A cost-utility analysis of patients undergoing orthognathic treatment for the management of dentofacial disharmony

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Record Status
This is a critical abstract of an economic evaluation that meets the criteria for inclusion on NHS EED. Each abstract contains a brief summary of the methods, the results and conclusions followed by a detailed critical assessment on the reliability of the study and the conclusions drawn.

Health technology
The orthognathic treatment of facial discrepancies was studied. The intervention consisted of a combination of orthodontic treatment and maxillofacial surgery.

Type of intervention
Treatment.

Economic study type
Cost-utility analysis.

Study population
The study population comprised patients with facial discrepancies. Further details on the inclusion and exclusion criteria were not reported.

Setting
The setting was an orthodontic/surgical unit. The economic study was carried out in the UK.

Dates to which data relate
No dates for the effectiveness or resource use data were reported. The price year was not reported.

Source of effectiveness data
The effectiveness data were derived from a single study, augmented by the authors' assumptions.

Link between effectiveness and cost data
The costing was performed prospectively on the same sample of patients as that used in the effectiveness study.

Study sample
Power calculations do not appear to have been reported. In addition, the method of sample selection was not described. A group of 21 patients (5 men and 16 women) were enrolled in the study, all of which were treated within the same orthodontic/surgical unit. Their mean age was 23 years (95% confidence interval: 20 - 26). Fifteen patients had bimaxillary surgery and 6 mandibular surgery alone. No patient was excluded from the initial study sample.

Study design
The effectiveness evidence was derived from a single cohort of patients who provided the data for the intervention.
group. A formal control group was not enrolled. The effectiveness data came from the Eastman Dental Institute for Oral Health Care Science at University College London. The patients were evaluated at the start and end of treatment, and three times during the treatment (6 months into preoperative orthodontics, at the end of the preoperative orthodontics, and 2 to 4 weeks postoperatively). No loss to follow-up was reported. The same person conducted all the interviews using a standard protocol. The total interview time for each patient was approximately 2.5 hours.

**Analysis of effectiveness**

All of the patients included in the study were accounted for in the clinical analysis. The primary health outcome used in the effectiveness analysis was represented by the utility values associated with the condition of dentofacial discrepancies. The time trade off (TTO) approach was taken, in which the patients were asked what length of life without their dentofacial discrepancy would be equivalent to their full life with it.

**Effectiveness results**

The utility values were not reported, although a graph was used to show that the utility values were higher after the treatment than before it. The graph was also used to explain the algorithm used to calculate the quality-adjusted life-years (QALYs).

**Clinical conclusions**

The effectiveness analysis showed that patient utility improved after the orthognathic treatment.

**Methods used to derive estimates of effectiveness**

The authors made some assumptions in the analysis.

**Estimates of effectiveness and key assumptions**

It was assumed that the patients' future life expectancy was 50 years (as the mean age of the respondents was 23 years). In addition, it was assumed that those patients who were not treated would remain at their current state for the remainder of their lives. This assumption appears to have provided the utility values for the control group.

**Measure of benefits used in the economic analysis**

The benefit measure used in the economic analysis was the QALY. The QALYs were calculated by multiplying the change in the utility value between the start and the end of treatment (effectiveness study) by the patient's future life expectancy (assumption). A 2% discount rate was used to discount future benefits.

**Direct costs**

A 6% discount rate was used since the costs were incurred over a long time period. The unit costs were not reported separately from the quantities of resources, although they were reported for a limited number of items. The health services included in the economic evaluation were orthodontic treatment, outpatient and inpatient services, and the operating theatre. The cost/resource boundary adopted in the study appears to have been that of the NHS. The unit costs were estimated on the basis of the Trust involved in the study and national NHS salaries. Resource use was estimated on the basis of the service consumption observed in the effectiveness study. The period during which the resource use data were collected was not reported. No price year was mentioned. It was assumed that those patients who were not treated did not incur any health service cost (zero costs in the control group).

**Statistical analysis of costs**

The costs were treated deterministically in the base-case, but confidence intervals (CIs) were calculated.
Indirect Costs
The indirect costs were not included.

Currency
UK pounds sterling ( ).

Sensitivity analysis
Sensitivity analyses were conducted on the cost side of the analysis to consider variations in the cost estimates. Low and high values were reported. The bootstrap method (1,000 iterations) was used to calculate the 95% CIs for the estimated QALYs. Uncertainty in the overall mean costs and QALYs was dealt with using the cost-effectiveness acceptability curve, which shows the health service payer's willingness to pay for the intervention.

Estimated benefits used in the economic analysis
The discounted mean QALYs for the complete treatment group were 5.67 (95% CI: 2.96 - 8.54).

