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# Effects of Pulsed Magnetic Field Therapy (PEMF) in the Treatment of Chronic Pain — A Pilot Study

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## ABSTRACT

*The value of pulsed magnetic field therapy in the treatment of pain was tested in a simple longitudinal study. In 22 patients with chronic pain refractory to conventional conservative methods, PEMF at 60 Gauss, 10 Hz was administered for 20 minutes per day for 10 days. Pain was assessed by use of a linear pain analogue scale, before and after each treatment session of the course. All patients showed significant subjective pain improvement after treatment.*

## KEYWORDS

*pulsed magnetic field therapy, electrotherapy, pain, chronic pain*

## INTRODUCTION

Chronic bone and soft tissue pain is a very common clinical problem. It can be disabling in those who do not respond satisfactorily to analgesics or local steroids, too high or too prolonged prescription of which may lead to significant side effects. (Anonymous 1982)

The underlying pathology may be quite heterogeneous, with fracture, delayed union, neuroma formation or collagen tissue abnormality as possible contributing factors. Of the various modalities of physical therapy, the application of pulsatile magnetic field of significant intensity to the diseased tissue, or pulsed magnetic field therapy (PMFT) have been reported to accelerate bone repair, nerve regeneration, skin ulcer healing, recovery from soft tissue injury, and collagen formation, all of which are mentioned as possible pathogenetic factors of chronic pain. Thus it could have great potential in the treatment of chronic pain. (Brighton 1981, Binder 1984, Kort 1980, Wolcon 1969, Sutcliffe 1982)

## A BRIEF HISTORY OF MAGNETOTHERAPY

Magnetic field therapy is not new. It was used as a laxative by the Greeks as early as 2000 B.C. and in the 11th century by the Arabs for treatment of liver and spleen pathology, ascites and baldness of head. (Pastakla, 1978, Paul, Roath, Melville 1968, Beisher 1971). It is interesting to note that oral ingestion of lodestone (magnets) was a component of some Chinese herbal combinations as early as the Chau Dynasty, (around 1000 BC — 221 BC) and

detailed record of such stories can be found in the books written by Sze Ma Chien (司馬遷) of Han Dynasty. (around 150 BC). In the Sung Dynasty, (around 12th century AD) there were records of external application of lodestone to the external auditory meatus for the treatment of hemorrhoids and anal prolapse was described as early as 700 AD, and can be found in the encyclopedia of herbs written by Li Sze Chun of Ming Dynasty. (around 15th century AD) (Chen 1976).

The unique feature of Chinese magnetotherapy was its theoretical correlation with acupuncture points and meridians. Similiar approaches have been adopted by Japanese and Korean herbal doctors. (Chen 1976) The mysterious Chinese Geomancy (FUNGSHUI), in fact, has many of its principles and calculations related to earth magnetism, and many of the 'deleterious' fungshui were ascribed to poor positioning of the bed or table in position to meridians of terrestrial magnetism. (Pastakia 1978, Reite 1978)

On the other hand, Western Magneto therapy principles have been more related to the physiological effects of magnetism on cell, membranes, and ions. (Wever 1976) It is important to remember that life developed under the influence of terrestrial magnetic fields. Around twenty different effects of weak magnetic field on biological systems were listed in 1964 (Wever 1976) specific natural electromagnetic frequencies around 10 Hz. trigger endogenous biological rhythms (Halpern 1976). Shielding the terrestrial magnetic field leads to many health problems including loss of calcium and stunted growth in mammals.

Though basic electromuscular phenomena were discovered as long ago as the early 18th century, the mechanism of cell regulation and communication was little understood. It was not until the 1960s with the substantial financial and research facilities of National Aeronautics and Space Administration of USA and Soviet space research centres, that the possible effect of magnetic fields on the human organism were seriously studied. (Reite 1978, Wever 1976, Halpern 1976).

