Radiographic identification of nonthreaded endoseous dental implants

Indira G. Sahiwal, BDS, DMD, MS,[a] Ronald D. Woody, DDS,[b] Byron W. Benson, DDS, MS,[c] and Guillermo E. Guillen, DDS[d]
Baylor College of Dentistry, Texas A&M University System, Dallas, Texas

Statement of problem. The identification of dental implant bodies in patients without available records is a considerable problem due to increased patient mobility and to the large number of implant systems with different designs.
Purpose. The purpose of this study was to document features that would help dentists identify nonthreaded implant bodies from their radiographic images.
Material and methods. More than 50 implant manufacturers were contacted and asked to provide implants with dimensions as close as possible to 3.75 mm (diameter) × 10 mm (length). Forty-four implants were donated, 16 of which were identified as nonthreaded. Radiographs were made of these implants at 0°, 30°, 60°, and 90° horizontal rotation combined with –20°, –10°, 0°, +10°, and +20° vertical inclination relative to the radiographic beam and film. A total of 20 images per implant were taken and examined to identify consistent, unique features that would aid in implant identification. At a 20° vertical inclination, vital features of implants were distorted enough to be deemed unrecognizable. Therefore, only those observations made from radiographs between –10° and +10° vertical inclination were used for implant identification purposes.
Results. All implants could be recognized from radiographs made between –10° and +10° vertical inclination. A series of tables and flowcharts describe the implants according to their identifying features.
Conclusion. Information from this study should help dentists identify nonthreaded endoseous implants from their radiographic images. (J Prosthet Dent 2002;87:552-62.)

CLINICAL IMPLICATIONS

Information from this study should help clinicians identify nonthreaded endoseous implants from their radiographic images when no patient records are available. This capability may increase the efficiency of restoration, aid in emergency situations, and be useful in forensic identification.

Variations in radiographic images of implant bodies at different horizontal rotations and vertical inclinations to the radiographic beam and film can be attributed to implant design.[1-3] This variability means that a clinician would have to be familiar with all possible images of an implant before he/she could use any one radiographic image to identify it. The aim of this investigation was to study multiple radiographic images of a significant number of implants and document their identifying features. A flowchart of these features would simplify the implant identification process.

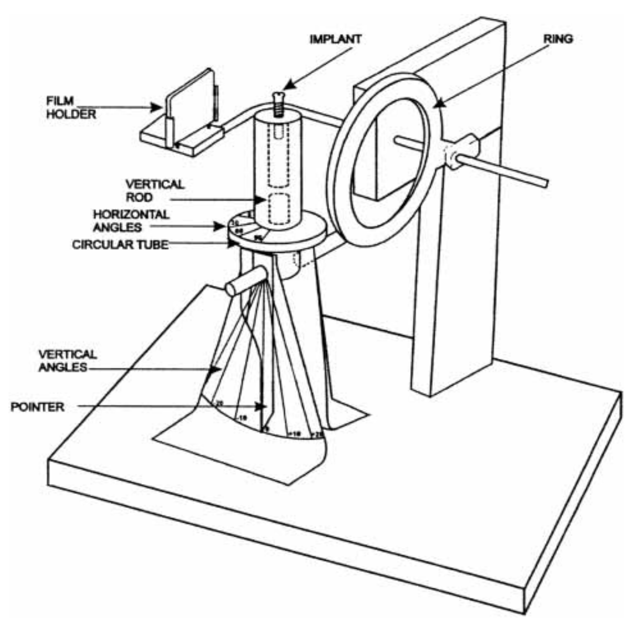

Fig. 1. Device used to conduct study.

Financial support was provided by Baylor College of Dentistry.
[a]Private practice, Palo Alto, Calif.
[b]Professor, Graduate Prosthodontics, Department of Restorative Sciences.
[c]Professor, Oral and Maxillofacial Radiology, Department of Diagnostic Sciences.
[d]Associate Professor, Graduate Prosthodontics, Department of Restorative Sciences.

