

# Life effects of orthognathic surgery health and social care essay



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Literature Review

1. Introduction

When a patient attends with a dentofacial deformity that is so severe that reasonable correction cannot be obtained by growth modification or orthodontic camouflage on its own, a combination of orthodontics and orthognathic surgery may provide the only feasible treatment option. Orthognathic surgery aims to correct deformity, functional deficiencies of the jaws and to produce a more harmonious facial skeletal appearance. The surgery itself does not only change the skeletal relations of the facial structures, but also those of the soft tissues. Modern day orthognathic procedures can be applied in many fields of surgery. Apart from correcting congenital and post traumatic deformities, orthognathic surgery has successfully been used in the treatment of the obstructive sleep apnoea, with a recent systematic review and meta analysis concluding that maxillo-mandibular advancements are a safe and highly effective treatment for obstructive sleep apnea. (Holty et al. 2010). Orthognathic surgical approaches are not only limited to surgery where the exclusive aim is to reposition the maxilla and/or mandible; they have also been described to reach centrally placed cranial base tumors. (Myoken et al. 2000, Yousseff et al. 2010)

2. Patient motivation for seeking for orthognathic surgery

The driving force for orthognathic surgery patients to seek treatment has been investigated comprehensively, with a desire for aesthetic improvement, being conveyed as the primary reason for patients seeking orthognathic surgery in numerous studies. (Kiyak & Bell 1991, McKiernan et al. 1992, Finlay et al. 1995, Burden et al. 1995; Giddon 1995, Phillips et al. 1997, Arpino et al. 1998; Cunningham 1999, Spyropoulos and Halazonetis 2001, Flores-Mir et al. 2004, Mugonzibwa et al. 2004, Kiekens et al. 2005, Knight and Keith 2005, Schlosser et al. 2005, Williams et al. 2005, Soh et al. 2006, <https://assignbuster.com/life-effects-of-orthognathic-surgery-health-and-social-care-essay/>

Al-Ahmed & Al-Omari 2009, Rivera & Sickels 2010) Other studies have suggested that functional improvements are also an important consideration for many patients. (Auerbach et al. 1984, Jacobson 1984, Flanary et al. 1985, Nurminen et al. 1999, Modhig et al. 2005, Proothi et al. 2010, Rivera & Sickels 2010) Whilst it is evident that functional problems do play a role in a patient's reasoning for seeking orthognathic treatment, achieving an aesthetic improvement has been identified as the key motivating factor, even by patients who initially expressed more concern about functional problems (Stirling et al. 2007). This is in agreement with another study which investigated patient rationale for undergoing orthognathic surgery and reported that improvement in physical appearance was a motivation given by 71% of the sample while improvement in function was a reason for 47% of the sample (Rivera et al., 2000). However in another study of 501 patients who had undergone orthognathic surgery, despite 76% of the patients stating that their appearance was affected by their condition, only 15% stated it was their primary motivation for undergoing surgical evaluation. Thirty-six percent specified that their malocclusion was their primary motivation for seeking treatment. (Proothi 2010). It is evident from these studies that most often potential orthognathic surgery patients present with aesthetic, functional and psychosocial concerns and it is the proportional significance of these factors that varies. Different social, psychological and cultural pressures motivate patients to seek treatment (Macgregor 1981, Jensen 1978, Auerbach et al 1984, Kiyak 2000, Frazao et al. 2006, Miguel 2010). Dentofacial deformities can affect an individual's awareness especially in relation to the development of body image (Shalhoub 1994).

The psychosocial impact of a dentofacial deformity can be more important to <https://assignbuster.com/life-effects-of-orthognathic-surgery-health-and-social-care-essay/>