The loss of calcium from bone has been blamed on the weaker magnetic field found in space. Also, a change in the voltage across the cell membrane can be found with many illnesses. This contributes to the slowing down of the metabolism. Magnetic field therapy may thus help to restore the cells so affected, to their normal metabolism. The theory of the pulsed positive magnetic field of low frequency, thus resulting in ion flow across the cell membrane. This flow is decided by the frequency chosen. (Cohen 1967)

Magnetotherapy has been intensely studied for its role in bone union. (Brighton 1981, Sutchiffe 1982) In Hong Kong, it also has been extensively publicised in the mass media being applied in form of necklaces and as adhesive plaster over tender points for pain cure. It has also been reported by newspapers to have been used in the management of injured racing horses. However, locally published studies on pain relief are not available. The present article describes an attempt to quantitatively monitor the efficacy of pulsed magnetotherapy.

#### PATIENTS AND METHODS

In November 1987, a series of 22 patients, all with chronic pain of duration greater than 2 months were treated with pulsed magnetic field therapy. Clinical details for all patients are given in table 1. All had significant pain that required regular analgesics in spite of which the pain severity had been static or increasing (as evidenced by increasing demand of analgesics), for at least 1 week before receiving pulsed magnetic field therapy. Another selection criteria for admission into the study was that they must be able to stay in hospital throughout the study. Use of the linear analogue scale and the purpose of the magnetotherapy were explained to all patients before the trial.

male: female=	11:11
age: 14 - 17 average	50
education: above primary	7 below primary 15
duration of pain before treatment	7 months (longest 1 year)
nature of pain:	
Soft tissue injury	7 7
low back pain	5 5
neck pain	2 2
fracture of limbs	8
number of sessions completed:	
10 sessions	: 9
9 sessions	: 4
8 sessions	: 4
6 sessions	: 4
dropout	: 1

Table 1. Patient data of the study

Patients were noted for details like their age, sex, occupation, diagnosis, duration of pain, previous treatment and results.

The patients were seen once during each day of the course. A Magnetopulse PPM 'System H' machine was utilised to administer 20 minutes of treatment of 60 Gauss (unit of magnetic flux density) at 10 Hertz, for 10 sessions.

#### LINEAR PAIN ANALOGUE

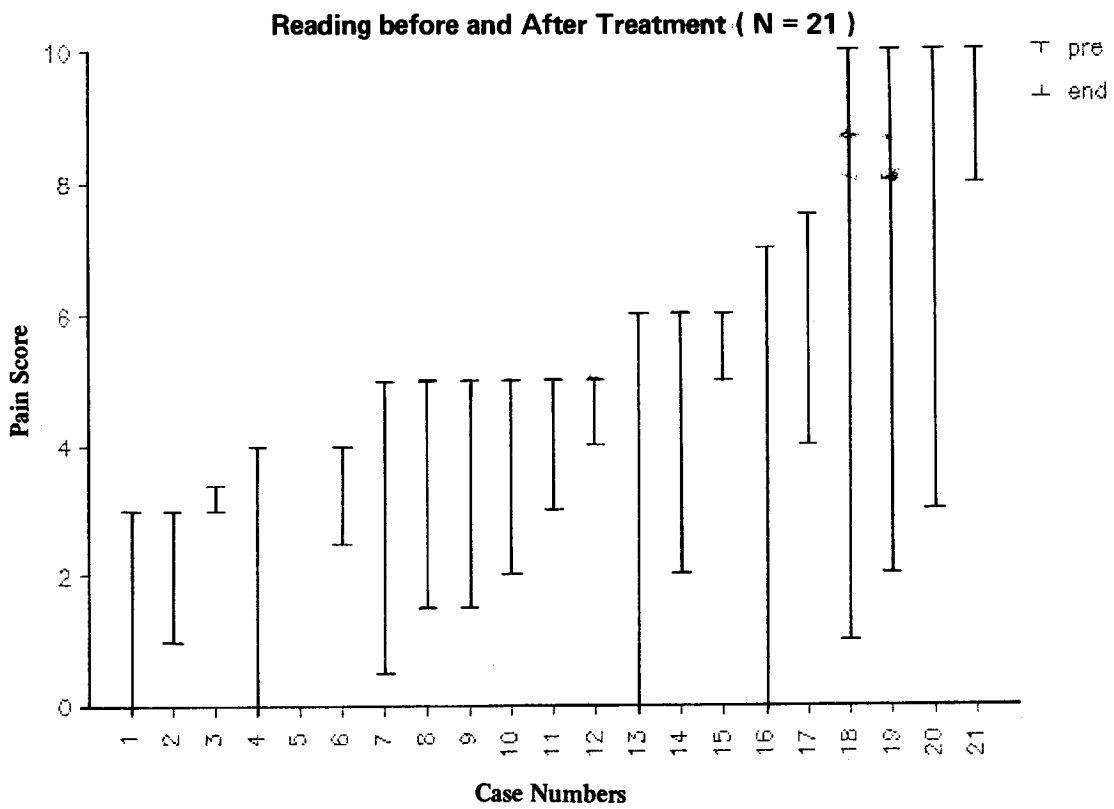
A linear pain analogue similar to one adopted by Revil et al was used. (Revo, 1976) A score of 0 indicates a state of mental and physical comfort. A score of 10 indicates the worst pain ever experienced. The scores in between represent a subjective measurement of the pain experienced. The patients were asked to mark the scale according to their level of pain, before and after each treatment throughout the course. 11 of the patients were given, in addition, a compass which visually demonstrated the magnetic field changes. (Appendix 1).

