Evaluation of Inhaler Technique Using the Aerosol Inhalation Monitor

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The objective of this study is to determine if the Aerosol Inhalation Monitor (AIM) can assist patients in learning correct inhaler technique and assess retention. A 9-month study was conducted in 5 Midwest pharmacies. Patients were eligible if they had filled a prescription for a metered-dose inhaler within 6 months. Consenting patients demonstrated their inhaler technique using the AIM. If they used improper technique, patients were trained and allowed to retry. Positive test patients (2 consecutive proper technique demonstrations without aid of the gauges) were assessed in 2 to 3 weeks for retention. Of 33 patients, 2 used their inhaler correctly without training. After 2 training periods, 48.5% of these patients failed to demonstrate correct technique. The AIM can assist pharmacists in inhaler technique training and can promote partnerships in the care of asthma patients by determining the need for spacers, alternative delivery methods, or further training.

KEY WORDS: Asthma, AIM (Aerosol Inhalation Monitor), pharmacist intervention, inhaler technique.

IN 1996, asthma affected approximately 10.2 million adults and 4.4 million children in the United States.[1] It has been estimated to cause greater than 100 million days of restricted activity[2] and 423,000 hospitalizations per year with more than 5438 deaths annually.[1] Because of the complications and poor health outcomes arising from asthma, the proper use of medications is important.

Although individuals with asthma use various medication-delivery devices (eg, metered-dose or dry-powder inhalers) most of their lives, many patients do not exhibit proper administration technique.[3] With incorrect inhaler technique, much of the medication never reaches the lungs, leading to reduced medication effectiveness, excessive medication use, and increased costs.[4] Repetition of training at regular refills can help ensure retention of inhaler technique. According to the American Pharmacists Association special report on asthma, "It is . . . critical to reevaluate the patient's technique each time the prescription is refilled or renewed. Even patients who have been taught how to use their inhalers properly tend to 'forget' proper technique over time."[5(p9)]

Pharmacists are in a key position to educate patients on proper technique for new and refill prescriptions. The Aerosol Inhalation Monitor (AIM Vitalograph, Lenexa, Kansas) is a device designed to help teach patients proper inhaler technique. It may be particularly valuable for objectively demonstrating the inadequacy of technique to long-time inhaler users. This study evaluates the effectiveness of the AIM device as a tool for educating asthma patients.

The AIM device (Figure 1) helps to assess a patient's inhaler technique using indicators and an incentive device. A placebo metered-dose inhaler is attached to the machine. The patient is instructed to attach a disposable mouthpiece to the placebo and use it as he or she would use his or her own inhaler. Following use, visual indicators either light green (correct technique) or red (incorrect technique) for each of the 3 major steps of proper inhaler technique. These steps include (1)

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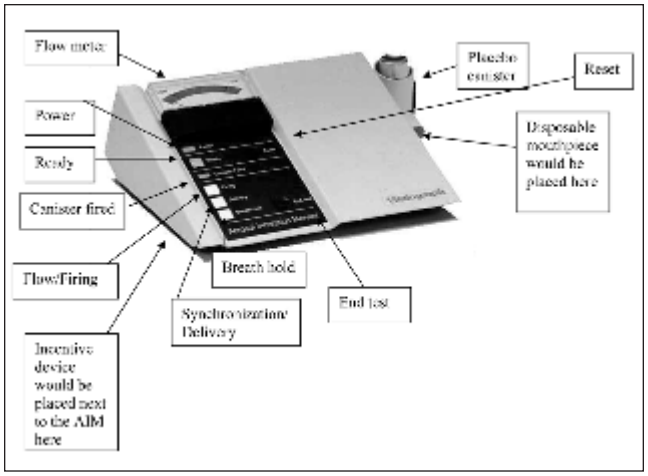

Figure 1. *Aerosol Inhalation Monitor (AIM) by Vitalograph. Used with permission from Vitalograph Inc.*

flow (eg, determines if proper airflow was attained when the inhaler was actuated), (2) synchronization (eg, continuation of inhalation), and (3) breath hold. The incentive device can be attached to the AIM device to assist patients, especially children, complete each step. This device uses a cartoon scene with torpedoes and a scuba diver. When the patient demonstrates proper inhaler technique, the scuba diver makes it to the surface and music plays.

OBJECTIVE

The primary objective of our study was to determine the extent to which the AIM device is able to assist patients in learning correct inhaler technique. Retention of correct inhaler technique also was assessed after AIM device-assisted training.

METHODS

The study was conducted in 5 community pharmacies. Two were located within the same building as a family practice clinic, and 3 were chain pharmacies. The pharmacies were the primary investigators' practice sites. Pharmacists and PharmD candidates at these sites were trained by the primary investigators on proper use of the AIM device and on study procedures. Sites were regularly contacted by the primary investigators to assess for procedural problems and progression of the study.