Table I. Implants used in this study and their manufacturers

Implant name	Implant manufacturer
Ace Cylinder 09222012	Ace Dental Implant System, Brockton, Mass.
Biolock IHSSHA410	Biolock International Inc, Deerfield Beach, Fla.
Friatec-2 stepped cylinder	Friadent, Irvine, Calif.
Imtec 406981	Imtec Corporation, Ardmore, Okla.
IMZ TPS 8039SR	Interpore International, Irvine Calif.
Innova 01B-9I1	Innova, Toronto, Ontario, Canada
Integral 0802	Sulzer Calcitek, Carlsbad, Calif.
ITI HC 042.108 S	Institut Straumann AG, Waldenburg, Switzerland
Minimatic IHCSHA315	Minimatic Implant Technology, Boca Raton, Fla.
O Company 4010TE	O Company Inc, Albuquerque, N.M.
Paragon Bio-Vent BV10 (00112)	Paragon Implant Company, Encino, Calif.
Parc Press-fit Star V057	Park Dental Research Corp, New York, N.Y.
Sterioss Cyl 2810 TPS	Sterioss Dental Implants, Yorba Linda, Calif.
Sterngold Implamed 921236	Sterngold Implamed Dental Implant Systems, Attleboro, Mass.
Tenax 10X-S	Tenax Dental Implant System, Collingwood, Ontario, Canada
3i Cylinder TP413	Implant Innovations, Palm Beach Gardens, Fla.

Table II. Radiographic features of the coronal part of the implants (–20° to +20°)

Implant number	Implant name	External hex	Internal hex	Morse taper	Other	Wider flange	Straight flange	Flared flange	Unique feature
1	Friatec-2 stepped cylinder				✓0-2		✓		
2	Innova 01B-9I1	✓0-2				✓0-2			
3	Ace Cylinder O9222012	✓0-2					✓		
4	Biolock IHSSHA410	✓0-2				✓0-2			
5	Imtec 406981	✓0-2					✓		
6	IMZ TPS 8039SR				✓0-2		✓		
7	Integral 0802				✓0-2		✓		
8	ITI HC 042.108 S			✓0-2				✓0-2	
9	Minimatic IHCSHA315	✓0-2				✓0-1			
10	O Company 4010TE				✓0-2		✓		Groove just below flange
11	Paragon Bio-Vent BV10 (00112)				✓0-2		✓		
12	Parc Press-fit Star V057				✓0-2		✓		
13	Sterioss Cyl 2810 TPS	✓0-2				✓0-2			
14	Sterngold Implamed 921236	✓0-2					✓		
15	Tenax 10X-S				✓0-2			✓0-2	
16	3i Cylinder TP413	✓0-2				✓0-2			

MATERIAL AND METHODS

Letters were sent to more than 50 implant manufacturers requesting implants with dimensions as close as possible to 3.75 mm (diameter) × 10 mm (length). Forty-four implants were donated, 16 of which were identified as nonthreaded (Table I). The morphological design characteristics of all 44 implants were described in a previous article.[4]

A special device (Fig. 1) was fabricated to make standardized radiographs of the 16 nonthreaded implants at different horizontal rotations and vertical inclinations. The implants were mounted on a resin cylinder 4 cm long and 1.5 cm wide with a dimple on one end to hold the implant and a cylindrical opening in the middle of the rod at the other end. The implant was mounted in the dimple on the resin rod with a glue gun, and a surveyor was used to confirm that the

Table III. Radiographic features of the midbody of the implants (–20° to +20°)

Implant number	Implant name	Tapered	Non-tapered	Threaded	Non-threaded	V-shaped threads	Square threads	Reverse buttress threads	Unique feature
1	Friatec-2 stepped cylinder	✓			✓				Stepped
2	Innova 01B-9I1	✓			✓				Fuzzy lateral surface
3	Ace Cylinder O9222012		✓		✓				
4	Biolock IHSSHA410		✓		✓				Wavy lateral surface
5	Imtec 406981		✓		✓				
6	IMZ TPS 8039SR		✓		✓				
7	Integral 0802		✓		✓				
8	ITI HC 042.108 S		✓		✓				
9	Minimatic IHCSHA315		✓		✓				
10	O Company 4010TE		✓		✓				Indent below flange
11	Paragon Bio-Vent BV10 (00112)		✓		✓				Radiolucent band on side
12	Parc Press-fit Star V057		✓		✓				Radiolucencies on sides
13	Sterioss Cyl 2810 TPS		✓		✓				
14	Sterngold Implamed 921236		✓		✓				
15	Tenax 10X-S		✓		✓				Fuzzy lateral surface
16	3i Cylinder TP413		✓		✓				

implant was perpendicular to the base. Distinctive features of the implant, such as apical holes, were placed perpendicular to the radiographic beam as a baseline. The resin rod was mounted in the center of a circular table 4 cm wide, such that the opening at the opposite end of the resin rod fit on a narrow rod (0.5 cm wide and 1 cm long) that extended from the center of the table. This was done in such a manner that the resin rod could be rotated 360° on the table rod.