#### RESULTS

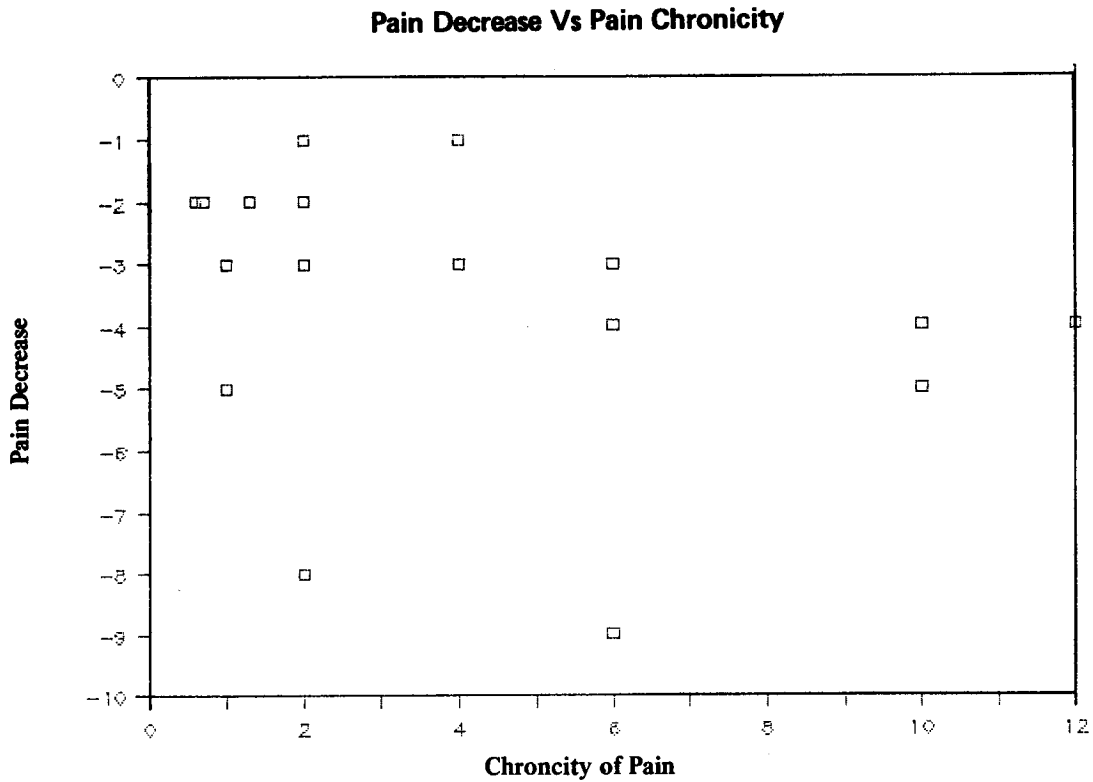
The subjective pain score before and after the course of magneto therapy is noted in table 2. and presented in graph 1. Most of the patients demonstrated an improvement in pain after each treatment, the average improvement being 1 point along the scale. Amongst those who did not show improvement after each daily treatment, all demonstrated pain decrease of various degree after completing the course of treatment, the average improvement being 3.5 points, ranging from a maximum of 9 points to a minimum of 1 point.

patient no.	pain score before treatment	pain score after treatment	difference
1	3	1	2
2	5	3	2
3	4	1	3
4	7	4	3
5	6	1	5
6	10	8	1
7	6	5	1
8	4	1	3
9	10	2	8
10	4	2	2
11	5	2	3
12	5	4	3
13	8	4	4
14	10	1	9
15	10	1	9
16	5	1	4
17	5	1	4
18	4	0	4
19	6	1	5
20	7	3	4
21	5	1	4

Table 2.