Patients were eligible if they presented to the pharmacy during the 10 weeks between August 28 and November 10, 2000, and had a prescription for a metered-dose inhaler (MDI) filled during the past 6 months. Prospective drug utilization review was used to help identify patients using an MDI but presenting to the pharmacy for a different purpose. Patients were excluded if they had used spacers/holding chambers, had previously used the AIM device, or had filled a 1-time prescription for an inhaler (eg, use < 10 days).

During the initial visit, patients signed an informed consent form explaining the study and provided demographic information (eg, age, gender, race). Patients then demonstrated their inhaler technique using the AIM device but without visual aid from the indicators and incentive device. If proper technique was demonstrated, the patient repeated the demonstration to assess attainment of a positive test (defined as 2 consecutive demonstrations of proper inhaler technique using the AIM device but without visual aid from the indicators and incentive device). Those who attained a positive test were scheduled for a follow-up appointment in 2 to 3 weeks to assess their retention of proper technique.

Patients who failed their first trial of inhaler technique or failed to achieve a positive test were trained in proper MDI technique using demonstration, printed literature, and the AIM device with the aid of the indicators and incentive device. Once patients felt confident in their technique, they tried again to achieve a positive test as previously defined. Patients failing to achieve a positive test after training were retrained and allowed another chance to achieve a positive test. If they were unsuccessful again, they were recorded as study failures and were referred to their physician with recommendations regarding alternative dosage forms or spacers/holding chambers.

A reminder call was made 1 to 3 days prior to the patient's follow-up appointment. If there was no answer and no messaging service available, 1 additional call was made. Patients failing to keep their follow-up appointment were called to reschedule within 1 week of their scheduled appointment.

At the follow-up appointment, patients attempted to achieve a positive test without additional training. If a positive test was achieved, they were scheduled for a 6-month appointment to assess retention. If unable to achieve a positive test in 2 attempts, patients were recorded as study failures.

Since the goal of the follow-up assessment was to assess retention, no additional training was provided until patients were recorded as study failures. At that point, patients were either offered the opportunity to

Table 1
Initial and Follow-up Visit Outcomes

AIM Device Training Outcome	Initial Visit (n = 33)		Follow-up* (n = 7)	
	n	%	n	%
Positive test without AIM device training**	2	6.1	3	42.9
Positive test with initial AIM device training**	14	42.4	4	57.1
Positive test with second AIM device training**	1	3.0	0	—
Study failures†	16	48.5	0	—

*Two- to 3-week assessment of inhaler technique.
**A positive test was 2 consecutive demonstrations of proper inhaler technique using the Aerosol Inhalation Monitor (AIM) device without using the indicators and incentive device.
†A study failure was 2 unsuccessful demonstrations (after retraining) of proper inhaler technique using the AIM device without using the indicators and incentive device.

be retrained using the AIM device, referred to their physician, or recommended alternative dosage forms or spacers/holding chambers.

The 6-month follow-up was planned in the same manner as the first follow-up, except patients were called and reminded 5 to 7 days prior to their appointment. Patients failing to keep their 6-month appointment were called and asked to reschedule within 2 weeks of their scheduled appointment.

RESULTS

Seventy-three patients were recruited to participate in the study. Eighteen patients declined enrollment, 16 were ineligible based on inclusion/exclusion criteria, and 6 were lost to follow-up. Thus, 33 patients completed the study.

For those patients declining enrollment, most were not interested or did not have the time to participate. Ineligible patients were currently using a spacer/holding chamber, had a 1-time inhaler prescription, or had previously used the AIM device. The 6 patients lost to follow-up were scheduled for an initial visit but did not return for the appointment.

Data on the initial visit were available for 33 patients. Of these 33 patients, 27 patients (81.8%) were female. The mean age was 39 (±18.5) years with a range of 8 to 70 years. Eight of these patients (24%) were 12 years of age and younger. Mean metered-dose inhaler use was 4.69 years with a range of less than a year to more than 30 years. The time spent with each patient at the initial assessment ranged from 5 to 15 minutes.

Two of the 33 (6.1%) patients were able to use their inhaler correctly without any training at the time of the encounter (Table 1). After pharmacist training with the AIM device, 15 of the 33 patients (45.4%) were able to use their inhaler correctly. Thus, a total of 17 patients (51.5%) attained a positive test. Sixteen patients (48.5%) were not able to demonstrate correct inhaler technique, even after 2 training sessions, and were classified as study failures.

Of the 16 patients who were unable to demonstrate correct technique, 5 patients (31.3%) were younger than 12 years. Also, these 16 patients had a range of inhaler use of less than 1 year to 10 years, with a median of 1 year and a mean of 2.3 years. These study failures were dispersed evenly across the 5 community pharmacy sites, ranging from 33.3% to 57.1% failures at each location.