an individual than the related physical problems, and an individual's entire life can be altered as a result of improving their facial appearance (Proffit and White, 1990). Motivational patterns and reasoning of patients seeking orthognathic surgery have been found in the literature to be varied and often compound in nature. The motivation for orthognathic surgery patients seeking treatment has been previously described as external or internal (Edgerton and Knorr, 1971). External motivations include the need to please others, having irrational ideas and the belief that one's career or social ambitions are being hindered by physical appearance. External motivations require a change in the patient's personal environment rather than surgery to solve the problem (Cunningham et al. 1995). Internal motivation is usually a more compelling form of motivation and includes long established inner feelings about deficiencies in one's appearance. Such individuals may feel that their facial anomaly interferes with their enjoyment of life and they may have a sense of inadequacy. Individuals driven by internal motivations generally make better candidates for surgery (Ostler and Kiyak, 1991, Cunningham et al. 1995). A recent study supports this traditional classification of external and internal motivations but suggests that the 2 categories form a continuum, with purely external motivation at one end and internal motivation at the other, rather than distinct and separate factors. (Ryan et al. 2012) Body dysmorphic disorder (BDD) is a severe psychiatric disease with delusions about defects in appearance for which patients seek surgical help (Vulink et al. 2008). Some studies demonstrate a higher prevalence in men than in women (Taqui et al. 2008), others a higher prevalence in women than in men (Phillips et al. 2005, Rief et al 2006) and others show equal prevalence between genders (Phillips et al. 1997) It has <https://assignbuster.com/life-effects-of-orthognathic-surgery-health-and-social-care-essay/>

been shown that patients presenting for orthognathic surgery with Body Dysmorphic Disorder are rarely satisfied with the results of othognathic surgical treatment (Hepburn and Cunningham 2006) and it is therefore important to recognize this group of patients to avoid unnecessary treatment and to refer them for appropriate management. (Phillips et al. 1993, Veale et al 1996). To assist in preventing dissatisfied patients, clinicians need to be aware of patient expectations of surgery before commencing treatment. (Nurminen et al. 1999)Stenvik et al. stated that a patient's decision can be influenced by a number of consumer and provider aspirations that have been summarized into patient factors (age, sex, environmental influence, desire to improve appearance, and social class), and also orthodontist factors (appreciation of treatment need, access to services, cost of treatment if applicable and treatment priority). (Stenvik et al. 1997)It has been established that whereas children and adolescent patients often seek orthodontic treatment as a result of a joint or sole parental decision, (Story 1966) adult patients tend to be self-motivated to seek treatment. (McKiernan et al. 1992). Despite this difference children, adolescents and adult patients all present with similar motivational factors when attending new patient clinics. (Pabari et al 2011, Story 1966, Sheats et al. 1998)In modern day society facial aesthetics have a big influence on our social life. According to one study, 63% of patients who underwent orthognathic surgery thought that their facial appearance had created problems and negatively affected their personal life and 44% believed it had caused problems in their social life prior to undergoing. (Garvill et al 1992)In a recent study, 92 lay raters were asked to define characteristics that they expected an individual to possess from solely looking at an antero-posterior profile photo of that

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individual. Using a 7 point likert scale each view was scored on 3 aesthetic dimensions and 5 personality dimensions. (Sinko et al 2012)Sinko et al found that patients who had underwent surgery were considered more attractive, pleasant, intelligent, good natured and confident when their pre and post op photos scores were correlated. This study clearly demonstrates that stereotyped views exist of patients with dentofacial deformities and are potentially perceived by patients in their daily lives. One would therefore be inclined to expect to find a correlation between severity of deformity and a patient's motivation for seeking joint surgery and orthodontic treatment; however studies have failed to establish any link between these factors (Wilmott et al. 1993, Bailey et al. 2001, Chew et al. 2006). However research does indicate that patients with more severe facial deformities show a significantly higher prevalence of emotional instability, introversion, anxiety, and unsociability. Such psychological profiles make orthognathic patients with severe facial deformity more prone to depression, psychological distress and adverse psychological reactions (Kovalenko 2012). Despite this study the evidence to suggest that those with greater facial deformities would be more likely to seek orthognathic treatment does not exist. In conclusion, over the last few decades, as society has become more accepting of surgical procedures to improve facial deformities, orthognathic surgery has gained widespread acceptance and an ever increasing demand. The core motivation for a majority of patients seeking surgical correction of facial deformity and abnormalities is to improve facial appearance with a hope that the quality of life will also be improved. Consequently the need to accurately predict facial profile outcomes has never been as important as it is now, as this for many patients will define success or failure. (Syliangco 1996 - soft tiissue 2)3.