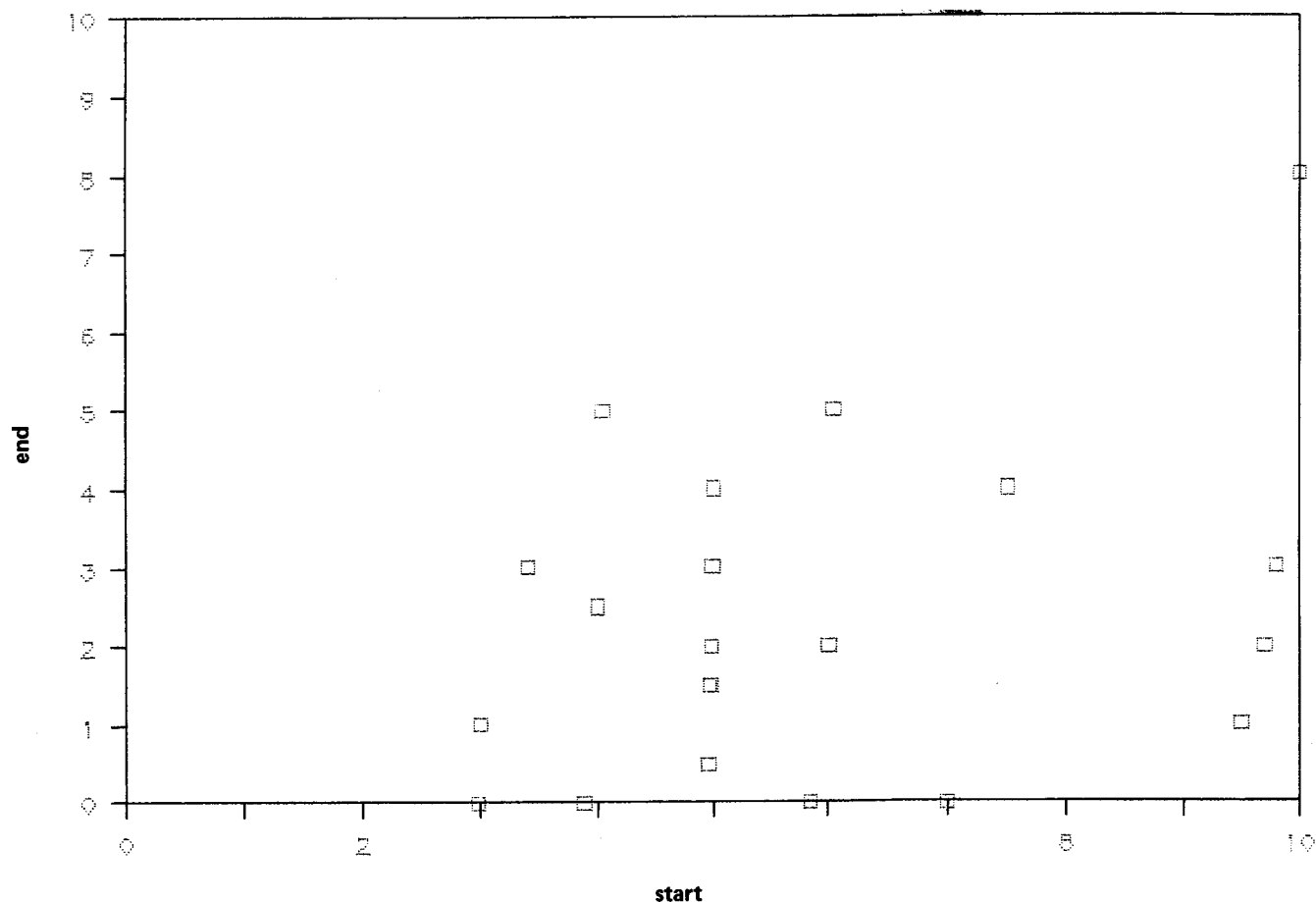


**Graph 1.** Showing the pain level before and after the whole course of treatment with a decrease in all cases.



**Graph 2(a).** Showing the degree of pain decrease versus chronicity of pain. No correlation could be demonstrated. Thus acute pain with spontaneous decrease was not likely.

