

# The Natural History of Treated and Untreated Zygomatic Arch Fractures

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**Abstract:** The authors present the case of a 32-year-old patient treated for a left, isolated zygomatic fracture following assault. The injury was reduced without fixation via the Keene approach. The same patient presented to the emergency room 16 months later with a right-sided fracture similar to the previous contralateral injury. This fracture was left untreated. Repeated assaults over a 4-year period provide us with a natural history of both injuries, allowing for comparison between the 2 approaches. The authors found that reduction of the arch without fixation led to an outcome without palpable or visible deformity and no impaired mastication. Additionally, considering etiology of injury, such as alcohol or drug use, treatment may provide an important point of intervention to prevent recurrence.

**Key Words:** Assault, Keene approach, open reduction without fixation, zygomatic arch fracture

B lunt force to the cheek can result in an isolated zygomatic arch fracture, with resulting indentation and possible trismus. Symptomatic or visible isolated zygomatic arch fractures are commonly treated using either the Keene (intraoral) or Gillies (temporal) approaches to reduce the fracture while avoiding visible scars. Typically, the reduced fractures are not rigidly fixated, but rather held in place by the native periosteal sleeve. Some controversy exists as to the assessment of reduction as well as durability of the reduction and need for fixation. Additionally, isolated zygomatic arch fractures are common, and though simultaneous bilateral isolated arch fractures have been observed, bilateral fractures at different stages in the healing process have not been as well represented in literature.<sup>1-7</sup>

We present a patient who was assaulted and suffered an isolated zygomatic arch fracture, which was reduced with a Keene approach without fixation. Repeat imaging following sequential assaults over 4 years demonstrates maintenance of anatomic reduction as well as a new contralateral zygomatic arch fracture, which was evaluated by another surgeon and not treated. This timeline and sequence of injuries and imaging studies in 1 patient demonstrate the natural

history of isolated zygomatic arch fractures following reduction versus observation.

## CLINICAL REPORT

A 32-year-old male presented to the emergency room following an assault with left cheek pain exacerbated by chewing, and malocclusion. A computed tomography (CT) scan demonstrated an isolated left zygomatic arch fracture with V-shaped medial displacement, 3 fracture lines (the anterior portion of the zygomatic arch within the zygoma bone, the zygomaticomaxillary suture, and the posterior portion of the zygomatic arch within the temporal bone), and impingement upon the temporalis muscle (Fig. 1A). The patient was treated under general anesthesia with a left upper gingivobuccal sulcus incision to facilitate the Keene approach, through which an elevator was introduced under the fractured zygomatic arch for reduction. Proper alignment was confirmed by palpation. No hardware or fixation was employed and no imaging techniques were used to confirm reduction. No pressure to the site and soft diet were recommended for 6 weeks. The patient recovered with no palpable or visible deformity and no impaired mastication.

The patient presented to the emergency room again 16 months later with complaints of right cheek pain following another assault. A CT scan demonstrated a well healed and anatomically reduced left zygomatic arch as well as a new isolated right zygomatic arch fracture similar to the previous contralateral injury, with V-shaped medial displacement (Fig. 1B). The new, right zygomatic arch fracture was evaluated by another surgeon and not treated.

Four years after the original injury and operation for the left zygomatic arch and 32 months after the right zygomatic arch fracture was injured and observed, the patient re-presented to the emergency room with jaw pain. A CT scan was obtained and although no new facial fractures were found, the left zygomatic arch was found to be well healed with anatomic alignment while the right zygomatic arch had significant malunion with persistent medial displacement (Fig. 1C).

## DISCUSSION

Patients with zygomatic arch fracture often present initially with cheek swelling followed by cheek depression as the edema resolves and the contour deformity becomes obvious. Other



**FIGURE 1.** A) Axial view CT scan demonstrating an isolated left zygomatic arch fracture with V-shaped medial displacement, 3 fracture lines (the anterior portion of the zygomatic arch within the zygoma bone, the zygomaticomaxillary suture, and the posterior portion of the zygomatic arch within the temporal bone), and impingement upon the temporalis muscle. B) Axial view CT scan of the same patient 16 months later with complaints of right cheek pain following another assault. Image demonstrates a well healed and anatomically reduced left zygomatic arch as well as a new isolated right zygomatic arch fracture similar to the previous contralateral injury, with V-shaped medial displacement. C) Axial view CT scan of the same patient 4 years after reduction of the left zygomatic arch and 32 months after the right zygomatic arch injury, which was not treated. Image demonstrates a well healed and anatomically reduced left zygomatic arch as well as malunion and persistent depression of the untreated right zygomatic arch.