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Quality of life effects of orthognathic surgeryThe term ' quality of life' is now found regularly in literature in relation to health care. Medical interest in quality of life analyses was inspired by success in prolonging life and from the realisation that people want to live, not just exist. (Cunningham et al 1996)Orthodontists and maxillofacial surgeons who work in this field can provide anecdotal evidence of the improvement in psychological and social wellbeing that combined orthodontic and orthognathic treatment brings to their patients. However, modern health care demands a higher level of evidence, particularly for lengthy and costly interventions that have well-recognized risks, such as orthognathic surgery. Many studies have all comprehensively reached similar conclusions that orthognathic patients experience psychosocial benefits as a result of orthognathic surgery, including improved self-confidence and social adjustment. (Kiyak 1986, Hunt et al. 2001) Aswell as notable increases in quality of life indices beyond the initial surgery period. (Hatch et al 1998, Moteogo et 2003, Modhig et al. 2005, Lee et al 2008, Al-Ahmed 2009)Although some studies have failed to establish a conclusive link between orthognathic surgery and increased quality of life measures (Cunningham et al 1996)The assumption in orthognathic surgery is that the patients accept short-term risks and discomforts in return for long-term benefits in terms of quality of their lives and it is for this reason that quality of life analyses are usually carried out several months after surgery. With those studies that analyse the quality of life effects on the immediate post operative period reporting an expected initial reduction in quality of life markers and indices. (O'Young et al 1987, Lee et al. 2008, Esperao et al 2010)A systematic review by Hunt et al. (2001) established that after orthognathic surgery, the majority of patients report

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psychological improvements which include improved self-esteem, self confidence, improved sense of body image i. e. facial attractiveness after surgery, desirable changes in personality, social functioning, emotional stability, overall mood as well as positive life changes such as better personal relationships and employment prospects. However the wide variations in study designs and a lack of uniformity in measuring the psychosocial changes has made it difficult to quantify the extent and the duration of the psychosocial benefits. (Hunt et al. 2001) Despite the inability to quantify these benefits it would be fair to conclude that, combined orthodontics and orthognathic surgery is a reliable treatment modality with significant positive effects on quality of life indicators. (Murphy et al. 2011)4.

The need for orthognathic surgery prediction. Should I have methods of prediction here or will it be fine as the next topic heading? Patient related factors Prediction of facial appearance prior to surgery may be used to manage patient expectations and avoid post surgical dissatisfaction along with educating patients about the aesthetic effects of treatment on the facial profile. Phillips et al. (1994) found that although imaging predictions did not directly affect patients' treatment decisions they were indirectly affected by strengthening the patients self image motivation and expectations and by confirming the necessity of surgery as the treatment option. Preparing patient expectations is an essential phase of orthognathic surgery as it has been demonstrated that patients who have neutral or negative expectations regarding the outcome of treatment tend to have more psychological distress after surgery, while those with positive treatment expectations tend to minimize or ignore unfavourable symptoms. (Phillips 2001). If these

patients are more involved in the process it would be hoped that not many  
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would reach the surgical stage with a negative or neutral expectation. The above findings have also been demonstrated in a recent study which concluded that patient's expectations of treatment outcome are one of the key determinants of satisfaction (Ryan 2012b). This highlights the importance of clinicians providing appropriate pre surgical information, which can include simulated images of treatment outcomes, as well as emotional support and referral to a mental health professional if necessary. As demonstrated previously the main motivating factors for patients to seek orthognathic surgery is to change facial appearance, and patients often want to visualise the expected improvements as a result of the surgery. From clinical experience the majority of patients are unaccustomed to viewing themselves in profile and it is therefore difficult for patients to imagine profile changes in their facial appearance following surgery (Pospisil 1987). It would be more productive and informative for patients if a three dimensional simulation could be visualised. The ability to predict the outcome of any orthognathic procedure relies on the surgeon's ability to accurately reproduce the desired skeletal movements. A study by Bryan and Hunt (1993) investigated the accuracy with which a planned surgical change could be achieved during orthognathic surgery. It is concluded that, despite individual variation, no statistically significant difference could be demonstrated between the orthognathic prediction and the surgical outcome. The results of this study were subsequently supported by Jacobson (2002), who found 80% of the surgical results fell within 2 mm of the prediction and Ong et al (2001) who when investigating the surgical accuracy of 30 continuously recruited patients found that 97% (29/30) of anterior maxillary movements in the vertical dimension, 90% (27/30) of