The table was marked every 30°. The resin rod had a vertical mark on its side so that its rotation relative to the table could be documented. This table was further mounted such that the whole apparatus could be inclined through 40° (–20° to +20°) in the vertical plane. An aiming ring from a radiographic film holding system (XCP; Dentsply-Rinn, Elgin, Ill.) was mounted 5 cm from the center of the clear rod, and the film-holding instrument was mounted 4.5 cm from the center of the rod on a base. The focal-spot-to-object distance was 25 cm, and the focal-spot-to-film distance was 29.5 cm. The film and tube were always parallel to each other, and only the inclination of the implant changed. The entire set-up was designed to mimic clinical situations in which the operator is not familiar with the inclination of the implant but has control over film and tube position.

Optimal radiographic exposure factors were determined subjectively by imaging an extracted premolar. A premolar was chosen because its size is between that of an incisor and a molar. The tooth was placed on the rod, and radiographs were made at 0.16, 0.20, 0.25, and 0.32 seconds. An exposure time of 0.20 seconds, a kVp of 63, and an mA of 8 were chosen subjectively to simulate a clinical situation. All radiographs were made at these exposures. Ultra speed radiographic film (D speed; Eastman Kodak, Rochester, N.Y.) was used in a standard radiographic unit (Prostyle; Prostyle Intra, Planmecca USA Inc, Woodale, Ill.) and processed in an automated machine (AT2000; Air Techniques Inc, Hicksville, N.Y.).

Radiographs for each implant were numbered 1 through 20. All radiographs were made in the same sequence, starting at 0° horizontal rotation and –20° (20° toward the cone) vertical inclination. The vertical inclination was changed to –10°, 0°, +10°, and +20° while the horizontal rotation remained constant. At 0° vertical inclination, the radiographic beam was perpendicular to both the implant and the film. The horizontal rotation was then changed to 30°, 60°, and 90°; at each stop, the vertical inclination was put into the same series of angles described above (from –20° to +20°).

Before the radiographs were made, mounting sheets were prepared for all implants. Each sheet was

Table IV. Radiographic features of the apical part of the implants (–20° to +20°)

Implant number	Implant name	V-shaped apex	Flat apex	Curved apex	Round hole	Oblong hole	Apical chamber	Grooves	Unique feature
1	Friatec-2 stepped cylinder			✓0-1					
2	Innova 01B-9I1		✓0-1						
3	Ace Cylinder O9222012			✓0-2	✓0-3				2 rows of holes
4	Biolock IHSSHA410		✓0-1				✓0-1		
5	Imtec 406981			✓0-1	✓0-3				
6	IMZ TPS 8039SR			✓0-1		✓0-3			
7	Integral 0802			✓0-1	✓0-3				
8	ITI HC 042.108 S		✓0-1		✓0-1		✓0-1		
9	Minimatic IHCSHA315		✓0-1				✓0-1		
10	O Company 4010TE			✓0-1	✓0-3				
11	Paragon Bio-Vent BV10 (00112)			✓0-1	✓0-2		✓0-1		
12	Parc Press-fit Star V057		✓0-1						
13	Sterioss Cyl 2810 TPS			✓0-1	✓0-3				
14	Sterngold Implamed 921236			✓0-1		✓0-3			
15	Tenax 10X-S	✓							
16	3i Cylinder TP413			✓0-1		✓0-3			

labeled with the name of the implant, and each pocket was numbered to coincide with the number of the film. Upon completion of a series of radiographs but prior to their being developed, the sequence of the numbers was verified. The mounting sheet was taken into the dark room, and films were mounted into the corresponding pocket as they came out of the developer to eliminate the possibility of mislabeling or misidentifying radiographs. Films were read on a lighted box with a viewscope (Pearson Dental Supply Company, Sylmar, Calif.) at ×2 magnification; extraneous light was blocked out.

Observations were recorded on 4 data collection sheets, 1 each for coronal, midbody, apex, and screw chamber features. On each form, the 20 angle combinations were listed vertically and the chosen features horizontally. A check mark was placed in the proper box when a certain feature was present at a certain angle. The radiographs were also analyzed with an arbitrary, subjective, nonparametric scale of 0 to 3. The baseline was 0 and included features at the 0°, 0° angle (0° horizontal rotation with the beam directed perpendicular to the implant). An image at a different angle that showed no change from the baseline was also labeled 0. An image was labeled 1 when only slight variation from the baseline was observed with all baseline features visible but no additional features present; 2 when large variation from the baseline was observed with all baseline features visible but no additional features present; and 3 when some baseline features were absent or additional features were present, thus changing the image. This methodology made it easy to observe variation at different angles from the table and allowed each implant to act as its own control (image at 0°,0°). The principal investigator made, processed, and mounted all radiographs and then compiled all data under the guidance of mentors.