## Correlation of Pain Severity Before and After treatment



**Graph 2(b).** Showing severity of pain before, versus that after treatment. No definite correlation could be demonstrated. Thus the more severe pain may not be relieved more.

We could not demonstrate any significant relationship between chronicity of pain and the degree of relief. (graph 2A) and the severity of pain and the degree of relief (graph 2B) Also, we could not demonstrate any relationship between the other recorded parameters to the degree of pain relief. The use of a compass as a visual stimulus was planned in 11 patients. However, it did not result in significantly different pain decrease. The method was thus abandoned halfway through the study. Similarly education level was not found to correlate with pain relief. As less educated patients may be more suggestible and more sensitive to placebo effect, this probably indirectly reflects that the effect of pulsed magnetic field therapy on pain was genuine and not a placebo effect.

### DISCUSSION

Our study was simple, uncontrolled, and done on a small sample, yet it indicated improvement during the 10 day period. The improvement could not be due to spontaneous changes, because the pain severity had been static for long duration before therapy. Our current choice of magnetic field strength and frequency was arbitrary, based on the empirical results of previous studies. Also, as this is not a double blind study, placebo effect could not be totally excluded. Thus controlled double blind studies in larger patient sample groups would be worthwhile. Also, studies to evaluate different therapeutic schemes on different pathologies would also be helpful to elucidate further the efficacy of magnetotherapy.

PAIN RELIEVING EFFECT OF PULSE-MAGNETO-THERAPY

Name:.....Serial No.....

Age:.....

Sex:.....

Occupation:.....

Education: Under Primary

Primary

Secondary

Tertiary

Diagnosis:.....

Pain - Acute

- Chronic .....Year.....Month.....Day

Previous Treatment:.....

- Post-op.

- #

- L.B.P.

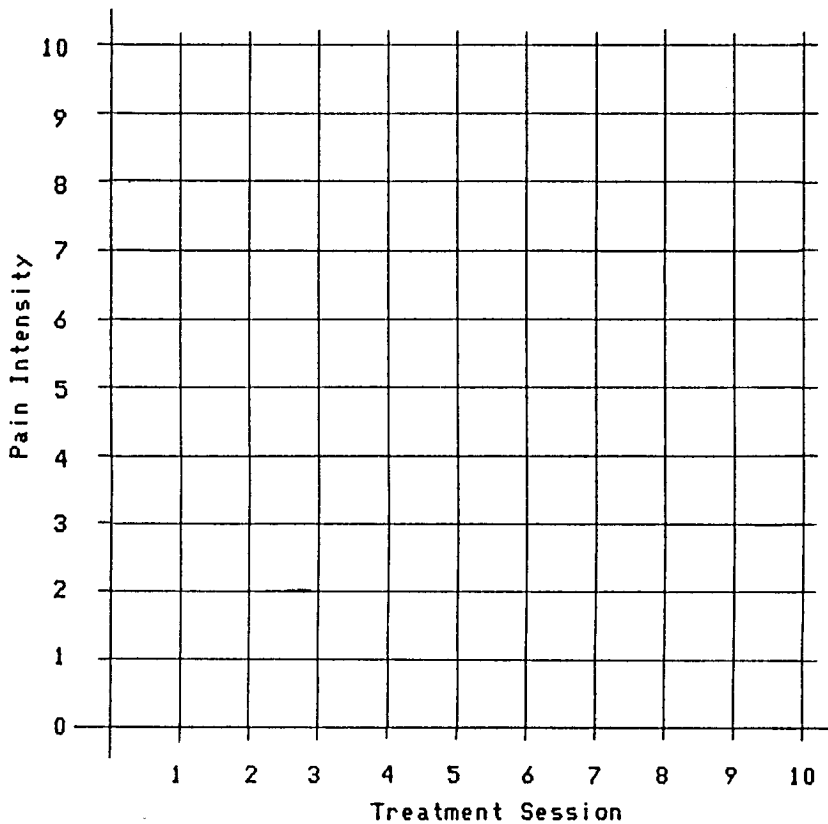
- Others.....