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anterior maxillary movements in the horizontal dimension and 87% (26/30) of movements in both dimensions had a difference of 2 mm or less. It is generally accepted that even if both the simulation and surgery are carried out identically that the soft tissue changes do not always mimic those of the underlying hard tissues. This is most likely due to a number of factors including variations in soft tissue thickness. (Subtelny 1959, Eckhardt and Cunningham 2004). However patient reaction to this relatively new technology has not been thoroughly investigated. In a randomized clinical trial of patients who sought a treatment consultation for a dentofacial disharmony, patients that were assigned to a group that was shown a treatment simulation ranked the treatment simulation as the most helpful part of the consultation. (Phillips et al 1995) Clinician related factors Accurate treatment planning is an important element of orthognathic surgery if optimum aesthetic and occlusal results are to be obtained (Eckhardt and Cunningham 2004). A thorough understanding of the soft tissue response to underlying bony movement is necessary for treatment planning, prediction, patient education, and informed consent. Accurately predicting surgical outcome is also of vital importance in treating dentofacial deformities. These predictions act to give the patient a reasonable preview of the outcome and also serve as a communication tool between the orthodontist and surgeon. (Gossett et al. 2005) Many changes have occurred in medical practice that have reduced patient availability for training, the advances in technology are contributing to greater use of computer simulated technology in medical education. Computer-based surgical simulators create a no-risk virtual environment and present a safe and effective method for surgical training. (Malone et al. 2010, Schendel et al., 2012) In addition, it has been shown that <https://assignbuster.com/life-effects-of-orthognathic-surgery-health-and-social-care-essay/>

virtual reality training improves operating room performance, allows objective quantification of surgical performance, and allows acceleration of baseline skills (Schendel et al. 2005), along with having the potential to increase predictability in the operating room. (Tucker et al. 2010)Pospisil (1987) investigated the accuracy of prediction tracings and demonstrated that 60% of the tracings showed inaccuracies when compared with postoperative tracings, 83% of all prediction tracings for planning bimaxillary procedures and 40% of all prediction tracing for planning unimaxillary procedures were inaccurate. This study highlights the need for prediction methods to be validated but also emphasises that clearly this form of prediction is not as accurate as one would prefer. (Predictions methods discussed later). Pospisil advocated that clinicians do not attach importance to these tracings to such a degree that they are shown to the patient, until we are confident that we are accurately presenting the correct changes. Whether we have now arrived at this stage with the advent of three dimensional surgical planning software systems remains to be seen. In a more recent study looking at patient expectations of video imaging when used for orthognathic surgery, Sarver et al (1998) demonstrated that patients had a positive attitude toward the imaging process; 89% felt that the predicted images were realistic and the desired results were achieved. The fear that a patient's expectations might become too great if the authors provided a pre surgical video prediction did not appear to be supported in this study. Sinclair et al. (1995) found that patients who had been imaged had more realistic expectations as to treatment outcome and therefore the chances of dissatisfaction were considerably reduced. However authors have questioned whether the introduction of computer generated predictions to <https://assignbuster.com/life-effects-of-orthognathic-surgery-health-and-social-care-essay/>

patients opens up litigation pathways if a patient feels the outcome is very dissimilar from the prediction. (Chavez et al. 1997, Koch et al. 1998, Sarver et al 1998). Maxillofacial technician related factors

Maxillofacial technicians currently provide essential laboratory support for surgical prediction planning and the fabrication of occlusal wafers / splints to guide the surgical correction of dentofacial deformities. The surgeon prescribes the technician the magnitude of the necessary horizontal and vertical displacement of the maxilla, based on clinical examination and the evaluation of the cephalogram. Using model surgery the technician is able to produce the surgical wafer(s) that guide the surgical positioning of the maxilla and/or mandible. Model surgery accuracy is dependant on several variable factors, all of which can introduce errors into the process. The orientation of dental models mounted on articulators using conventional face bows does not accurately replicate the orientation of the patients' teeth and jaws. (Berbenel et al. 2010). Not only are there errors when using a facebow to register the maxillary complex on the articulator in the same relationship as the maxilla exists in the patient (Gaterno et al. 2001), but the process of facebow transfer itself has been shown to further cause inaccuracies by permitting imprecise study model orientation (Sharifi et al. 2008). This discrepancy in mounting the casts will produce errors in moving the casts during model surgery. (Paul et al 2012) There is strong evidence of inaccuracies in surgical outcomes, and the development of three dimensional surgical assisting technology has provided the potential to overcome some of these inaccuracies. Several authors have reported techniques whereby using CAD/CAM technology the need for model surgery is removed entirely with the surgical wafers / splints being constructed from three dimensional

