Table 1: Controlled clinical trials of progressive muscle relaxation for cancer

Source: Ava Lorenc, CAM-Cancer Collaboration. Progressive Muscle Relaxation [online document]. CAM Cancer cam-cancer.org, 2024.

First author Year	Study design	Participants Diagnosis (number)	Interventions/controls	Main outcome measures	Main results	Comments
Anshasi 2023	RCT	Cancer patients receiving palliative care (n=148)	1) PMR 2) Usual care	1) Brief Pain Inventory (BPI)	Significant decrease in pain intensity, pain interference with general activity, mood, relations with others, sleep, and enjoyment of life scores for the PMR group compared to the control group at both T1 and T2 ($p < 0.05$)	Well conducted and reported. Large, powered sample.
Barton 2019	RCT	Women with breast or gynecologic cancer (n=87)	1) PMR 2) Hypnosis	1) Impact of Treatment Scale (ITS) (body image) 2) Sexual Self-Schema Scale for women) 3) Positive/Negative Affect Scale-PANAS 4) Patient-Reported Outcome Measurement Information System (PROMIS) sexual health measure 5) Perceived change (Global Impression of Change Scale-GICS) 6)Adverse effects.	Both groups reported significant improvements on body image over time (within group effect size Cohen's d = 0.49–0.75) with no significant difference between groups (p = 0.15). Secondary outcomes were not significantly different between groups. One participant in the hypnosis arm had grade 1 agitation at week 4 and one grade 1 restlessness at week 1. There were no adverse effects reported in the PMR group.	Lack of info on randomization. Small sample size with potential lack of power. No non treatment control. Included fidelity checks on interventions.
Cannici 1983	RCT	Patients with a variety of different cancers (n=30)	1) PMR 2) Usual care	1) Daily sleep questionnaire 2) State-Trait Anxiety Inventory	The mean sleep onset latency was reduced from 124 to 29 minutes in the intervention group, but only from 116 to 104 minutes in the group receiving routine care.	Small sample size
Cotanch 1987	RCT	People with different types of cancer (n=60)	1) PMR 2) Control group where participants listened to music 3) Usual care	1) Duke Descriptive Scale (DDS) 2) State-trait anxiety inventory	A statistically significant difference was obtained for the dependent variables of vomiting (p=0.03), trait anxiety (p=0.05). Difference obtained for the variables of nausea and state anxiety were not significant at the 0.05 level.	Minimal information given about randomisation method.

Dikmen 2019	RCT	Gynaecological patients undergoing chemotherapy (n=80)	1) Reflexology 2) PMR 3) Reflexology + PMR 4) Control (unclear what)	1) Brief Pain Inventory 2) Fatigue Inventory 3) Multidimensional Quality-of-Life Scale – Cancer 4) Adverse effects	Although mean difference of in-group fatigue severity scores between the control group ($p = 0.196$) and the PMR-only group ($p = 0.076$) was statistically insignificant, mean score of fatigue effects on daily life was significantly lower in the PMR-only group than the controls ($p < .05$). Patients reported no adverse effects or harm after the interventions.	Reporting has many limitations e.g. no details on what control group received, numbers in flow chart don't add up. Baseline differences in pain scores were not adjusted for, analgesia use was not controlled for. Sample size powered but quite high loss to follow-up. Patients and researchers were blinded.
Goerling 2014	Prospective randomised	Women with gynaecological cancer (n=45)	1) Single psycho-oncological session 2) Single session PMR	1) Hospital Anxiety Depression Scale (German version) 2)Perceived stress questionnaire 3) Physiological stress parameters measured by a portable Nexus-10 device	Both types of intervention may reduce anxiety. A single psycho-oncological session might be slightly more effective in treating depression ($p=0.078$). A single PMR session has a slightly stronger effect on physiological stress parameters ($p=0.031$)	Small sample size reduces external validity. Both interventions only consisted of a short single session.
Gok Metin 2019	RCT	Early breast cancer patients receiving paclitaxel. (n=63)	1) PMR 2) Mindfulness medication 3) Usual care	1) Brief Fatigue Inventory (BFI) 2) Coping styles: brief COPE, 3) Functional Living Index-Cancer	A significant reduction in the BFI scores in the PMR group compared to control ($p=.002$). The use of emotional support and positive reframing subdimension scores of Brief COPE were significantly higher in the PMR group than control at weeks 12 ($p=.017$) and 14 ($p=.042$). Planning and active coping sub-dimension scores were significantly higher in the PMR group than control ($p=.000$). No significant difference in QOL. No participants dropped out owing to unexpected adverse events of PMR.	Not registered. Well conducted and reported. Good sample size with low loss to follow up.