Treatment

- No. of session:

- Daily

- Dosage: 20 minutes x 60 Gs x 10 Hz



Key:

A - After Rx

B - Before Rx

Day	1	2	3	4	5	6	7	8	9	10
Date										
A										
B										

Comment.....  
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Appendix 1. The patient chart.

## ACKNOWLEDGEMENT

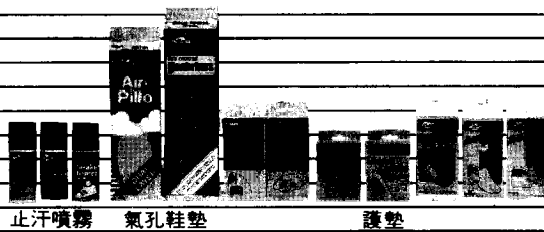
We would like to thank Archer Medical Co. for sponsoring the instrument for the study.

## REFERENCES

- Anonymous (1982). 'Electromagnetic fields and bone (Editorial)', *Journal of American Medical Association*, 247, (5) : 669
- Beischer DE(1971). 'The null magnetic field at reference for the study of geomagnetic directional effects in animals and man', *Annals of the New York Acadamey of Sciences*, 188, 12: 323-343
- Binder A, Parr G, Hazlemen B (1984). 'Pulsed electromagnetic field therapy of persistent rotator cuff tendinitis', *Lancet*, March: 695-698
- Brighton CT, Black J, FriedenberG ZB et al (1981). 'A multicentre study of the treatment of non-union with constant direct current', *Journal of Bone and Joint Surgery*, 63: 1-13
- Chen SK, Li SF, Fong LC et al (1976), *Magnetotherapy*, 1st ed., Shangshi People's Press, Shangshi.
- Cohen D (1967), 'Magnetic fields around the torso: production by electrical activity of the human heart' *Science*, 156: 652-4.
- Halpern VD (1976). 'Space biomagnetics', *Space Life Sciences*, 1: 12
- Kort J, Ito H, Bassett CAL (1980). 'Effects of pulsing electromagnetic fields on peripheral nerve regeneration', *Journal of Bone and Joint Surgery*, 4: 238.
- Pastakia B (1978). 'Biological effects of electromagnetic fields', *New England Journal of Medicine*, 298(24): 21
- Paul F, Roath S, Melville D, 'Differential blood cell separation using a high gradient magnetic field', *British Journal of Hematology*, 38: 273.
- Revil SI, Robinson JD, Rosen M, Hogg MIJ (1976). 'Reliability of a linear analogue for evaluating pain', *Anaesthesia*, 1: 1191-1198
- Reite M, Zimmermann J (1978). 'Magnetic phenomena of the CNS', *Annual Review of Biophysics and Bioengineering*: 167-188.
- Sutchiffe ML, Boldberg AAJ (1982). The treatment of congenital pseudoarthroses of the tibia with pulsing electromagnetic fields' *Clinical Orthopaedics*, 165: 53-57.
- Wever R (1976). 'Effect of magnetic field on biological system', *Neuroscience Research Program Bulletin*, 15, 1: 39.
- Wolcon TE, Wheeler PC, Rowley BA (1969). 'Acclerated healing of skin ulcers by electrotherapy', *South Medical Journal*, 62:

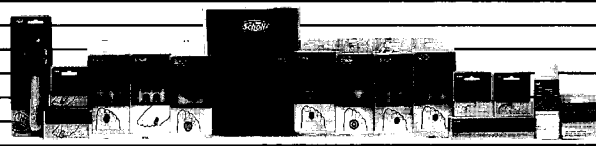
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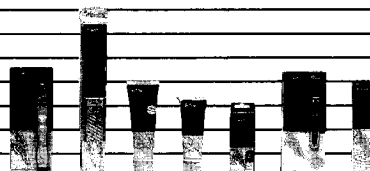
止汗噴霧    氣孔鞋墊    護墊

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