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COMPARITIVE EVALUATION OF INTRAORAL AND EXTRAORAL DIGITIZATION OF MALOCCLUSION- AN INVIVO STUDY

Orthodontics

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ABSTRACT

Aim: To evaluate and compare the Intraoral and Extraoral digitization of malocclusion with the greatest accuracy, in terms of trueness and precision in vivo. **Materials And Methods:** Twenty patients with different skeletal patterns were enrolled for this study. Each participant was subjected to both Intraoral scanning and elastomeric impression (Sample A and sample B) respectively. Intraoral scan was performed using ITERO ELEMENT intraoral scanner for both the samples. ORTHOANALYSER 3M Software was used to compare both the sample A and B. The ITERO 3D scanner captured the samples and ORTHO ANALYSER SOFTWARE evaluated various parameters including dentoalveolar measurements, distance from 11 to the line joining 6-6, overjet and scanning time. **Results:** The current study indicates a substantial agreement in terms of accuracy in the anteroposterior length of the lower dental arch between the two groups. It signifies a high level of consistency in the inter-canine distances of the upper arch between groups A and B. It suggests an almost perfect agreement in the intermolar distances of the lower dental arch between the two groups. It shows a high degree of agreement in overjet measurements between groups A and B. **Conclusion:** To summarize the differences between various dental measurements for the two groups, Significant differences are observed in certain measurements, while others show no significant discrepancies. Thus the dimensional accuracy of intraoral scan data may differ significantly according to the type of scanner, with the amount of error in terms of trueness being clinically significant.

KEYWORDS

3D models, Intraoral scanner, iTero, Digital orthodontics, 3D scanner

INTRODUCTION

In this evolution, intraoral scanners represent a significant step with a promising future. In 2008, the dental market witnessed the release of the first in-office digital impression system via full arch scanning, the Cadent iTero. Since then, technology has greatly evolved, and several companies have launched different models of intraoral scanners. Using optical scanning, digital dental scanning reproduces the patient's mandibular and maxillary arches' anatomical structure.

Advantages of intraoral digital scanning

Utilization of digital scanning is also advantageous to orthodontics in various aspects like

- Decreased treatment time
- Enhanced diagnosis and treatment planning,
- user-friendly,
- Refined appliance efficiency,
- Rapid data compliance to the laboratories

Aim And Objectives

To evaluate and compare the Intraoral and extraoral digitization of malocclusion with the greatest accuracy, in terms of trueness and precision in vivo

MATERIALS AND METHODS

20 Patients with different skeletal patterns (class I, II and III) were enrolled for this study. Detailed information on the research purposes, expected duration of the study, and study protocols were explained. Informed consent was received from all subjects Each participant in the study was subjected to intraoral scanning and alginate impression. (Sample A and sample B respectively) Intraoral scan was performed using iTero Element intraoral scanner for both the samples. Orthoanalyser 3M software was used to compare both the sample A and B.

Parameters

A) Dentoalveolar Measurements

1. Upper Inter canine distance
2. Lower Inter canine distance
3. Upper Inter molar distance
4. Lower Inter molar distance

B) Upper And Lower Arch Anteroposteriorlength
C) Distance From 11 To Line Joining 6 – 6
D) Overjet
E) Comparision Of Time Duration

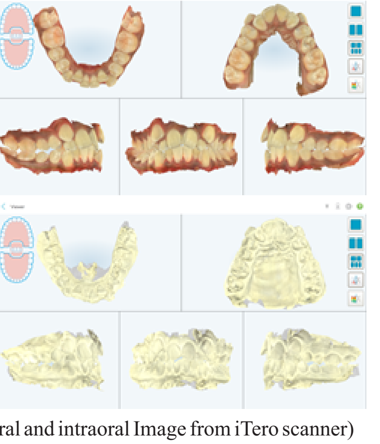
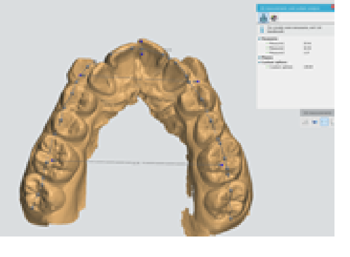