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surgery simulations. (Metzger et al. 2008, Schendel & Jacobson 2009, Swennen et al. 2009, Quevedo et al. 2011, Centenero & Hernández-Alfaro 2012)Cephalometric prediction planning methods in orthognathic surgery. A number of cephalometric methods have been used to predict post surgical orthognathic results, these include: Freehand alterations of tracing of cephalometric radiographs (McNeil et al., 1972), Combined cephalometric tracings and photographs (Henderson 1974), Computerised prediction (Harradine & Birnie 1985). Free hand alteration of tracings of cephalometric radiographsFish and Epker (1980), Proffit and Epker (1980) and Moshiri et al. (1982), recommended the modification of tracings from lateral skull radiographs as the means of orthognathic prediction. The technique of using cephalometric radiographs to aid in predicting the hard and soft tissue relations was developed by McNeil (McNeil et al., 1972). The procedures for this technique were: 1. Establishment of a tentative post treatment dental relationship using dental casts. 2. The prescribed tooth movements are simulated with a diagnostic set up prior to repositioning the cast2. An overlay tracing is made of the cephalometric radiograph of the hard tissues which will not be affected by the surgery along with the soft tissue profile which likewise will be unaffected. 3. The overlay tracing is sectioned and the hard tissue movements made to reproduce the planned occlusion. Molar and incisor relationships on the reoriented casts serve as guides for correct overlay positioning. The new skeletal relationships are then traced on the overlay in a different colour. 4. The prediction planning is completed by adding the soft tissue profile outlines. 5. This prediction process is undertaken several times until best compromise between ideal tooth position and jaw position is achieved. The procedure proved useful in orthognathic

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planning but it suffered from some disadvantages. Firstly, it was extremely time consuming if done carefully and accurately. Secondly, the best available data on soft tissue changes was hard to collect and increasingly complex and a degree of subjective skill was required (Proffit and Epker, 1980). Combined cephalometric tracings and photographs

In an attempt to produce a more life-like prediction for the patient, the cephalometric radiograph was combined with a photograph of the patient (Henderson, 1974). The procedure is as follows, 1. A tracing was made of the relevant hard tissue structures from the cephalometric radiograph. 2. The photograph was sectioned along the planned osteotomy sites and moved accordingly to the desired hard tissue surgical movements. 3. The soft tissues were then moved according to the known ratios of hard to soft tissue movements. The known ratios of the soft to hard tissue movement can vary considerably in each individual (Freihofer, 1977), and therefore only mean figures of such ratios when designing prediction tracing of a facial profile can be utilised. It is therefore reasonable to assume that in certain cases inaccurate prediction tracings will be inevitable. A much simpler and quicker technique of cutting round and repositioning segments of a tracing has also been devised (Cohen, 1965), but as with sectional photographs, this method takes no account of differential soft tissue movement within each segment (Harradine and Birnie 1985). Additionally, photographs have their limitations (Robertson 1976, Moss et al. 1994) small variations in camera angulation can give the illusion of 'improving' or 'worsening' the facial images produced. This problem can be overcome by taking standardised profile and frontal facial views (Robertson 1976, Ras et al. 1996). However, with a full-face view, the nose is closest to the camera so appears larger, while the ears appear smaller. If

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such images were used to obtain measurements, the results would be inaccurate (Miller 2007). Computerised prediction Quick Ceph (Quick Ceph Systems, San Diego, USA) was the first orthognathic surgical prediction software program to be made commercially available, however this was one year after an article describing computer aided surgical prediction for orthognathic surgery was printed in the Journal of Maxillofacial Surgery (Harradine & Birnie 1985). In this article the authors further reveal that the program which would subsequently be called Consultants Orthodontic Group Software Orthognathic Prediction Analysis (COGSoft OPAL) (British Orthodontic Society, London, UK) was developed and being used since 1982. It however wasn't commercially available until 1988. These respected prediction software systems were introduced to overcome short comings of the available techniques of the time. These techniques at the time were deemed to be time consuming and lacking in accuracy because of human error involved in model planning, tracings, distortion in radiographic images or photographic angulation errors (Harradine & Birnie 1985, Pospisil 1987, Talwar & Chemaly 2008). Presentations of treatment simulations can potentially improve clinical communication between the orthodontist, oral surgeon and patient and also improve clinical decision-making, make care more patient-based while enhancing patient understanding of treatment (Grubb et al. 1996, Kaplan & Lundsgaarde 1996, Sarver 1998). The development of computer technology has also made digital tracing possible, either by on screen digitization of a scanned image file, tracing followed by digitization of the identified points or by direct digitization. However in all methods, the points are located manually and human errors in landmark location remain. Errors in landmark identification have been found to be a <https://assignbuster.com/life-effects-of-orthognathic-surgery-health-and-social-care-essay/>