RESULTS

Data were compiled for inclinations from –20° to +20° (Tables II through V) and for inclinations from –10° to +10° (Tables VI-IX). The presence of selected features was noted along with the range of variation for each feature at different angles. The prosthetic interface was described in the data forms for completion of description. It was not, however, included in implant identification because in normal clinical conditions it is covered with either the healing cap or the abutment and thus not visible. Similarly, the shape of the end of the screw chamber, though described, could be used for identification only rarely due to the extreme subtlety of this feature.

Results were established for nonthreaded, tapered implants (Fig. 2, *A*) and nonthreaded, nontapered

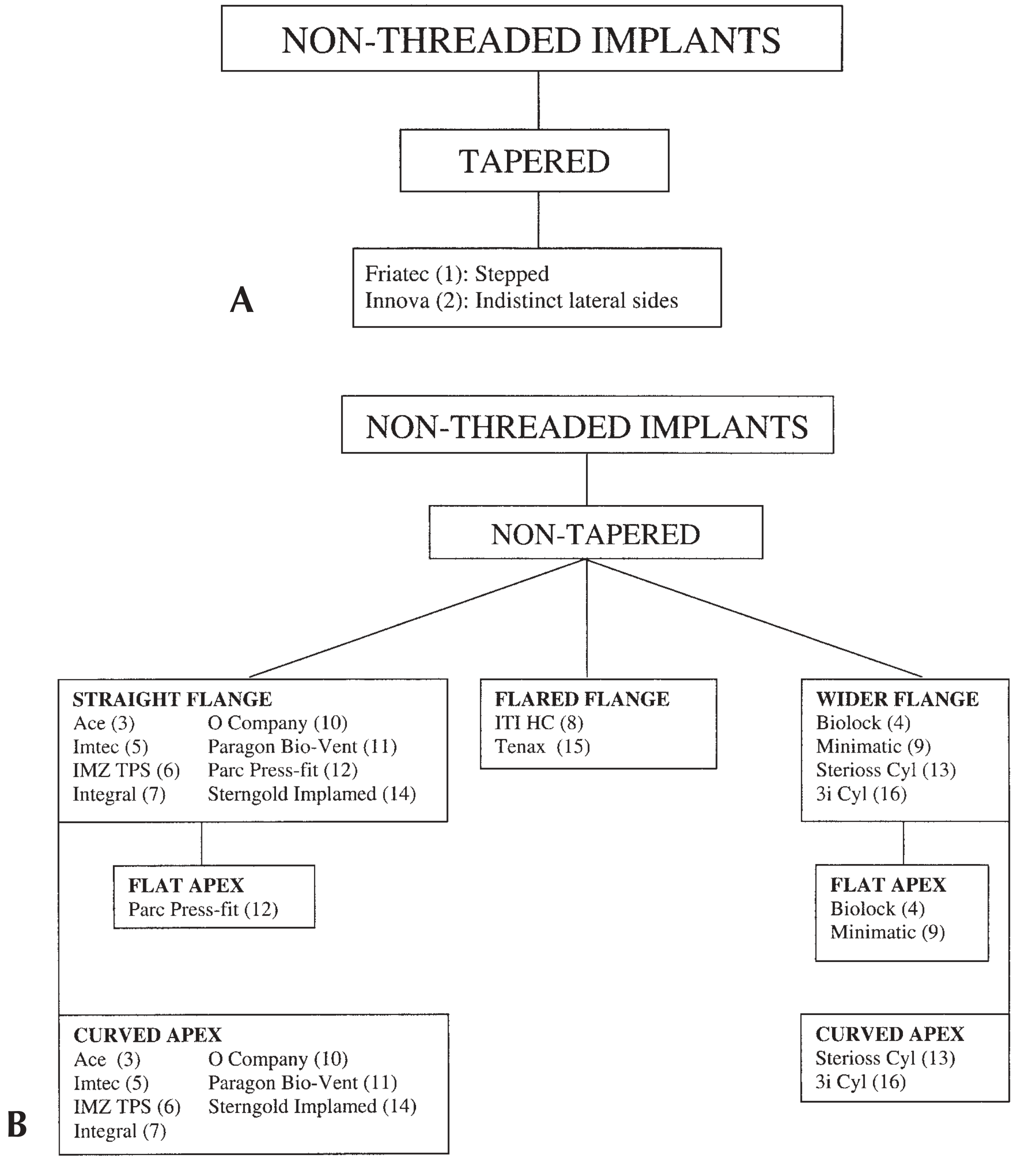

Fig. 2. A, Flowchart for identification of nonthreaded, tapered implants. Number assigned to implant in parentheses. **B,** Flowchart for identification of nonthreaded, nontapered implants. Number assigned to implant in parentheses.

