Head and neck systematic review

Review title

A systematic review of thermoplastic masks versus alternative immobilization methods in head and neck irradiation

Reviewers

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Center conducting the review

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Review question/objective

Is an alternative immobilization method increasing reproducibility and comfort in head and neck cancer patients receiving radiotherapy compared to thermoplastic masks?

The quantitative objectives are to identify the effectiveness of a thermoplastic mask on the reproducibility of patient set up with specific observation to population systematic and random errors.

Other objectives are to identify if patient reported outcomes have been assessed on the experiences of immobilization methods in radiotherapy.

Background

In England and Wales around 7,000 patients are diagnosed with head and neck cancers each year. Patients with diagnosed head and neck cancers usually have a combination of treatment including surgery, chemotherapy and radiotherapy. The majority will have 30 days of radiotherapy. This implicates that annually more than 200,000 radiotherapy fractions are delivered. Patients receiving head and neck radiotherapy treatment firstly have a planning computerised tomography (CT) scan. They are placed in a position to restrict motion of their skeletal anatomy. The CT scan is transferred to a treatment planning computer and defines the treatment target area, position and size of radiotherapy beams and assesses the dose to normal tissues and organs. It is essential that the daily treatment position is a replica of the patient position and tumour delineated on the planning CT. The reproducibility and accuracy of the radiotherapy is what determines if the patient is cured, and that their acute and long-term side effects are limited. Currently, patients are positioned on rigid devices with their head and neck immobilised in a mask to aid reproducibility. Perspex or thermoplastic masks are used, although some studies have suggested using other methods and materials. However, the position of the skeleton and internal organs changes, therefore affecting accuracy. For
radiotherapy to the head and neck, the desired geometric accuracy targeting the
tumour is ≤3mm 5, 6, 7. Presently, intensity modulated radiotherapy (IMRT) and
volumetric arc radiotherapy (VMAT) is delivered to head and neck cancer patients,
and this extremely beneficial technique requires a high degree of geometric
precision. IMRT and VMAT are clinically utilised to enable a homogenous radiation
dose to the target and avoid the surrounding organs.

Local regional control in head and neck cancers have improved with advances in
radiotherapy such as a hyper-fractionated dose regimes (standard fractionation
70%> hyper-fractionated 60% at 5 years). Advances such as IMRT have improved
local control by 87% at four years 8. Presently there is little evidence to suggest that
IMRT increases overall survival. The patients quality of life should also be
considered hence a PHIII randomised controlled trial (The PARSPORT trial)
comparing an IMRT regime to standard regime of radiotherapy has shown a
decrease in side effects such as xerostomia 9. In addition, there is little clinical
evidence in relation to VMAT and overall survival or local regional control. However
the ART-DECO trial aims to combine hyper fractionation with VMAT looking at
overall survival and local regional control to fill this gap 10, 11. The quest to deliver a
therapeutic dose to the target and avoid dose to normal tissues, has led to adaptive
VMAT. As the external contour of the patient changes, due to tumour shrinkage or
weight loss, the plan can be adapted to account for this change and still achieve the
original planning parameters 12.

The advent of new treatment delivery methods such as IMRT, VMAT, ART, and
accelerated treatments mean that the immobilisation used must fit for purpose.
These new techniques require millimetre precision and this is mainly achieved
through effective immobilisation using a thermoplastic mask or alternative methods.
Radiotherapy clinics need to ensure they have the most effective immobilisation;
therefore the aim of this systematic review is evaluate the effectiveness of thermoplastic
versus an alternate immobilisation method in head and neck cancer irradiation.

Inclusion criteria

Types of participants

Patients undergoing radiotherapy to the head and neck

Inclusion:

Patients receiving minimal 5 fractions/episodes of treatment delivery verification imaging.
Any head and neck cancer, radiotherapy to the head and neck, 3D/4D CBCT,

Exclusion:

Cranial/intracranial irradiation only
2D planar imaging/Electronic portal imaging/ plain film

Types of intervention

Inclusion

thermoplastic masks and other alternative immobilization system, optical tracking systems

Exclusions
head rests/ mouth bites/stents

Types of outcomes
Population systematic and random set up errors of geometric displacements as defined by Herk 2004. Any authors/investigators not presenting their results like this will be contacted and their data requested.

Patient comfort - patient reported outcomes

Types of studies
This review will include both experimental and epidemiological study designs including randomized controlled trials, non-randomized controlled trials, quasi-experimental, before and after studies, prospective and retrospective cohort studies, case control studies and analytical cross sectional studies for inclusion.

Search strategy
The search strategy aims to find both published and unpublished studies. A three-step search strategy will be utilized in this review. An initial search of MEDLINE, EMBASE, CINAHL and Cochrane will be undertaken followed by analysis of the text words contained in the title and abstract, and of the index terms used. A second search using all identified keywords and index terms will then be undertaken across all included databases. Thirdly, the reference list of all identified articles will be hand-searched for additional studies. Studies published in any language will be considered for inclusion in this review. Studies published between 2004 and 2014 will be considered for inclusion in this review due to the technology used.

The search for unpublished studies will include:

Contacting investigators in the field and asking for the unpublished data.

Search terms used are:

Radiotherapy immobilization, radiotherapy immobilization for head and neck, all head and neck diagnosis, comfort of radiotherapy immobilization, head and neck set up error, reproducibility, and thermoplastic mask,

Assessment of methodological quality
The articles selected for retrieval will be assessed by two independent reviewers for methodological validity prior to inclusion in the review using the Cochrane collaboration data extraction and assessment form. GRADE will be used to assess the quality of the research. Any disagreements that arise between the reviewers will be resolved through discussion and an independent third reviewer.

Data collection
Quantitative data will be extracted from papers included in the review using the Cochrane collaboration data extraction and assessment form. The data extracted will include specific details about the interventions, populations, study methods and outcomes of significance to the review
question and specific objectives.

**Data synthesis**

Data will be tabulated and descriptively analyzed

**Conflicts of interest**

There are no conflicts of interest.

**Acknowledgements**

None

**References**


(4) Cheng KF, Wu VW. Comparison of the effectiveness of different immobilisation systems in different body regions using daily megavoltage CT in helical tomotherapy: Br J Radiol. 2014 Feb;87(1034):20130494


(10) ART DECO http://www.icr.ac.uk/our-research/our-research-centres/clinical-trials-and-statistics-unit/clinical-trials/art_deco
