

Systematic Review Craniofacial Deformities

Complications of mandibular distraction osteogenesis for acquired deformities: a systematic review of the literature

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Abstract. A systematic review on complications in all forms of mandibular distraction osteogenesis (MDO) for acquired deformities was performed. Search terms expressing distraction osteogenesis were used in ‘AND’ combination with search terms comprising ‘mandible’ and terms for complication, failure, and morbidity. A search using PubMed (National Library of Medicine, NCBI), EMBASE, and the Cochrane Controlled Trials Register yielded 644 articles published between 1966 and mid October 2013. Three hundred and twenty-one eligible articles were screened in detail. Complications related to MDO in acquired deformities were reported in 105 clinical articles, involving 1332 patients. Treatments included alveolar distraction osteogenesis (ADO), mandibular lengthening, DO in bone grafts, and bi-/trifocal transport disc DO (TDDO) for segmental mandibular defects. A high incidence of complications was seen in MDO for acquired deformities (ADO 44.4%; residual group 43.9%). An index for classifying complications in MDO, based on the impact and further treatment or final results, was used. In the ADO group, soft tissue complications (8.0%), insufficient vector control (7.6%), temporary inferior alveolar nerve (IAN) neurosensory disturbances (6.5%), device-related problems (3.5%), mandible fractures (2.8%), insufficient bone formation (2.5%), and fracture of the transport disc (1.3%) were seen. In the residual group, temporary IAN neurosensory disturbances (13.4%), minor infection (5.3%), DO failure (4.0%), and device-related problems (3.8%) were reported.

Key words: distraction osteogenesis; complication; complicated; failure; morbidity; mandible; mandibular; alveolar process; obstructive sleep apnoea; TMJ ankylosis; systematic review; PRISMA statement.

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Mandibular distraction osteogenesis (MDO) is a versatile technique that is applied in patients with congenital,¹ developmental,² and acquired mandibular deformities. After its introduction for the lengthening of the human mandible by McCarthy in 1992, a broad spectrum of indications and applications has arisen.³

Vertical distraction osteogenesis of the alveolar bone (ADO) for dental implant placement as an alternative to bone grafting is a common indication.^{4,5} However, this challenging technique is prone to a variety of complications.⁶⁻⁹

Patients with indications for reconstructive surgery for segmental mandibular defects after ablative oncology surgery, post-traumatic patients, and patients with complications following prior surgery to the mandible have been treated successfully using a form of DO. Transport disc DO (TDDO) can be applied in a bifocal or trifocal manner, enabling DO at more than one location in the patient.¹⁰ DO can also be used for bone regeneration in free vascularized bone grafts (e.g. fibula).¹¹⁻¹⁴ Temporomandibular joint (TMJ) ankylosis can be treated successfully by means of DO for mandibular lengthening, and this can be done in combination with a gap arthroplasty in some patients.¹⁵⁻¹⁷

The aims of this study were (1) to perform a systematic review of the literature on complications of MDO for acquired deformities, and (2) to classify all complications using a new classification.¹

Materials and methods

Literature search

A comprehensive systematic review of the literature was performed in the bibliographic databases PubMed (National Library of Medicine, NCBI), EMBASE, and the Cochrane Central Register of Controlled Trials from inception to 15 October 2013; the review was performed in accordance with the PRISMA statement.¹⁸ Search terms included controlled terms from medical subject headings (MeSH) in PubMed and Emtree in EMBASE, as

Table 1. Primary and secondary keywords used for the systematic research.

Primary keywords	Secondary keywords
Distraction	Mandible
Distraction osteogenesis	Mandibular
Lengthening	Alveolar
Complication	
Complicated	
Failure	
Morbidity	

well as free text terms. We used free text terms only in The Cochrane Library. Search terms expressing distraction osteogenesis were used in 'AND' combination with search terms comprising 'mandible' and terms for complication, failure, and morbidity' (Table 1). The references of the articles identified were searched for additional relevant publications.

Study selection and inclusion criteria

Two reviewers independently screened all potentially relevant titles and abstracts for pre-specified eligibility criteria.¹⁸ If necessary, the full text article was checked for the eligibility criteria. Differences in judgement were resolved through a consensus procedure. Full text articles were then obtained for further review.¹⁸

Articles were included if they met the following eligibility criteria: (1) clinical article, (2) mandibular distraction osteogenesis (MDO), (3) acquired mandibular deformity, and (4) a report on complications. Exclusion criteria were (1) insufficient data on complications, (2) no available translation, and (3) non-clinical article (Table 2).

The remaining articles, which were clinically relevant to the subject of the study, were included in the systematic review. According to their emphasis, these relevant papers were included if they described MDO in acquired deformities. The articles were screened for the following

data: type of deformity, number of patients, type of DO, distraction device, vector, and type and number of complications. The latter were classified according to the proposed classification index shown in Fig. 1.¹ This classification places emphasis on the severity and clinical consequences of a complication by dividing events according to whether they are spontaneously resolving or permanent complications, and whether hospitalization or general anaesthesia is required for correction of the complication.

The initial literature search yielded a total of 973 references: 521 in PubMed, 437 in EMBASE, and 15 in The Cochrane Library. After removing duplicate references that were selected from more than one database ($n = 329$), 644 papers remained. The titles and abstracts were screened for eligibility. Three hundred and twenty-three articles were excluded from the review based on the abstract. The full text was obtained for 321 papers and analyzed further. In total, 216 articles were excluded from the review (Table 2): (1) 130 articles described MDO in patients with non-acquired mandibular deformities; (2) 41 articles had insufficient or no information on complications and/or methods; (3) 17 papers were non-clinical (three scientific, 14 synopsis); (4) four papers had no relevance (three non-DO, one maxilla); (5) 10 papers had no available translation (four Russian, three Chinese, two Hebrew, one Japanese); (6) nine articles had an edited publication type (five discussion, four letters to the editor/authors); and (7) five papers were not available in the international libraries. These seven groups were excluded from further evaluation. In the case of a paper that reported complications in a mixed population (congenital, developmental, and/or acquired), in which the complications could not be traced back to the exact patient subgroup, the article was excluded on the basis of insufficient data. A total of 105 articles met the inclusion criteria and described MDO in acquired deformities. A flowchart of

Table 2. Inclusion and exclusion criteria.

Condition	Article types	Number of papers (<i>n</i>)
Excluded from the systematic review	Non-acquired deformity	130
	No relevance: complications and/or methods were inadequately or not mentioned	41
	Non-clinical articles (experimental, scientific, synopsis)	17
	Non-(mandibular) distraction osteogenesis	4
	No translation available	10
	Publication type, e.g. letter to the editor, discussion	9
	Not available in international libraries	5
Included in the systematic review	Clinical articles on complications in mandibular distraction osteogenesis for acquired deformities	105

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