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Distraction osteogenesis for management of obstructive sleep apnoea in temporomandibular joint ankylosis patients before the release of joint

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ABSTRACT

Aim: To evaluate the effects of distraction osteogenesis in management of obstructive sleep apnoea patients secondary to temporomandibular joints ankylosis.
Methods: Fifteen patients were included in study. Preoperatively the patients were worked up for polysomnography and CT scans. Only those patients with Apnoea–hypopnoea index >15 events/h denoting moderate to severe obstructive sleep apnoea were included in the study. Distraction osteogenesis was followed with 5 days latency period in adult patients and 0 days for children. Rate of distraction was 1 mm/day for adults and 2 mm/day for children till the mandibular incisors were in reverse overjet. After 3 months post distraction assessment was done using polysomnography and CT scan.

TMJ ankylosis was released by doing gap arthroplasty after distraction osteogenesis.
Results: Post distraction improvement was seen in clinical features of OSA like daytime sleepiness and snoring. Epworth sleepiness scale improved from a mean of 10.25 to 2.25. Polysomnographic analysis also showed improvement in all cases with apnoea–hypopnoea index from 57.03 to 6.67 per hour. Lowest oxygen saturation improved from 64.47% to 81.20% and average minimum oxygen saturation improved from 92.17% to 98.19%. Body mass index improved from a mean of 18.26 to 21.39 kg/m^2.
Conclusion: Distraction osteogenesis is a stable and beneficial treatment option for temporomandibular joint ankylosis patients with obstructive sleep apnoea.

1. Introduction

Retrognathia whether acquired or congenital leads to reduced posterior airway space and may cause obstructive sleep apnoea. Acquired retrognathia may occur due to temporomandibular joint ankylosis (TMJ).

Obstructive sleep apnoea is a sleep-related disorder defined as absence of breathing for 10 or more seconds despite the effort to breathe (Kushida et al., 2005). Besides having immediate effects of hypoxia, arousal during sleep, snoring and daytime sleepiness, long term repetitive nocturnal upper airway obstruction has a risk of the development of hypertension, stroke and myocardial infarction. Exposure to intermittent hypoxia leads to oxidative stress, inflammation, atherosclerosis and endothelial dysfunction (Prabhakar, 2001). Intermittent hypercapnia and hypoxia may be the mechanism responsible for cardiovascular effects of obstructive sleep apnoea due to sustained activation of the sympathetic nervous system (Patel et al., 2003).

Obstructive sleep apnoea in retrognathic patients can be treated successfully by mandibular advancement procedures. The mandible can be advanced up to 10–12 mm by orthognathic surgery. This advancement is useful only for mild to moderate obstructive sleep apnoea.

Obstructive sleep apnoea secondary to severe acquired retrognathia usually requires extensive advancement. This is easily achieved by using distraction osteogenesis. Distraction induces histogenesis of blood vessels, muscles, nerves, cartilages, ligaments, skin and mucosa.

Mandibular lengthening by distraction osteogenesis is now a commonly used technique to correct congenital and acquired retrognathia (Rao et al., 2004; Shang et al., 2012). Distraction osteogenesis is less invasive, can be applied to children and due to histogenesis there is less chance of relapse (Iatrou et al., 2010; Miloro, 2010).

This study reports our experience in the treatment of obstructive sleep apnoea with distraction osteogenesis in severely retrognathic patients' secondary temporomandibular joint ankylosis.

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TMJ ankylosis was released by gap arthroplasty after completion of a consolidation period post distraction osteogenesis.

2. Material and methods

A prospective study including 15 patients with retrognathia were enrolled in the study. Retrognathia followed temporomandibular joint ankylosis (TMJ) in all 15 cases. Mean age was 18.2 years with a range of 2–46 years. Male: female ratio was 3:2. Institutional review board approval was obtained prior to commencement of the study.

Preoperatively the patients underwent polysomnography and CT scans. Only those patients with an apnoea–hypopnoea index (AHI) >15 events/h, denoting moderate to severe obstructive sleep apnoea (OSA), were included in the study. The distraction vector was planned by computer simulation (Fig. 1a–e). Distraction was done using a stainless steel linear distractor manufactured by Synthes (GmBh Oberdorf, Switzerland.) in all 15 cases. The distractors were placed using a submandibular incision and the activation arm was taken out through a stab incision in the mental foramen region (Figs. 2(a,b) and 3(a,b)).

The standard procedure for distraction osteogenesis (DO) was followed with a 5 day latency period in adult patients and 0 day for children. The rate of distraction was 1 mm/day for adults and 2 mm/day for children until the mandibular incisors were in reverse overjet or edge to edge position.