implants (Fig. 2, *B*). In nonthreaded implants, the spiral image around the screw chamber (Fig. 3) always indicates that it is threaded; the same cannot be assumed for threaded implants. Because the number of implants in the nonthreaded, nontapered category was large, their features are presented separately in Table X. The "identifying" features were present at all inclinations (–10° to +10°); the "other" features were not apparent at all inclinations.

DISCUSSION

In reference to Table X, it is important to remember that implants with identifying features would have to be eliminated from a group or subgroup before implants without identifying features could be identified. As an example, consider the implants that are nonthreaded, are nontapered, and have straight flanges and curved apexes. Of the 7 implants in this group, 5 have identifying features. If these 5 were eliminated, information in the "other features" column could be used to distinguish between the remaining 2 implants, one of which has a round hole and the other an oblong hole. If the implants with distinguishing features had not been eliminated, most implants in the group would have either round or oblong holes, making identification based on this feature alone difficult.

Images of implants without apical features varied

Table V. Radiographic features of the screw chamber of the implants (–20° to +20°)

Implant number	Implant name	Straight	Stepped	Threaded	Non-threaded	Curved end	Flat end	V-shaped end	Unique feature
1	Friatec-2 stepped cylinder		✓0-2		✓				Screw chamber indistinct
2	Innova 01B-9I1	✓		✓0-2				✓0-3	
3	Ace Cylinder O9222012	✓		✓0-2		✓0-2			
4	Biolock IHSSHA410	✓		✓0-2					End indistinct
5	Imtec 406981	✓		✓0-2					End indistinct
6	IMZ TPS 8039SR	✓		✓0-2			✓0-3		Screw chamber 2/3 body width
7	Integral 0802	✓		✓0-2					Screw chamber 1/2 body width; end indistinct
8	ITI HC 042.108 S	✓		✓0-2			✓0-1		
9	Minimatic IHCSHA315	✓		✓0-2		✓0-2			
10	O Company 4010TE	✓		✓0-2					Screw chamber 1/2 body width; end indistinct
11	Paragon Bio-Vent BV10 (00112)		✓0-2	✓0-2					End indistinct
12	Parc Press-fit Star V057		✓0-2	✓0-2		✓0-1			Only top of screw chamber threaded
13	Sterioss Cyl 2810 TPS	✓		✓0-2		✓0-1			
14	Sterngold Implamed 921236	✓		✓0-2		✓0-1			
15	Tenax 10X-S	✓			✓	✓0-1			Wide ring below flare
16	3i Cylinder TP413	✓		✓0-2		✓0-1			

little at different rotations and angulations and thus were easier to identify. As an example, Figures 4 and 5 show the Friatec-2 stepped cylinder at each of the horizontal rotations and vertical angulations, respectively, included in this study. Minimal change is evident. This outcome can be attributed to the fact that image variations usually result from changes in the relationship of the apical features to the radiographic beam.

The O Company 4010TE is an excellent example of how apical features can complicate implant identification. This implant has 2 vertical grooves with a dimple in each in the apical area of the implant. These features create a variety of images depending on the rotation of the implant, even when the vertical inclination remains unchanged (Fig. 6). If a dimple faces the radiographic beam and the beam passes directly through the 2 dimples 180° apart, the implant appears cylindrical with a relatively radiolucent circle in the apical area. At 30° horizontal rotation, 2 relatively radiolucent circles can be seen in the apical area; at 60°, 2 semicircular relative radiolucencies can be seen in the apical area. At 90°, the implant appears tapered in the apical area with 2 semicircular relative radiolucencies. Although the

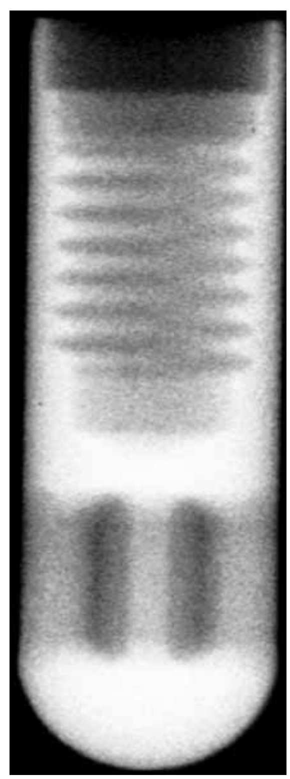

Fig. 3. Threaded screw chamber in IMZ TPS 8039SR.