Haase 2005	RCT	Elderly colorectal carcinoma patients undergoing conventional resection (n=60)	1) PMR (audiotape only) and standard care 2) Guided imagery (audiotape only) and standard care 3) Usual care	1) Patient controlled analgesia (PCA) 2) Subjective pain intensity using VAS	Analgesic consumption (P = 0.6) and subjective pain intensity at rest (P = 0.3) and while coughing (P = 0.3) were not different between groups. Recovery of pulmonary function, duration of postoperative ileus, and subjective postoperative fatigue were also not influenced.	Some details of randomisation are missing. Sample size powered. Minimal loss to follow-up. Patients and investigators blinded as to which of the two interventions patient had received. PMR was audiotape only. Collected data on practice (average 10 times/week after surgery)
Holland 1991	RCT	Patients with a variety of cancers (n=147)	1) PMR (face-to-face and audiorecording) 2) Alprazolam	1) Covi Anxiety scale 2) Raskin Depression scale 3) Affects Balance scale 4) Symptoms Checklist-90 (SCL-90).	Both groups reported a decrease from baseline levels in anxiety and symptoms of depression, although patients receiving the drug showed a slightly more rapid decrease in anxiety and a greater reduction in depressive symptoms	No non-treatment control arm included. Sample size not powered and quite high dropout.
Isa 2013a (*note 2013a and 2013b are based on the same study*)	Non-randomised quasi-experimental	Men with prostate cancer (n=138)	1) PMR 2) Matched comparison group (no intervention)	1) SF 36	Significant between group difference for mental component summary (MCS) (p=0.0327) and overall HRQOL (p=0.042). No significant between group difference for physical component summary (PCS) (p=0.965).	Lack of randomization, principle investigator also conducted PMR. Questionnaires were self-administered.
Isa 2013b (*note 2013a and 2013b are based on the same study*)	Non-randomised quasi-experimental	Men with prostate cancer (n=138)	1) PMR 2) Matched comparison group (no intervention although they did receive general information about prostate cancer and quality of life issues)	1) Depression Anxiety Stress scale -21 (DASS-21)	Significant improvements in anxiety and stress were reported in both groups (p<0.01). No reported improvement in depression scores (p=0.956) in either group.	Lack of randomization, principal investigator also conducted PMR. Questionnaires were self-administered.
Jaya 2020	RCT	Cancer patients undergoing radiotherapy (n=50)	1) PMR 2) Group walking	1) Fatigue Symptom Inventory 2) Hospital Anxiety and Depression scale	Between group comparison showed no superior improvement one over the other.	Not registered. Small sample and no sample size calculation. Minimal information on randomization and other methods. No flowchart or information on loss to follow up. No no-treatment control. No limitations mentioned.

Kim 2016	Non-randomised quasi-experimental	Colorectal cancer patients undergoing laparoscopic surgery (n=46)	1) PMR (face-to-face, 10min sessions twice a day for 5 days) and treatment as usual (post-operative nursing care) 2) Usual care	1) Cortisol levels 2) Stress Arousal Checklist (SACL) 3) Blood pressure 4) Heart rate	Cortisol levels were significantly lower in PMR group on the first day after surgery (p=0.036) but not on the third or fifth days. Total SACL score was not significantly different (although three of the 30 items were). Systolic and diastolic blood pressure were significantly lower at 3 (p=0.043; p=0.003) and 5 days postoperatively (p=0.010; p<0.001). Heart rate was significantly lower at 1 day (p=0.002) and 3 days (p=0.010) postoperatively.	Powered sample size. Study was not randomised or blinded. No information on missing data.
Kirca 2021	RCT	Patients with lung cancer receiving chemotherapy (n=84)	1) PMR (via a recording) 2) Usual care	1) Memorial Symptom Assessment Scale 2) Strategies Used by People to Promote Health Scale.	The symptom scores (frequency, severity and level of distress) significantly decreased in the experimental group, compared with the control group (p = 0.0001). Similarly, self-efficacy scores significantly improved in the experimental group (p = 0.001)	Not registered. High loss to follow up and not included in analysis. Effect size not calculated.
Kurt 2018	Non-randomised open label trial	Breast cancer patients undergoing chemotherapy (n=49)	1) PMR 2) Usual care (given PMR after the study)	1) Edmonton symptom diagnostic scale (ESDS)	The severity of pain, fatigue, nausea, sadness, anxiety, sleeplessness, lack of appetite, feeling bad, shortness of breath, change in skin and nails and mouth ulcers were significantly less in the intervention group than in the control group. The severity of these symptoms significantly increased in the control group (p < 0.05).	Not randomised (although groups were homogenous for demographics and disease characteristics). Sample size powered based on a pilot study. Used reminders etc to encourage PMR practice - participants practiced an average of 5.5 sessions/week for average of 21 mins/session. However, the reminders may have affected the outcomes
Kwekkeboom 2008	Controlled pilot (crossover design)	Hospitalized patients with a variety of different cancers (n=40)	Each participant had two trials of PMR, two trials of analgesic imagery and two trials of a control condition	1) Imagery Ability Scale 2) Relaxation Ability Scale 3) Outcome Expectancy Scale 4) Edmonton Symptom Assessment 5) Pain intensity scale (not specified) 6) The Control Sub-scale from the Survey of Pain Attitudes	In comparing means between treatment and control conditions, both PMR and analgesic imagery produced greater improvements in pain intensity, pain-related distress, and perceived control over pain than the control condition. However, individual responder analysis revealed that only half of the participants achieved a clinically meaningful improvement in pain with each intervention.	Small sample size, no non-treatment control group included.