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common complaints include impaired mandibular motion, or trismus, due to compression of the temporalis muscle, impingement on the coronoid process of the mandible, spasm of masticatory muscles, hematoma or edema.<sup>8</sup> A CT scan confirms the diagnosis and characterizes the zygomatic arch fracture in terms of degree of displacement and comminution, and is also necessary to rule out associated facial or cervical spine fractures.<sup>8</sup>

Once diagnosed, a decision is made for operative versus non-operative treatment. Observation with soft diet may be indicated in the absence of impaired mastication or physical deformity with minimally displaced fractures. Nevertheless, the initial edema from the injury may mask the deformity that may eventually develop. In the absence of medical contraindication, operative treatment should be considered.

Operative treatment can be performed through a coronal incision or endoscopic approach, or, more commonly, through remote incisions in the mouth or hairline. The most common approaches for open reduction are the Gillies (temporal incision) and Keene (intraoral incision) with use of an elevator to lift the bone fragments.<sup>2,3,9–11</sup> Some have advocated using a coronal incision and internal fixation with miniplates or wire cerclage of the arch.<sup>9,12,13</sup> Closed reduction by inflating a Foley catheter placed under the arch fracture has also been described.<sup>14</sup>

High-frequency ultrasound can also provide a real-time, low-cost visualization of arch reduction.<sup>15</sup> Intraoperative 3D computer navigation has also been described. Although we have described the utility of intraoperative 3D navigation for zygomatic complex fractures, we feel that manual palpation alone is sufficient for most isolated zygomatic arch fractures.<sup>16,17</sup>

Isolated zygomatic arch fractures are common, accounting for between 8 and 14% of all zygomatic complex fractures.<sup>1–5</sup> It is therefore important to consider how such injuries are managed, as treatment practices will have important implications for a large population of patients. Although simultaneous bilateral isolated arch fractures have been observed, bilateral fractures at different stages in the healing process have not been as well represented in literature.<sup>6,7</sup> Thus, our case provides valuable insight on the treatment of isolated zygomatic arch fractures with its sequential timeline of treatment and imaging. This demonstrates the long-term results after reduction without fixation versus contralateral non-operative management, allowing for comparison between the 2 approaches.

In our case, reducing the isolated zygomatic fracture via the Keene approach, with manual palpation to confirm proper alignment, resulted in a well-healed fracture with long-term stability and anatomic alignment. Importantly, axial CT images show proper healing and alignment without the use of fixation. By comparison, the untreated and observed fracture shows malunion and persistent long-term deformity.

Beyond treatment alone, the etiology of injury must also be considered to prevent recurrence. Incidence of such fractures is higher among men and among young adults between the ages of 20 and 40.<sup>2–6,12,18,19</sup> Road traffic accidents and assault account for most zygomatic arch fractures.<sup>2,3,12</sup> Drug or alcohol use is a common and related complaint, as seen in our patient.<sup>18,20</sup> This may have contributed to his presentation of fractures. When a patient presents with a facial fracture, the fracture may be a harbinger of an underlying substance abuse, which could lead to further injury. Caring for the patient and identifying drug or alcohol abuse thus becomes a point of intervention with the potential to save the patient's life and prevent recurring injuries.

## CONCLUSION

We describe the long-term natural history of isolated medially displaced zygomatic arch fractures in a patient with sequential bilateral fractures and imaging. When a Keene approach is used for closed reduction without fixation and the reduction is assessed by palpation alone, the fracture can heal well with anatomic alignment and long-term stability. When a similar fracture is observed rather than reduced, malunion, and persistent long-term deformity results. Identifying underlying causes of zygomatic fractures, especially drug or alcohol abuse, may be an effective way to prevent reinjury.

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## Quality of Life Assessment for Elderly Patients Treated With Orthognathic Surgery

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**Aim:** The purpose of the present study was to evaluate the impact of orthognathic surgery on quality of life (QoL) in elderly patients.

**Methods:** Twenty patients who underwent orthognathic surgery to correct Angle Class I, II e, III relations were evaluated. Condition-specific QoL through a 22-item Orthognathic Quality of Life Questionnaire (OQLQ) and generic oral health-related QoL through a 14-item short-form Oral Health Impact Profile (OHIP-14) were assessed.