significant source of error (Baumrind & Frantz 1971, Midtgård et al. 1974, Cohen 1984, Houston et al. 1986). Some authors have commented that digitisation of a traced image increases the risk of error (Cohen 1984) while others have found that the use of computer software for cephalometric analysis carried out on scanned images does not increase the measurement error (Sayinsu 2007). Computer software programs have been developed and used to analyze and predict the outcome of orthognathic surgery (Walters and Walters, 1986; Laney and Kuhn, 1990; Turpin, 1990). These programs are designed so that they allow surgical manipulation of both the skeletal and overlying soft tissue response. The drawback with using these software programs is that they require time, practice, and precision to use the different tools available for predictable results, and the novice user would find this challenging (Kusnoto, 2007). Historical orthognathic literature focused on the analysis of soft tissue/profile prediction errors, from the perspective of visual treatment objectives, patient counselling and surgical accuracy (Bryan and Hunt, 1993). The programs have been usually developed by academic institutions for research purposes, which may then evolve into commercially available software prediction packages specifically for orthognathic surgery. The advantages and disadvantages of computer prediction include (Harradine and Birnie, 1985): Advantages: Manipulation of the image (enlargement and enhancement), allowing for more accurate assessment of poorly defined areas (only indirect digitization). Speed and choice of analysis. Rapid superimposition of serial radiographs. Storage and retrieval of multiple records. Easy comparison of data in studies.

Disadvantages: Profile prediction only i. e. A-P and vertical changes. Expense of equipment  
The learning process. Validity of the computer packages.

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Currently there are a wide variety of computer-assisted 2D cephalometric prediction software programs available, and the reliability of each of the programs has been tested with varying results reported. Most of the reported inaccuracies have been in the soft tissue predictions, with a number of these studies reporting the accuracy of these computerized programs to predict soft tissue changes, 2D Prediction Software: CASSOS™ Computer-Assisted Simulation System for Orthognathic Surgery (SoftEnable Technology Ltd., Hong Kong) COGSOFT™ Consultants Orthodontic Group Software (Consultants Orthodontic Group Software, UK) DFP Dento Facial Planner (Dento Facial Software Inc., Canada) Dolphin Imaging™ Dolphin Imaging Inc., USA OPAL Orthognathic Prediction Analysis™ (Consultants Orthodontic Group Software, UK) Orthognathic Treatment Planner™ Pacific Coast Software Inc., USA Portrait Planner™ Practise Works Inc., USA QC™ Quick Ceph (Quick Ceph Systems Inc., USA) TIOPS™ planning system Total Interactive Orthodontic Planning System The area where most of the larger prediction differences appear is the lower lip. Early studies used only lateral cephalogram tracings without considering soft tissue profile photos in their dental facial planner programs; hence, their prediction programs mostly showed the upper labial region to be more anterior than the actual result and the lower labial region to be more posterior than the actual outcome (Eales et al., 1994; Konstanto et al., 1994). These inaccuracies were dealt with by Carter (Carter et al., 1996), who used photography along with cephalometric tracings for accurate prediction of the overlying soft tissue in the Orthodontic Treatment Planner software programme (Pacific Coast Software Inc., USA). The results however were no different from the other studies, with significant differences still present in the lower lip area (Syliangco et al., 1997; Sameshima et al., 1997; <https://assignbuster.com/life-effects-of-orthognathic-surgery-health-and-social-care-essay/>

Hing, 1989; Kazandjian et al., 1999, Jones et al., 2007). The clinical implication is that there is a need to caution patients about potential limitations in the prediction of horizontal and vertical changes in the lower lip area. The stated reasons for the discrepancies are: different lip tonicity, length, posture, and mass (Lines and Steinhauser 1974; Quast et al., 1983; Stella et al., 1989; Syliangco et al., 1997; Sameshima et al., 1997; Kazandjian et al., 1999). The shortcomings of 2D prediction planning are that prediction is only accurate as the ratios for hard to soft tissue movements, which is based on historical, varied and questionable evidence. Moreover, only profile prediction analysing horizontal and vertical changes can be determined. The technique does not investigate and therefore cannot report on the third, transverse, dimension (Kaipatur and Flores-Mir, 2009). This is further complicated by the fact that patients are unaccustomed to seeing themselves in profile and any transverse facial asymmetry problems can not be predicted.