Fig 1 (Extraoral and intraoral Image from iTero scanner)



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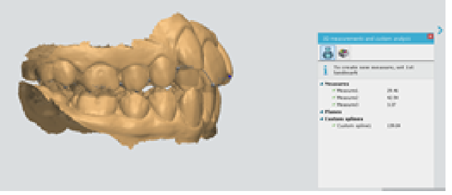


Fig 2 – Measurements from ortho analyser software

Outcome Results

A Upper arch anteroposterior length & B Upper arch anteroposterior length : Strong positive correlation ($r = 0.953$, $p < 0.001$) suggests a high degree of similarity in the anteroposterior length of the upper dental arch between groups A and B

A Lower arch anteroposterior length & B Lower arch anteroposterior length: Strong positive correlation ($r = 0.942$, $p < 0.001$) indicates a substantial agreement in the anteroposterior length of the lower dental arch between the two groups.

A Upper Inter-canine distance & B Upper Inter-canine distance : Very strong positive correlation ($r = 0.981$, $p < 0.001$) signifies a high level of consistency in the inter-canine distances of the upper arch between groups A and B.

A Lower Inter-canine distance & B Lower Inter-canine distance : Moderate positive correlation ($r = 0.692$, $p = 0.001$) suggests a significant but not perfect agreement in the inter-canine distances of the lower dental arch between the two groups.

A Upper Intermolar distance & BUpper Intermolar distance: Strong positive correlation ($r = 0.770$, $p < 0.001$) indicates a substantial similarity in the intermolar distances of the upper dental arch between groups A and B.

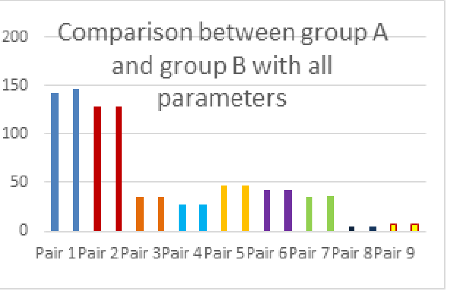
A Lower Intermolar distance & B Lower Intermolar distance: Very strong positive correlation ($r = 0.988$, $p < 0.001$) suggests an almost perfect agreement in the intermolar distances of the lower dental arch between the two groups.

A Overjet & B Overjet: Very strong positive correlation ($r = 0.904$, $p < 0.001$) indicates a high degree of agreement in overjet measurements between groups A and B.

A Scan Timing & B Scan Timing : Moderate positive correlation ($r = 0.655$, $p = 0.002$) suggests a significant but not perfect similarity in scan timing between groups A and B.

Correlation Table :
Table 1

Paired Samples Correlations (GROUP A & B)		N	Correlation	Sig. p value
Pair 1	Upper arch anteroposterior length	20	.953	.000
Pair 2	Lower arch anteroposterior length	20	.942	.000
Pair 3	Upper Inter canine	20	.981	.000
Pair 4	Lower Inter canine distance	20	.692	.001
Pair 5	Upper Intermolar distance	20	.770	.000
Pair 6	Lower Intermolar distance	20	.988	.000
Pair 7	Overjet	20	.904	.000
Pair 8	Scan Timing	20	.655	.002



