Compliance with long-term oxygen therapy by concentrator

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Controlled oxygen therapy has been developed to treat chronic respiratory failure in patients with hypoxic obstructive airways disease (COAD). In two studies published in the early 1980's long term oxygen therapy (LTOT) improved survival and reduced clinical deterioration over a three year period in such patients [1, 2]. The reduction in mortality was proportionate to the number of hours per day of oxygen therapy. The minimum daily time for clinical benefit was 15 hours with greater benefit for longer periods. It is important, therefore, that patients comply fully with prescribed therapy.

A number of studies are now reviewed to assess patient compliance under different regimens. In the MRC trial patients were prescribed oxygen therapy for at least 15 hours per day [1]. They were visited every 6 weeks at home and all patients had two monthly clinic appointments. The weighing of cylinders after use (in Sheffield), recording the time of use of concentrators (in Birmingham), and random visits to patients and assessment of liquid oxygen usage (in Edinburgh) all suggested that most patients took at least the prescribed amount of oxygen. In the NOTT trial patients were prescribed either nocturnal (12 h/day) or continuous (24 h/day) oxygen [2]. For the first 6 months of the study patients received weekly home visits by a nurse practitioner and were seen each month in an out-patient clinic. After the first 6 months they were visited at home at least once a month and examined in an out-patient clinic at least every 3 months. The patient and family members were required to keep written records of oxygen use. According to oxygen concentrator time-checks, nocturnal oxygen therapy patients averaged 12.0±2.5 (SD) h/day but continuous (24 h) oxygen therapy patients averaged 17.7±4.8 h/day. According to patients' logs 56% of continuous oxygen therapy patients used oxygen for 19 or more hours per day. This was considered to be good compliance with therapy [3]. The investigators believed compliance was good because patients were followed very closely and found it easy to believe that oxygen was beneficial to them.

EVANS *et al.* [4] reported their clinical experience with oxygen concentrators. In the first year, 14 concentrators were allocated to patients with cor pulmonale associated with COAD. Every three months technical staff visited the patient's home to read the hidden clock, change air filters, perform minor servicing and to ensure the concentration of oxygen delivered was at least 90%. Patients were seen at three monthly intervals in out-patients for clinical assessment. Patients used the machines for a mean of 13.3 hours per day (range 9.0–16.5 h). Instructions were for 15 h daily usage. Only two patients achieved 15 hours or more. After a further analysis 6 years later mean usage of the oxygen concentrators was 15 h/day (range 8.6–24). Fifty percent of patients used the concentrator for 15 h or more daily. The lack of compliance with a 15 h a day regimen and the inadequate arterial oxygen tension (Pao_2) of some patients needs further study. The lack of compliance is explained by non adherence to the prescribed flow rate, hypercapnia and machine problems. Patient support in the home is most important as patients need to be constantly reminded of their treatment.

VERGERET *et al.* [5] studied the use and benefit of portable oxygen in 159 hypoxic COAD patients on long term oxygen therapy prescribed at least 15 h/day oxygen. They were randomly allocated either to a control group (75 patients) with oxygen concentrators only or to a group (84 patients) with, according to centre, either oxygen concentrators plus gaseous portable oxygen in 0.4 m^3 cylinders or liquid oxygen in the form of a stroller and liberator. Patients were visited at home by an interviewer every month and had three monthly clinic checks. Daily oxygen therapy increased progressively for all patients during the first three months of the study as the patients adaptated to the equipment and, above all, to the interviewers visits. The benefit of regular and informative supervision of patients was emphasised, maximum benefit was achieved within the first three months after which no further improvement was noted.

Mean duration of oxygen therapy in the fixed oxygen group was 14±3 h/day; 53% of these patients took oxygen for less than 15 h/day. Portable oxygen increased the daily duration of oxygen therapy to 17±3.5 h/day and only 24% of patients took oxygen for less than 15 h/day. Twenty five percent of patients allocated portable oxygen never used it and 15% used portable oxygen only at home. The remaining 60% of patients with portable oxygen liked it. The authors claim that restricting factors were weight, appearance of the equipment and limited autonomy.

WALSHAW *et al.* [6, 7] reassessed the prescription of oxygen concentrators for long term oxygen therapy in one district in the United Kingdom and looked at factors influencing compliance. Their patients had no regular home supervision but they could call either their family doctor or concentrator company personnel in case of need. The prescribed number of hours oxygen therapy varied between 8 and 24 h/day. Comparison between the prescribed number of hours of oxygen therapy (13.3±4.2 h/day) with actual usage (14.7±5.3 h/day) showed no significant difference. Patients were likely to have a more effective oxygen prescription and be more compliant

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if they were seen by a respiratory physician than if the family doctor alone arranged the concentrator installation.

We are currently studying concentrator machines installed in 1986 in the UK by analysing contracting company records. Physicians vary widely in their prescribing habits and their patients even more in compliance (table 1). 36% of patients were prescribed oxygen for less than effective daily durations. Patient compliance deteriorated at higher daily prescribed hours.

Table 1. – O_2 usage of 531 oxygen concentrators installed in 1986 in the UK and subsequently removed

Category of daily O_2	n	Prescribed h	Actual usage h
<15 h daily	192	10.2 (4–14)	9.9 (0–24)
>15 h	339	17.9 (15–24)	13.4 (0–24)

Data taken from contracting company records of prescription and clock readings on the machines. Values are means with ranges in brackets.

Conclusion

LTOT is a complex and expensive treatment imperfectly understood by many physicians and patients. It requires a careful selection of patients, constant education to explain the nature of the disease and reason for therapy and a good home care service providing regular home visits. Compliance with therapy is below the level at which clinical benefit is to be expected in at least 50% of treated patients.

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Lessons from diabetes education?

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At the moment about 20,000,000 people world-wide are treated with insulin. This is unbelievable and even wonderful considering insulin was only discovered in 1921 by Banting and Best in Toronto. As we all know, diabetes is a chronic disease induced by a relative or absolute deficit in insulin, inducing hyperglycemia and, in the long term, leading to specific complications. Two different groups can be distinguished: type I or juvenile diabetes and type II diabetes. Each of them has its own characteristics and its own schedule of treatment.

It is only for the last 20 years that physicians have dealt with the typical management of 'chronic incurable' illness in which patients can participate in their own care. For diabetes, for example, it was in 1977 that the first congress was organized in Geneva by a specific study group (DESG= diabetes education study group). This group is a part of the European association for the study of diabetes (EASD).

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Is education helpful?

The first important question has to be "is education of the diabetic patient helpful?". Studies had shown that it reduced hospitalisation, especially for diabetic dysregulation and foot problems. It also reduced the acute complications (ketosis and severe hypoglycemia) as well as the number of leg amputations [5].

The disease and treatment characteristics

Before going in detail into the "education process" we have to describe the specific characteristics of therapy and disease. The therapy of diabetes is based on four areas: treatment with oral anti-diabetic medication or insulin injections, diet, physical exercise and education.