Table VI. Radiographic features of the coronal part of the implants (–10° to +10°)

Implant number	Implant name	External hex	Internal hex	Morse taper	Other	Wider flange	Straight flange	Flared flange	Unique feature
1	Friatec-2 stepped cylinder				✓0-1		✓		
2	Innova 01B-9I1	✓0-1				✓0-1			
3	Ace Cylinder O9222012	✓0-1					✓		
4	Biolock IHSSHA410	✓0-1				✓0-1			
5	Imtec 406981	✓0-1					✓		
6	IMZ TPS 8039SR				✓0-1		✓		
7	Integral 0802				✓0-1		✓		
8	ITI HC 042.108 S			✓0-1				✓0-1	
9	Minimatic IHCSHA315	✓0-1				✓0-1			
10	O Company 4010TE				✓0-1		✓		Groove just below flange
11	Paragon Bio-Vent BV10 (00112)				✓0-1		✓		
12	Parc Press-fit Star V057				✓0-1		✓		
13	Sterioss Cyl 2810 TPS	✓0-1				✓0-1			
14	Sterngold Implamed 921236	✓0-1					✓		
15	Tenax 10X-S				✓0-1			✓0-1	
16	3i Cylinder TP413	✓0-1				✓0-1			

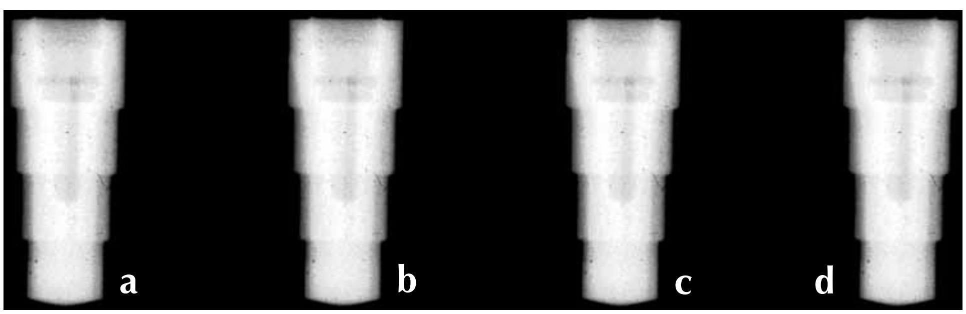

Fig. 4. Friatec-2 stepped cylinder at *(a)* 0°, 0°; *(b)* 30°, 0°; *(c)* 60°, 0°; and *(d)* 90°, 0°.

apical part of the radiographic images obviously cannot be used to identify the O Company 4010TE, the implant is readily identifiable because the coronal part does not change and has a distinct groove under the flange that is visible at all rotations.

A taper on the O Company 4010TE appears when 2 grooves are parallel to the film. If this image were the only one available, a clinician unfamiliar with the criteria used to place implants in certain categories might be tempted to place this implant in the tapered group. As noted in a previous article,[4] it is critical that only the middle third of an implant be used to identify it as tapered or nontapered. Implant identification can then proceed based on Figure 2.

Considerable distortion of the shape of apical holes at inclinations greater than 10° was observed in this study. Circular holes that appeared oblong could lead to false identification. Given this possibility, the clinician should approximate the angle at which a radiograph was made before using it for implant identification. The observation of predictable changes in images of the apical chamber and internal prosthetic interfaces of the implant enables approximation of the vertical inclination of implants relative to the beam and film.

For example, when present and not covered by another feature, the apical chamber of an implant usually appears as a relative radiolucency in the apical area

Table VII. Radiographic features of the midbody of the implants (–10° to +10°)

Implant number	Implant name	Tapered	Non-tapered	Threaded	Non-threaded	V-shaped threads	Square threads	Reverse buttress threads	Unique feature
1	Friatec-2 stepped cylinder	✓			✓				Stepped
2	Innova 01B-9I1	✓			✓				Fuzzy lateral surface
3	Ace Cylinder O9222012		✓		✓				
4	Biolock IHSSHA410		✓		✓				Wavy lateral surface
5	Imtec 406981		✓		✓				
6	IMZ TPS 8039SR		✓		✓				
7	Integral 0802		✓		✓				
8	ITI HC 042.108 S		✓		✓				
9	Minimatic IHCSHA315		✓		✓				
10	O Company 4010TE		✓		✓				Indent below flange
11	Paragon Bio-Vent BV10 (00112)		✓		✓				Radiolucent band on side
12	Parc Press-fit Star V057		✓		✓				Radiolucencies on sides
13	Sterioss Cyl 2810 TPS		✓		✓				
14	Sterngold Implamed 921236		✓		✓				
15	Tenax 10X-S		✓		✓				Fuzzy lateral surface
16	3i Cylinder TP413		✓		✓				

