

Evaluating the Reconstitution of Intramuscular Ziprasidone (Geodon) Into Solution

To the Editor:

The management of the agitated patient with underlying psychiatric illness is a common problem in emergency medicine. Often, these patients may be violent and require physical or chemical restraint. In the situation where the patient is unlikely to accept oral medication, emergency physicians have typically administered haloperidol intramuscularly. This treatment is often given in combination with a small dose of intramuscular lorazepam, a benzodiazepine.^{1,2} Recently developed atypical antipsychotic agents offer advantages over older antipsychotic medications in part because they cause fewer side effects, such as dystonia, akathisia, and tardive dyskinesia.³ The only intramuscular atypical antipsychotic currently available is ziprasidone (Geodon), which has been available in the United States since August 2002.

Powdered ziprasidone is provided in a glass vial and reconstituted with 1.2 mL of sterile water. One milliliter of the solution (20 mg) is typically given intramuscularly as the recommended dose. An instructional card originally provided states that reconstitution is achieved after 1 minute of vigorous shaking. Current reconstitution guidelines provided in the package insert by the manufacturer

advise to "shake vigorously until the entire drug is dissolved and affords a colorless to pale pink solution."⁴ There is no mention of the time required for complete reconstitution in the package insert. We conducted a small evaluation of the solubility of ziprasidone using 1.2 mL of sterile water. Sixteen vials of medication were reconstituted according to direction, 8 by vigorous manual shaking and 8 using a commercially available agitator (Model #AB1A3201, Scientific Industries Incorporated, Bohemia, NY). The time required for complete reconstitution using a visibly clear solution as the endpoint was recorded. We checked each sample at 30-second intervals for clarity with a quick visual evaluation under a bright light (Table).

The agitator yielded a mean reconstitution time of 5.6875 minutes (± 0.53 minutes). A manual shaking method produced a mean reconstitution time of 2.875 minutes (± 0.3535 minutes). A significant difference was found with a 2 sample *t* test ($P < .001$). We found the samples achieved a clear appearance when held up to a bright light in this time with no trace of pale pink as stated in the package insert.

Our study provides preliminary information on the amount of time needed to successfully reconstitute ziprasidone. We found that hand shaking provides a quicker and more effective method of reconstitution than that of a commercially available agitation machine. Two to 3 minutes of the manual shaking method may seem to be too long in an emergency situation. One option is to store reconstituted ziprasidone, which is done out of sunlight at room temperature (15° to 30°C [59° to 86°F]) for 24 hours or in a refrigerator (2° to 8°C [35.6° to 46.4°F]) for up to 7 days.

We found the time needed for complete reconstitution of ziprasidone to be between 2.5 to 3.5 minutes by continuous hand shaking. In addition, an agitator used to aid in the dissolving of ziprasidone is a less effective method of

Table (Ewing).

Comparison of manual shaking versus agitator time for ziprasidone reconstitution.

Vial Tested	Manual Shaking Time, min	Agitator Time, min
1	3	5
2	2.5	6
3	2.5	6.5
4	3	6
5	2.5	6
6	3	5.5
7	3	5
8	3.5	5.5

reconstitution. It is our recommendation that ziprasidone be reconstituted by vigorous hand shaking and, if regular use is anticipated, stored in a refrigerator for immediate use in the acute agitated patient with underlying psychiatric illness.

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doi:10.1016/j.annemergmed.2003.08.015

We thank Gary Phillips, MAS, Senior Consulting Research Statistician, Center for Biostatistics, The Ohio State University.

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