid were used in the formulations. The formulated tablets were subjected to various quality control tests *viz*., average weight, drug content, disintegration time, hardness, wetting time and water absorption ratio and results were shown in Table 2 relatively equal tablet hardness values observed for all tablets. Friability values are found in less than 1% for all the formulations. All the formulations passed the disintegration requirement. The values of other parameters including wetting time and water absorption ratio were found to be satisfactory.

The comparative dissolution profile of different formulation was depicted in Figure 1. The dissolution rate of Atenolol was to be influenced by the nature and concentration of super disintegrant used in the formulation. Based on the dissolution rate super disintegrants can be ranked as sodium starch glycolate > croscarmellose sodium > crospovidone. From the preliminary studies, it was observed that out of the three different super disintegrants used sodium starch glycolate showed rapid drug release. Hence to study the influence of concentration of super disintegrants on the dissolution rate of atenolol, four different concentrations of sodium starch glycolate i.e., 2, 4, 6 and 7% w/w were used. It was observed that the formulation prepared with 7% w/w concentration of sodium starch glycolate had rapid drug release when compared with other formulations.

Based on the dissolution rate, lubricants can be ranked as magnesium stearate > polyethylene glycol 6000 > Stearic acid. Among the three different lubricants used, magnesium stearate showed rapid drug release and it was selected to study the influence of concentration of lubricant on the dissolution rate of atenolol. Out of the three different concentrations of magnesium stearate used i.e., 1.75, 1.25 and 0.8% w/w concentration was found to be optimum.

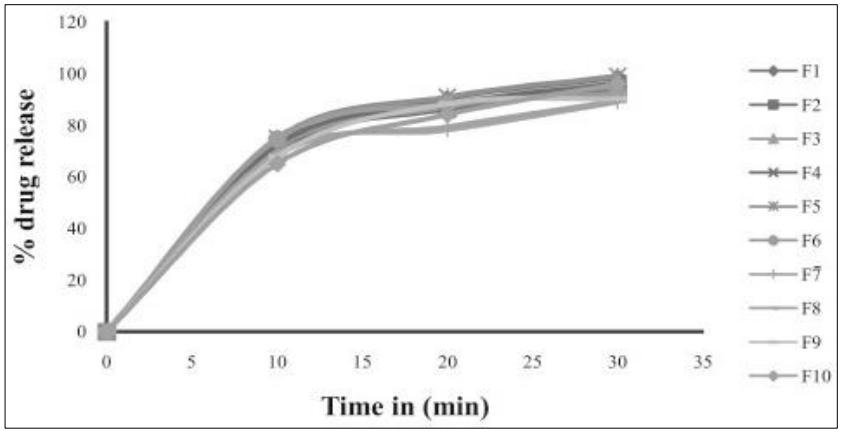

Fig 1: Graphical representation of F1-F10 Formulations

Table 1: Formulation Chart

S. No.	Ingredients	Quantity Per Tablet (mg)									
		F1	F2	F3	F4	F5	F6	F7	F8	F9	F10
1.	Atenolol	20	20	20	20	20	20	20	20	20	20
2.	Croscarmellose sodium	5	-	-	-	-	-	-	-	-	-
3.	Crospovidone	-	5	-	-	-	-	-	-	-	-
4.	Sodium starch Glycolate	-	-	5	5	5	5	5	4.2	2.8	1.4
5.	Magnesium Stearate	1	1	1	-	-	0.7	1.4	1	1	1
6.	Poly Ethylene Glycol 6000	-	-	-	1	-	-	-	-	-	-
7.	Stearic acid	-	-	-	-	1	-	-	-	-	-
8.	Dicalcium phosphate	54	54	54	54	54	54.3	53.6	54.8	56.2	57.6
	Total weight	80	80	80	80	80	8	80	80	80	80

Table 2: Post Compression Para meters

Parameters	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10
Average weight (mg)	81.2±0.2	80.37±0. 2	81.5±0.4	79.0±0.8 8	0.0± 0.5	80.2±0.4	79.2±0. 2	81.76±0. 3	80.05±0.4	78.3±0. 3
Drug content (%)	99.45±0.1	99.46±0. 3	99.65±0. 4	99.50±0. 9	9.60 ±0. 2	99.65±0. 1	99.5±0. 2	98.45±0. 4	99.20±0. 2	99.5±0. 21
Disintegration time (min)	4	4.32	2.15	3.45 5.0 5		3.0	3.50	4.45	4.29 5.01	
Friability (%)	0.51	0.536	0.514	0.756	0.8 23	0.612	0.802	0.594	0.877	0.789
Hardness (kg/sqcm)	6.5±0.02	6.0±0.04	6.5±0.05	6.0±0.05	6.5±0.04	6.0±0.04	7.5±0.06	6.5±0.05	6.5±0.05	6.0±0.02
Wetting time (sec)	26.25	49.72	18.92	24.69	35. 18	34.61	40.72	50.26	46.83	65.62
Water absorption ratio	88.78	65.83	95.36	90.22	84. 54	87.71	75.43	63.57	70.15	48.13

Table 3: Dissolution Profile

Formula Code	10min	20min	30 min
F1	74.33	90.4	98.43
F2	70.31	86.38	94.41
F3	71.11	87.18	95.22
F4	72.32	88.39	96.42
F5	75.13	91.2	99.24
F6	74.73	88.39	92.41
F7	69.1	78.34	89.19
F8	68.3	79.55	89.59
F9	67.9	88.39	90.4
F10	65.12	84.2	96.17

Conclusion

Although super disintegrants and lubricants were considered as inert, the nature and the concentration of the super disintegrant/ lubricant influenced the dissolution rate of the drug. With increase in the concentration of the super disintegrant, the dissolution rate of the drug increased whereas with increase in the concentration of the lubricant, the dissolution rate decreased.

References

1. Balasubramaniam J, Bee T. Influence of super disintegrants on the rate of drug dissolution from oral solid dosage forms, pharmaceutical technology; c2009. p. S6-S14.
2. Balasubramaniam J, Bindu K, Rao VU, Ray D, Halder R, Brzeczko AW. Effect of super disintegrants on dissolution of cationic drugs, dissolution technologies. 2005;15(2):18-25.
3. http://www.pharmapedia.com/tablet: formulation of tablets/ lubricants.
4. Banker UV. Pharmaceutical dissolution testing: Factors that influencing dissolution testing, Marcel Dekker, New York; c1992. p. 151.

5. Levy G, Gumtow RH. Effect of certain tablet formulation factors on dissolution rate of the active ingredient 111: Tablet lubricants, journal of pharmaceutical sciences. 1963;52(12):1139-1144.
6. Liberman HA, Lachman L, Schwartz JB. Pharmaceutical dosage forms: Tablets, volume 1, 2nd ed, marcel dekker, New York; c2000. p. 439.
7. http://www.drogbank.com/cardiovascular drugs/atenolol.
8. Indian pharmacopeia. The Indian pharmacopeia Ghaziabad; 2007. p. 111.
9. USP 27/NF 22, Asian edition: General test procedure, U.S. pharmacopoeil convention, Rockwille MD; c2000.
10. http://www.accessdata.fda.gov/scripts/cder/drugsatFDA /index.cfm.