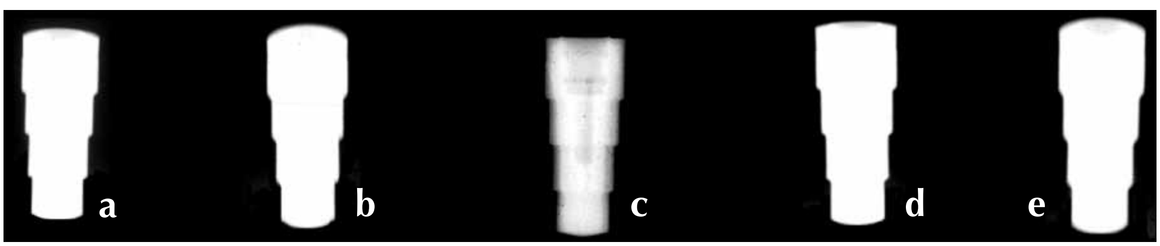

Fig. 5. Friatec-2 stepped cylinder at *(a)* 0°, –20°; *(b)* 0°, –10°; *(c)* 0°, 0°; *(d)* 0°, +10°; and *(e)* 0°, +20°.

at 0° vertical angulation. Regardless of whether the apical chamber can be seen at 0°, the circumference of the chamber becomes increasingly visible at the apex at increased vertical angulations because the 2 sides of the implant do not overlap (Fig. 7). A visible circumference of the apical chamber therefore indicates that the radiographic beam is not at a right angle to the axis of the implant in that particular radiograph. This would also be true if the implant were not parallel to the film. The degree to which the apical chamber circumference is visible should give an astute clinician an approximate idea of the implant inclination to the film and beam. This information could also help in implant identification when the presence of an apical chamber is suspected, as changing the beam angulation might help clarify the apical chamber and thus identify the implant. The internal hex (or any other internal prosthetic interface, if present and visible) also becomes increasingly identifiable at increased vertical angles.

Radiographs are comparable only when they are taken at similar angulations.[5,6] To determine the comparability of 2 radiographs at recall, a clinician could use the visibility of certain features (as described above) as an indication of the angle of the radiographic beam in relation to the implant body. This is especially relevant for nonthreaded implants, as variation in the image of threads in threaded implants is a good indicator of angle variation.

Studies have demonstrated that the accuracy of bone height measurements is compromised even at very small deviations from parallelism between the implant body axis and film plane.[5,6] This discrepancy is further increased with a greater width of the alveolar process. Based on a theoretical and experimental

Table VIII. Radiographic features of the apical part of the implants (–10° to +10°)

Implant number	Implant name	V-shaped apex	Flat apex	Curved apex	Round hole	Oblong hole	Apical chamber	Grooves	Unique feature
1	Friatec-2 stepped cylinder			✓0-1					
2	Innova 01B-9I1		✓0-1						
3	Ace Cylinder O9222012			✓0-2	✓0-3				2 rows of holes
4	Biolock IHSSHA410		✓0-1				✓0-1		
5	Imtec 406981			✓0-1	✓0-3				
6	IMZ TPS 8039SR			✓0-1		✓0-3			
7	Integral 0802			✓0-1	✓0-3				
8	ITI HC 042.108 S		✓0-1		✓0-1		✓0-1		
9	Minimatic IHCSHA315		✓0-1				✓0-1		
10	O Company 4010TE			✓0-1	✓0-3				
11	Paragon Bio-Vent BV10 (00112)			✓0-1	✓0-2		✓0-1		
12	Parc Press-fit Star V057		✓0-1						
13	Sterioss Cyl 2810 TPS			✓0-1	✓0-3				
14	Sterngold Implamed 921236			✓0-1		✓0-3			
15	Tenax 10X-S	✓							
16	3i Cylinder TP413			✓0-1		✓0-3			