**Results:** A statistically significant reduction ( $P < 0.001$ ) in the average overall score was detected between the presurgical and postsurgical assessments. Male group showed significant improvement in physical pain ( $P = 0.047$ ) and psychological discomfort ( $P = 0.039$ ). No difference was found between the OHIP-14 ( $P = 0.582$ ) and OQLQ ( $P = 0.525$ ) total scores for the type of surgery (mono-maxillary or bimaxillary).

**Conclusions:** Orthognathic surgical treatment had a positive impact on oral health-related QoL in the patients evaluated. The results of this study emphasize the concept that dental esthetics influence patients' oral health-related QoL.

**Key Words:** Aging, oral and maxillofacial surgery, quality of life

Patients with skeletal and dentofacial discrepancies, especially those severe cases that require surgical correction, have been proven to cause problems with mastication and facial esthetics.

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These problems can lead to some difficulties with social interactions, interpersonal relationships, and even selection of partner and profession, which all affect their oral health-related quality of life (QoL).<sup>1</sup>

Orthognathic surgery is a reliable method for the treatment of dentofacial anomalies<sup>2</sup>; it is indicated in severe malocclusion cases that cannot be corrected by orthodontic treatment alone.<sup>3</sup> The primary goal of this surgery is to achieve esthetic and functional changes, such as the provision of normal harmony and balance to the face and normalizing chewing and speech function.<sup>4,5</sup> Present research reflects interest in how orthognathic surgery affects patients' QoL.<sup>6</sup>

The World Health Organization (WHO) defines QoL as "an individual's perception of their position in life, in the context of culture and value systems in which they live and about their goals, expectations, standards and concerns." QoL is a vast and comprehensive concept, affected in a complex way by the person's physical health, psychological state, social relationships, and environment. It can also be defined as the "sense of well-being of a person who derives satisfaction or dissatisfaction with areas of life that are important to them."<sup>7–9</sup>

QoL assessments have been widely used in the evaluation of orthognathic surgical patients in recent years. For this purpose, generic general health scales determine the overall health differences and impact of oral health on QoL, regardless of disease or condition; specific condition scales that determine the effects of any oral disease or disorder (eg, dentofacial deformity) on QoL have been used as well.<sup>1</sup>

Several questionnaires have been developed to assess the impact of dental conditions on the QoL.<sup>10</sup> The 49-item Oral Health Impact Profile (OHIP) is one of the most commonly used indices to measure an individual's perception of the social impact of oral disorders on their well-being.

The OHIP<sup>11</sup> was originally developed to evaluate the dysfunction, discomfort, and disability attributed to oral conditions in adults or elderly populations (mainly those aged  $\geq 60$  years); it presented 49 items grouped into 7 domains.<sup>12</sup> A shorter version of the OHIP-49 including only 14 items (OHIP-14) was also developed, and it has well-documented psychometric properties, covering specific aspects of oral health: functional limitation and physical pain, psychological discomfort, physical disability, social aspects of disability, and handicaps.<sup>8,11,13</sup> Another instrument using was the Orthognathic Quality of Life Questionnaire (OQLQ), a condition-specific QoL measure targeting patients with dentofacial deformities. The OQLQ is a brief disease-specific tool that has shown validity and reliability.<sup>14</sup>

Previous studies that have examined the effects of orthognathic surgery on QoL have generally been conducted by taking measurements before and after the operation in the same patient group.<sup>1,15–17</sup> Such research is important for determining whether orthognathic surgery allows normal levels of QoL to be reached and whether patients obtain normal appearance and function.<sup>2</sup>

Since the early 1990s, indicative of the increased search for esthetic procedures, elderly patients have been giving off important signs.<sup>18</sup> Since then, several esthetic procedures have been shown to be more prevalent in elderly patients than in young patients. Yeslev et al in 2015<sup>19</sup> demonstrated that the search for cheek augmentation, browlift, blepharoplasty, facial rejuvenation, and facelift procedures is significantly more sought after by the elderly than by young people. Countless esthetic surgeries knowingly increase the QoL, despite postoperative morbidity.<sup>20</sup> However, there are insufficient data to show how the QoL of elderly patients with orthognathic surgery relates to that of normal, young individuals.