There were a total of 10 recommendations for spacers made to the group of study failures. Five of the remaining study-failure patients requested additional education at a follow-up appointment. One patient's mother was a pharmacist and felt she could do further training at home.

Seventeen patients were scheduled for the 2- to 3-week follow-up; however, only 7 returned. Three patients (42.9%) attained a positive test, and 4 patients (57.1%) were able to demonstrate correct technique after retraining (Table 1). Three patients were scheduled for the 6-month follow-up, with none returning.

DISCUSSION

From this study, it appears that inhaler technique is largely inadequate. Of the 33 patients, only 2 patients were able to demonstrate proper technique without any training. Yet it appears that the AIM device was helpful in assisting patients with the development of proper inhaler technique. After training, 15 patients were successful. However, 16 patients were still having difficulty with their technique after training. The step of inhaler technique (flow, synchronization, and breath hold) at which the patients failed is unknown.

Similar to our findings, an earlier study using an AIM device found that there was a statistically significant increase in the percentage of patients correctly using a metered-dose inhaler after training with the AIM

device.[6] In addition, they found that at a 6-week follow-up, that inhaler technique was suboptimal. The authors suggested that continuing education is required to reinforce proper inhaler technique.

In our study, patients also were helped by using the AIM device, with 15 patients demonstrating proper technique. Similar to the earlier cited study, 4 of the 7 patients in our study required additional training with the AIM device to reinforce proper inhaler technique.

In a study focused on improving asthma patients' health outcomes, education on inhaler technique was provided primarily by the health care professional.[7] With continued instruction over a period of 1 year, the percentage of patients demonstrating proper technique progressively improved, suggesting the need for continual assessment and education in inhaler technique. Consistent with results from our study, the authors found that a low percentage of patients were able to demonstrate proper inhaler technique prior to patient education.

Although our sample is limited, this study, along with others, demonstrates a major education gap in the proper use of inhalers. The mean years of inhaler use for the study group at the initial visit was >4 years. Thus, the majority of patients had been using their inhalers improperly for years, perhaps leading to reduced efficacy of their medication and putting them at risk for respiratory complications.

By using the AIM device, the patient, as well as the pharmacist, was able to identify improper technique. The advantage is that patients can use the feedback to identify an error in technique and receive immediate training. After using the AIM device and receiving instruction from the pharmacist, many of the patients' technique improved. However, because of poor follow-up from patients, it is difficult to ascertain how long proper technique is sustained. The results from this study, as well as the others cited, suggest that technique deteriorates over time, indicating patients need to be assisted in this area of asthma care. The data from this pilot study suggest that larger studies are needed to show the true impact of using the AIM device in teaching appropriate inhaler technique and assessing retention. Future studies could also assess the relationship between inhaler technique using the AIM device and overall asthma control by looking at emergency room visits, status of respiratory function (FEV_1), absence from school or work, and frequency of rescue inhaler use.

A major limitation of this study was the lack of patient interest in participation and follow-up. Of the 73 patients asked to participate, 18 patients declined enrollment. There were 17 patients scheduled for the 2- to 3-week follow-up. Of these, 10 patients did not keep their appointment. For any future research of this nature, some type of incentive (perhaps some small monetary compensation) would be beneficial. Using an incentive may "open the door" to increasing patient interest by providing education. This gives the pharmacist an opportunity to develop a relationship and engage the patient about his or her health.

In retrospect, the timing of the follow-up assessments may have contributed to the lack of participation. The 2- to 3-week follow-up assessment was chosen because of concern for retention of inhaler technique. However, follow-up assessments conducted at monthly refills may have increased patient participation due to convenience.

Another limitation was the variation in prescription volume, staffing responsibilities, and pharmacist willingness to participate among the 5 sites. Prescription volume varied from approximately 100 to 300 prescriptions per day. Staffing responsibilities and time constraints, especially in the higher volume stores, may have limited pharmacists' participation. In addition, the pharmacists may not have felt a "duty" to participate, as this was not a study created by them. These sites had PharmD candidates on 4-week rotations, and the study was often designated by the pharmacists as a good "student project." PharmD candidates were involved with all 33 patients trained on the AIM device. Although student involvement is a good learning experience and helps facilitate pharmaceutical care efforts, this does not encourage pharmacists to take a more active role in the provision of care. PharmD candidates may not be as experienced in providing patient counseling as more seasoned practitioners. The fact that there were multiple students and practitioners involved in the project also could have introduced variability in the training that was provided to patients.

CONCLUSIONS

Although small, this study reinforces a need for inhaler technique training of patients using metered-dose inhalers. Although patients may be trained on inhaler use when first prescribed, it appears that they do not retain proper technique. Patients may require multiple training sessions to ensure correct technique is maintained and their medications continue to work effectively.

Using the AIM device, pharmacists can play a role in educating patients on correct inhaler use.

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