Loh 2022	RCT	Patients with head and neck cancer (n=60)	1) PMR (using a recording) 2) Usual care	1) VAS for: - muscle tightness - pain - fatigue - anxiety - depression - sleep disturbances.	The PMR group displayed significantly lower overall pain and muscle tightness than control group along with the timeline of multiple measurements ($p < 0.01$). PMR significantly reduces sleep disturbances and levels of fatigue, anxiety, and depression compared with the control group with time trend ($p < 0.01$). PMR also lowered the respiratory rates and diastolic blood pressure ($p < 0.01$).	Sample was powered but quite high loss to follow-up. PMR using a recording rather than face to face. Unclear if they monitored practice/adherence.
Noruzizamenjani 2019	RCT	Cancer patients (n=80)	1) PMR (face-to-face) 2) Usual care	1) Strategies Used by People to Promote Health (SUPPH) questionnaire	Statistically significant difference between the means of self-efficacy (p=0.001).	Sample size was powered and there were no drop-outs. Randomisation described. Researcher-delivered PMR.
Ozhanli 2022	RCT	Patients undergoing colorectal cancer surgery (n=82)	1) PMR 2) Usual care	1) Short Form McGill Pain Questionnaire 2) State-Trait Anxiety Inventory (STAI) 3) Vital signs 4) Oxygen saturation	Patients in the experimental group had lower postoperative pain and anxiety levels and a lower rate of using opioid analgesic on postoperative day 0 compared to the control group. PMR had no statistically significant effect on serum cortisol or physiological parameters ($P > .05$)	Baseline difference in social support not mentioned. Lacking information on randomization. Some loss to follow up. Concludes PMR is safe but didn't appear to collect safety data.
Pathak 2013	Quasi experimental randomised controlled trial	People with a variety of different cancers receiving radiotherapy (n=100)	1) PMR 2) Usual care	1) Numerical Pain Rating Scale (NPRS) 2) Cancer Fatigue Scale (CFS)	A significant reduction in pain and fatigue ($p<0.01$) were reported in the intervention group. Fatigue levels increased significantly in the control group ($p<0.01$)	Randomisation process unclear. It is not clear if the outcome measures used are validated scales
Pifarré 2015	RCT	Oncological patients undergoing a stressful diagnostic medical intervention (n=84)	1) PMR (face-to-face) and usual care 2) Diazepam and usual care 3) Usual care	1) Brain glucose metabolism (measured by positron emission tomography)	Compared to reference control subjects, the PMR and diazepam groups showed a statistically significant, bilateral and generalized cortical hypometabolism (7–8% reduction in glucose utilization). No significant differences between PMR and diazepam groups.	No information on randomisation or drop-outs/missing data. Little information on recruitment.

Shirzadi 2022	RCT	Patients with breast cancer (n=82)	1) PMR 2) Escitalopram 3) Placebo	1) Menopause rating scale	Significant differences in in the mean number of diurnal hot flushes between the PMR and placebo groups ($p<0.001$). No significant difference between the escitalopram and PMR groups.	Trial was registered. Protocol states sample size of 87 but study included only 82, with no sample size calculation. Minimal information on randomisation reported. No control for PMR.
Simeit, 1991	RCT	Patients with a variety of different cancers (n=229)	1) Multi-modal psychological sleep management programme 2) Standard rehabilitation programme (including counselling, relaxation, psychological support etc)	1) Questionnaire derived from the Pittsburgh Sleep Quality Index (PSQI) 2) EORTC-QLQ-30	The intervention group participants benefited with moderate or large-scale effects on sleep latency ($p<0.001$), sleep duration ($p<0.001$), sleep efficiency ($p<0.001$), sleep quality ($p<0.001$), sleep medication ($p<0.05$) and daytime dysfunction ($p<0.05$).	PMR (n=80) and autogenic training (n=71) were equally effective in enhancing various sleep parameters and reducing the need for sleep medication. No non-treatment control group included.
Sulistyawati 2021	RCT	Children with cancer (n=30)	1) PMR 2) Usual care	1) Pain assessment questionnaire with numeric rating scale 2) Rhodes index of nausea, vomiting, and retching (Rhodes INVR) 3) PedsQL Multidimensional Fatigue Scale 4) Pittsburgh Sleep Quality Index (PSQI).	No average score difference of sleep quality, fatigue, pain, and nausea-vomiting was significant ($p > 0.05$).	Not registered. Small sample and did not achieve target sample size. Methods reporting is limited so difficult to evaluate potential bias. Abstract vs results very confusing – abstract implies a significant difference in sleep quality but results say not significant.
Vuttanon 2019	Quasi-experimental	Breast cancer patients undergoing chemotherapy (n=96)	1) PMR 2) Usual care	1) Edmonton Symptom Assessment Scale (ESAS). 2) Symptom severity VAS	Within the experimental group, the mean scores of Cluster 3 significantly decreased after PMR treatment ($p < 0.01$). When comparing the mean scores of the control group, there was a statistically significant reduction in Cluster 3, and 4 ($p < 0.01$).	Not registered. Powered sample size and no loss to follow up.