Graph 1 – Comparision Between Group A &group B

Table 2 – Paired Differences Between 2 Groups

PARAMETERS		Paired Differences Mean	Std. Deviation	95% Confidence Interval of the Difference Lower	Upper	t	P value
Pair 1	A Upper arch anteroposterior length B Upper arch anteroposterior length	-3.72	4.34	-5.75	-1.69	-3.84	.001
Pair 2	A Lower arch anteroposterior length B Lower arch anteroposterior length	-1.14	4.93	-3.44	1.17	-1.03	.316
Pair 3	A Upper Inter canine distance – B Upper Inter canine distance	.04	.24	-.07	.16	.79	.439
Pair 4	A Lower Inter canine distance – B Lower Inter canine distance	-.61	1.29	-1.22	-.01	-2.13	.047
Pair 5	A Upper Intermolar distance – B Upper Intermolar distance	-.01	1.87	-.89	.87	-.02	.981
Pair 6	A Lower Intermolar distance – B Lower Intermolar distance	-.03	.39	-.21	.15	-.35	.727
Pair 7	A Distance from 11 to line joining 6-6 – B Distance from 11 to line joining 6-6	-1.88	3.40	-3.47	-.29	-2.47	.023
Pair 8	A overjet – B overjet	-.31	.69	-.63	.02	-1.99	.061
Pair 9	A Scan Timing – B Scan Timing	-.34	.97	-.79	.11	-1.57	.134

DISCUSSION

Digital technologies have been applied to obtain digital models, calculate spacing and crowding, simulate virtual tooth movements, virtualizes orthognathic surgery and fabricate surgical wafers, Measurements on 3-dimensional (3D) dental models, which were rendered from either CBCT or extra orally digitized plaster casts, were clinically reliable and accurate compared to those from current gold standard plaster models.

In the present study, the time needed for a digital impression obtained by an intraoral scanner in comparison to the time needed for a conventional impression is of no significant differences as the scanner reduces both chair side and processing time. This is in agreement with the result of the study by Sfondrini et al, Burhardt et al.

In a study by Rudd et al, Miller et al, Power et al suggested that with all current digital dental models, there are errors inherent in the fabrication process. For instance, with digital models fabricated from alginate impressions, fine details of tooth anatomy might be lost because of the limited ability of the impression material to flow into areas with undercuts, and potential shrinkage upon desiccation can compound the problem.

Kravitz et al concluded that the inaccuracy associated with IOS impressions can be related to the steps involved with the scanning procedure. Any light scanning process is based on emitting light on tooth surface and capturing the reflected light. Excessive reflection, due to metallic restoration or excessive saliva, or areas with poor access, will influence the quality and the sharpness of the captured image. This is in agreement with the current study in which IOS Scanning (sample A) shows shorter upper and lower anteroposterior length compared to the conventional method (Sample B).

Yun et al suggested that iTero scanner was highly accurate and reliable in ex-vivo scanning of both the buccal and lingual brackets on the dental casts and also linear measurements were precise. This is in agreement with the current study, Group A has a significantly shorter upper arch anteroposterior length compared to Group B. The mean difference is -3.72 with a standard deviation of 4.34 Group A has a significantly shorter upper arch anteroposterior length compared to Group B. Group A has a significantly shorter upper arch anteroposterior length compared to Group B.

The current study indicates a substantial agreement in terms of

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accuracy in the anteroposterior length of the lower dental arch between the two groups and also signifies a high level of consistency in the inter-canine distances of the upper arch between groups A and B. It indicates a substantial similarity in the intermolar distances of the upper dental arch between groups A and B and suggests an almost perfect agreement in the intermolar distances of the lower dental arch between the two groups. It shows a high degree of agreement in overjet measurements between groups A and B.

CONCLUSION

The following conclusions were drawn from the comparative study of intra oral and extra oral digitization of malocclusion:

- Group A has a significantly shorter upper arch anteroposterior length compared to Group B. The mean difference is -3.72 with a standard deviation of 4.34.
- There is no significant difference in the lower arch anteroposterior length, upper &lower intermolar distance, upper inter canine distance and overjet between Group A and Group B.
- Group A has a significantly shorter Inter canine distance compared to Group B. The mean difference is -3.72 with a standard deviation of 4.34.
- Group A has a significantly shorter Distance from 11 to line joining 6-6 compared to Group B. The mean difference is -1.88 with a standard deviation of 3.40.

Thus the dimensional accuracy of intraoral scan data may differ significantly according to the type of scanner, with the amount of error in terms of trueness being clinically significant.

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