Comparative trial of manual and mechanical percussion technique with gravity-assisted bronchial drainage in patients with cystic fibrosis

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SUMMARY Chest physiotherapy still remains one of the most important aspects in the treatment of chest complications of cystic fibrosis. A mechanical device that allows the patient with cystic fibrosis to do his own chest physiotherapy will be of great benefit if it is as effective as manual percussion. 14 patients with cystic fibrosis using mechanical and manual percussion physiotherapy were studied by measuring sputum volumes, and FEV and FVC. Results with the mechanical percussor were as good as with the manual percussor and, therefore, it would be reasonable for the older patient to use the former on his own.

The life expectancy of patients with cystic fibrosis (CF) has greatly improved in recent years (Anderson and Goodchild, 1976), and most CF clinics are now having to extend their care to the adolescent and young adult. Any patient, as he grows older, resents having to depend on another adult for chest physiotherapy. We have, therefore, compared the use of manual with mechanical percussion as the latter would enable the patient to do his own treatment and thus gain independence (Denton, 1962).

Patients and method

14 patients with CF between ages 7 and 21 years who could co-operate with the use of the Vitalograph spirometer were chosen. At the time of testing the patients were in clinical remission. 11 were normally sputum producers and 3 produced sputum only when they had exacerbations of chest infection.

Apparatus. The mechanical percussion unit, Equi-Med percussor* (Fig. 1) operates on 230 volts at 200-3200 strokes/min using a 10-speed selector switch. All the children were tested using 230 strokes/min. The percussor weighs 1.588 kg. The

*Obtainable from Medical and Scientific Computer Services Ltd, Altona Road, Lisburn, Co. Antrim, N. Ireland.

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unit is applied to the chest wall, the percussor head being directly in contact with the rib cage (Fig. 2) over the selected segment of the lung to be drained.

Fig. 1 *Equi-Med percussor.*

Fig. 2 *Teenage patient using the percussor.*

The percussion was interrupted only for expectoration and change of position.

Experimental conditions. Patients were treated on one day with manual and the next with mechanical percussion, random sampling tables being used to determine the initial method. Each patient was treated at the same time each day. The Vitalograph readings were FEV₁, FVC, FER, the readings being taken at 10-min intervals for one hour after treatment. Amounts of sputum were measured by weight.

The postural drainage positions were those described by Kendig and Chernick (1977).

Lower lobes

Four segments, right and left, anterior, posterior, lateral, superior.

Middle and lingular lobes

Upper lobes

Two segments, right and left, anterior, apical, using a treatment time of 32 minutes for each period.

The various lobes were treated in the same order in each patient and all segments were treated for a period of 2 minutes.

Table 3 Amount of sputum in 14 patients after manual and mechanical chest percussion

Case	Age (years)	Amount of sputum (g)	
		Manual	Mechanical
1	9½	8.51	15.42
2	8½	23.06	27.46
3	14½	18.54	8.09
4	12½	12.68	3.38
5	12½	18.54	8.09
6	12	—	—
7	7½	0.856	0.778
8	6½	1.55	1.33
9	20½	20.34	32.26
10	21	1.81	0.71
11	7	1.5297	1.7137
12	7	—	—
13	14½	—	—
14	8½	25.66 (vomit)	8.8413

Table 1 FEV₁ results (in litres) in 14 patients using manual and mechanical percussion

Case	Age (years)	Manual			Mechanical		
		Before	+ 10 min	+ 60 min	Before	+ 10 min	+ 60 min
1	9½	1.55	1.50	1.75	1.35	1.50	1.75
2	8½	0.85	0.70	0.85	0.85	0.77	0.90
3	14½	1.8	1.63	1.80	1.95	1.55	1.69
4	12½	1.30	1.25	0.74	0.72	0.80	0.86
5	12½	1.20	0.84	1.15	1.1	1.15	0.98
6	12	1.65	1.42	1.34	1.60	1.39	1.20
7	7½	0.45	0.55	0.65	0.45	0.45	0.51
8	6½	0.55	0.40	0.54	0.45	0.42	0.43
9	20½	0.82	0.74	0.77	0.81	0.75	0.80
10	21	2.85	2.92	2.05	1.90	2.45	2.80
11	7	0.50	0.51	0.50	0.56	0.45	0.48
12	7	1.75	1.65	1.60	1.63	1.73	1.70
13	14½	0.55	0.44	0.40	0.6	0.60	0.75
14	8½	1.25	1.34	1.15	0.98	0.95	1.50

Table 2 FVC results in litres in 14 patients using manual and mechanical percussion

Case	Age (years)	Manual			Mechanical		
		Before	+ 10 min	+ 60 min	Before	+ 10 min	+ 60 min
1	9½	2.15	2.10	2.40	1.85	2.10	2.30
2	8½	1.0	0.90	1.20	1.15	1.06	1.25
3	14½	2.30	2.20	2.30	2.50	2.15	2.20
4	12½	1.30	1.25	1.33	1.35	1.40	1.48
5	12½	1.65	1.56	1.75	1.70	1.95	1.80
6	12	2.10	2.00	2.06	2.20	2.00	1.85
7	7½	0.07	0.75	0.90	0.72	0.55	0.70
8	6½	1.15	1.15	1.30	1.20	1.19	1.15
9	20½	1.86	1.70	1.82	1.86	1.67	1.75
10	21	4.52	4.80	4.45	4.50	4.4	4.60
11	7	1.00	1.00	0.88	1.10	0.90	1.25
12	7	2.05	2.09	1.95	1.96	2.05	1.98
13	14½	1.25	1.00	1.10	1.45	1.53	1.53
14	8½	1.95	1.80	1.75	1.80	1.80	2.05

Results

The FEV (Table 1) and FVC data (Table 2) show there was no obvious difference between mechanical and manual treatment, and this was confirmed by statistical analysis. Amounts of sputum are shown in Table 3. It was suggested by the parents that the children coughed up more sputum when using the mechanical percussor at home but, when the actual amounts were measured, there was no overall difference.

Discussion

All patients and all parents (with the exception of one) preferred mechanical percussion. Patients found it was less tiring and that it gave them a sense of support. Most parents admitted that they felt that they could not do the manual technique as well as the trained physiotherapist and felt the children were not gaining maximum benefit. However, they thought the children received maximum benefit with the mechanical percussor. All patients could treat some segments themselves, particularly the upper lobes. The main disadvantage for the patient was the noise of the percussor. We find that small babies adjust to the mechanical percussor and often fall asleep during treatment. The youngest child who could use the percussor independently was 13 years. Small children could not reach the basal segments of the lower lobes and found the middle lobe difficult, although they could treat the upper ones.

It would appear that mechanical is as effective as manual percussion. The percussor costs about £85 (plus VAT). This is a large sum to spend, particularly as manual percussion can be just as effective. The main advantage of a mechanical percussion unit is that a teenage or adult CF patient can use it entirely on his or her own and thus be independent.

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