A sub-group analysis showed that the estimated QALYs were 6.28 (95% CI: 3.31 - 9.61) among the patients undergoing bimaxillary surgery, and 4.14 (95% CI: -2.21 - 10.37) among those receiving single jaw surgery. These two groups made up the total treatment group.

The QALYs in patients not receiving any orthognathic treatment were assumed to be zero.

Cost results
The discounted mean costs per patient in the total treatment group were 3,182 (95% CI: 2,931 - 3,432). The low estimate was 3,015 (95% CI: 2,779 - 3,251) and the high estimate was 4,943 (95% CI: 4,527 - 5,359).

Among those receiving bimaxillary surgery, the discounted mean costs per patient were 3,431 (95% CI: 3,192 - 3,671). The low estimate was 3,249 (95% CI: 3,021 - 3,478) and the high estimate was 5,283 (95% CI: 4,810 - 5,765).

Among those having single jaw surgery, the discounted mean costs per patient were 2,553 (95% CI: 2,363 - 2,743). The low estimate was 2,430 (95% CI: 2,258 - 2,602) and the high estimate was 4,094 (95% CI: 3,784 - 4,403).

The costs in patients undergoing no procedure were assumed to be zero. Non discounted costs were also fully reported in the paper.

Synthesis of costs and benefits
An incremental cost-utility ratio was calculated to combine the costs and benefits of the two interventions.

The estimated cost per QALY in the intervention group, compared with the control group (no intervention), was 561 (546 for the bimaxillary group and 617 for the single jaw group).

The acceptability curve showed that, if the health service payer was willing to pay at least 825 for each extra QALY, then the probability of orthognathic treatment being cost-effective exceeded 90%.

Authors' conclusions
Even under uncertain assumptions, the estimated cost per quality-adjusted life-year (QALY) associated with the orthognathic treatment was relatively low, and there was a high probability of the treatment being cost-effective.

CRD COMMENTARY - Selection of comparators
The rationale for the choice of the comparator was clear. No intervention was selected, as the objective of the analysis...
was to evaluate the active value of orthognathic treatment. However, the authors did not state whether other alternative treatments were available for patients with dentofacial disharmony. You should decide whether it represents a valid comparator in your own setting.

Validity of estimate of measure of effectiveness
The analysis of effectiveness focused only on one outcome (the patient’s utility values), whereas clinical measures (intervention efficacy, recovery time and complication rates) were not evaluated. Thus, it must be assumed that the intervention was always successful. The effectiveness evidence came from a single group of patients who were undergoing the orthognathic treatment, while the utility in the control group was derived from the authors’ assumptions, which were not supported by any scientific evidence. The authors admitted that the sample size was small and that, with the exception of age, details of the patients enrolled were not reported. Thus, it was unclear whether the sample included in the study was representative of the study population. The expected survival was assumed to have been 50 years, which seems reasonable. A bootstrap analysis was conducted to account for uncertainty in the effectiveness data estimated in the study.

Validity of estimate of measure of benefit
QALYs were used as the benefit measure in the analysis and the method used to elicit the patient’s utility values was reported. The use of QALYs enables comparisons to be made with the benefits of other interventions, which are actually funded in the context of the NHS.

Validity of estimate of costs
The perspective adopted in the study appears to have been that of the NHS. All the relevant categories of costs were included in the economic evaluation. The unit costs and the quantities of resources used were not reported separately and the price year was not given. Thus, the reproducibility of the cost analysis in other settings would be hindered. A detailed breakdown of the costs was not reported. The costs were reported as averages with CIs, and the authors attempted to take into account the variability in cost estimates. Bootstrap values were also reported. The cost estimates were specific to the study setting, although low and high estimates were used in the sensitivity analyses.

Other issues
The authors did not compare their findings with those from other studies. They stated that their analysis represented the first full economic evaluation on a treatment for facial discrepancies. The issue of the generalisability of the study results was not addressed. In addition, the overall external validity of the analysis was low, as local cost data were used and few sensitivity analyses were conducted. The study referred to the wide group of patients with facial discrepancies and this was reflected in the conclusions of the analysis. The authors discussed some limitations of their study, such as the small sample size and the lack of an explicit control group.

Implications of the study
The study suggests that maxillofacial surgery may be a cost-effective intervention from the perspective of the UK NHS. It is associated with improvements in the patient’s quality of life at moderate costs.

Source of funding
None stated.

Bibliographic details

Indexing Status
Subject indexing assigned by NLM

MeSH
Adult; Cost-Benefit Analysis /methods; Female; Great Britain; Health Care Costs; Humans; Male; Malocclusion /surgery; Oral Surgical Procedures /economics; Quality-Adjusted Life Years

AccessionNumber
22003000514

Date bibliographic record published
30/11/2003

Date abstract record published
30/11/2003