The consolidation period was calculated using 3 days for 1 mm of distraction in all cases. Patients have polysomnography and CT scan 3 months after distraction osteogenesis. Further surgery to remove the distractor was performed after the completion of consolidation period. TMJ ankylosis was released 6 months after the removal of distractors. Wilcoxon Signed Ranks Test was applied for statistical analysis of the study (Table 1), (Figs. 4–6).

3. Results (Table 2)

3.1. Mandibular advancement

Bilateral advancement was carried out in all cases except one. The range of advancement was from 15 to 30 mm, with a mean of 22.4 mm on right side and 23.16 mm on left side.

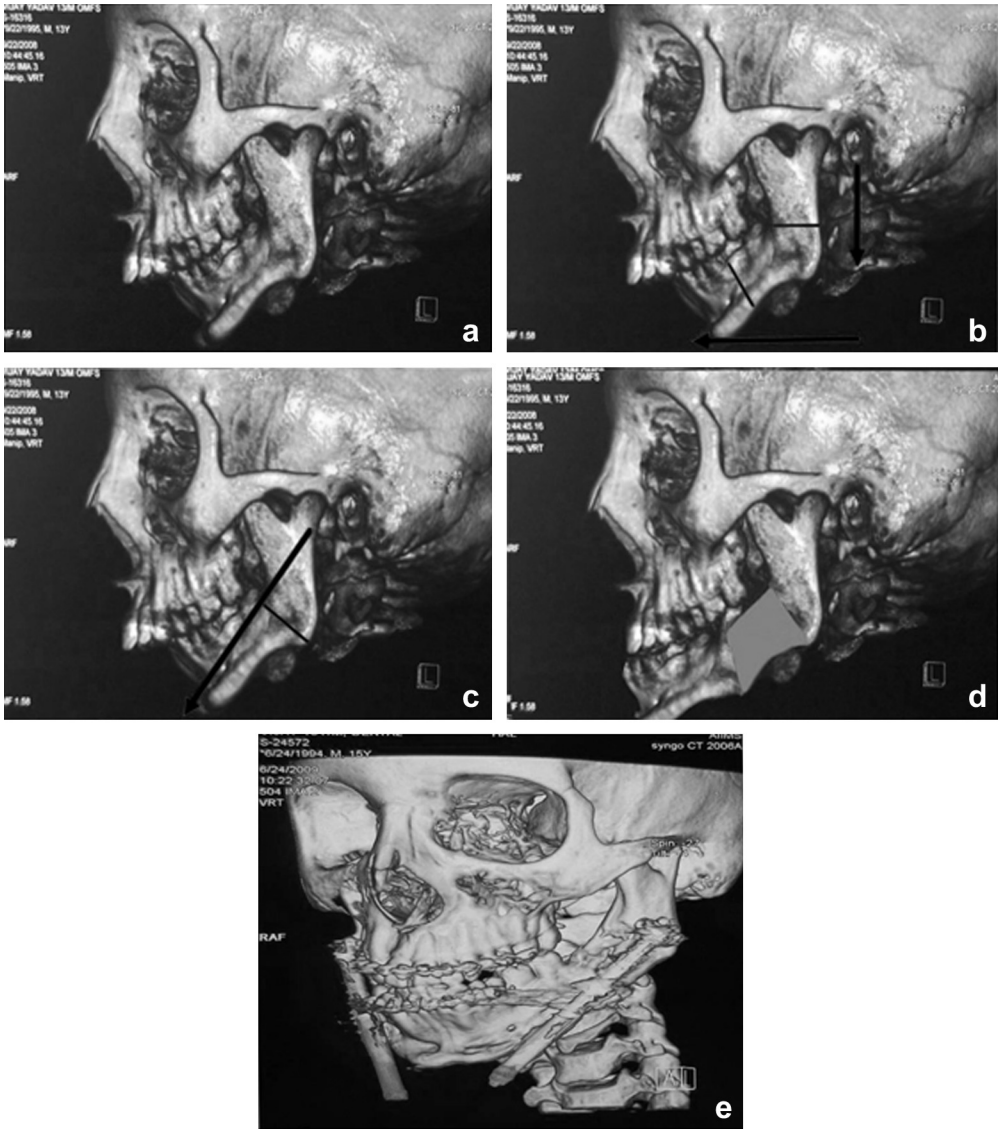

Fig. 1. a) Pre operative CT. (b) Planning phase pre operative CT showing the 2 possible osteotomy cut in horizontal and vertical ramus. (c) Planning phase pre operative CT showing the desired cut at angle of mandible to have the desired vector for distraction. (d) Planning phase pre operative CT showing computer simulation of planned distraction. (e) Post operative CT showing amount of distraction achieved as proposed in planning phase.