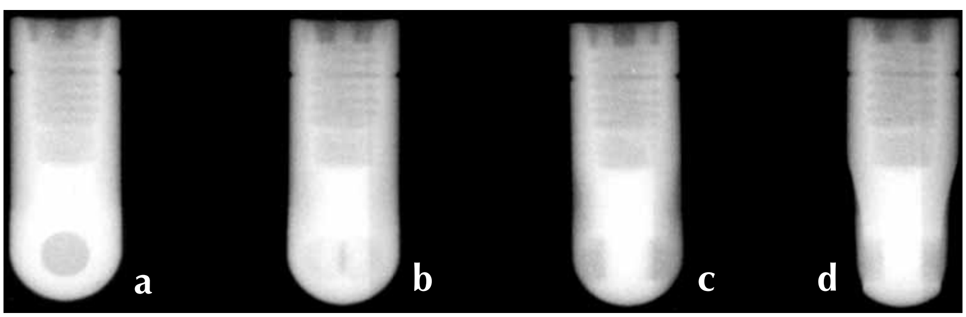

Fig. 6. O Company 4010TE at *(a)* 0°, 0°; *(b)* 30°, 0°; *(c)* 60°, 0°; and *(d)* 90°, 0°.

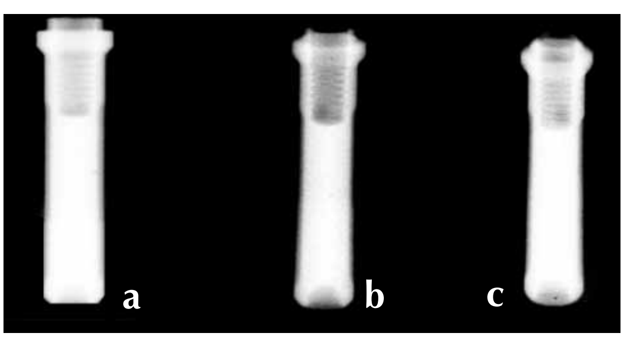

Fig. 7. Apical chamber in Minimatic IHCSHA315 at *(a)* 0°, 0°; *(b)* 0°, -10°; and *(c)* 0°, -20°.

model, it was reported that distortion between bone margins varied between 0.1 mm at 1° vertical angulation and 4.8 mm at 20° vertical angulation depending on the width of the alveolar ridge and buccolingual position of the implant body. It was also reported that ignoring differences in projection angles may lead to a false impression of bone growth or to an underestimation of bone loss around implants. If an implant is depicted from an oblique view, the bone adjacent to the implant will appear more condensed than it would if the projection angle were 90°. The fact that changing the angle of the radiographic beam can result in different images of the same clinical situation underscores the importance of being able to estimate angulation based on the visibility of certain implant features.

Another important clinical application of this skill is confirmation of implant-abutment and abutment-prosthesis seating. Begona Ormaechea et al[7] reported

Table IX. Radiographic features of the screw chamber of the implants (–10° to +10°)

Implant number	Implant name	Straight	Stepped	Threaded	Non-threaded	Curved end	Flat end	V-shaped end	Unique feature
1	Friatec-2 stepped cylinder		✓0-1		✓				Screw chamber indistinct
2	Innova 01B-9I1	✓		✓0-1				✓0-3	
3	Ace Cylinder O9222012	✓		✓0-1		✓0-1			
4	Biolock IHSSHA410	✓		✓0-1					End indistinct
5	Imtec 406981	✓		✓0-1					End indistinct
6	IMZ TPS 8039SR	✓		✓0-1			✓0-3		Screw chamber 2/3 body width
7	Integral 0802	✓		✓0-1					Screw chamber 1/2 body width; end indistinct
8	ITI HC 042.108 S	✓		✓0-1			✓0-1		
9	Minimatic IHCSHA315	✓		✓0-1		✓0-1			
10	O Company 4010TE	✓		✓0-1					Screw chamber 1/2 body width; end indistinct
11	Paragon Bio-Vent BV10 (00112)		✓0-1	✓0-1					End indistinct
12	Parc Press-fit Star V057		✓0-1	✓0-1		✓0-1			Only top of screw chamber threaded
13	Sterioss Cyl 2810 TPS	✓		✓0-1		✓0-1			
14	Sterngold Implamed 921236	✓		✓0-1		✓0-1			
15	Tenax 10X-S	✓			✓	✓0-1			Wide ring below flare
16	3i Cylinder TP413	✓		✓0-1		✓0-1			

Table X. Features of implants categorized in Figure 2, *B*

Implant name	Identifying features	Other features
Straight flange, flat apex		
Parc Press-fit	Radiolucent bands laterally	
Straight flange, curved apex		
Ace	2 rows of round holes apically	
Imtec		Round hole and slightly curved apically
IMZ TPS	Screw chamber 2/3 body width	Oblong hole
Integral	Screw chamber 1/2 body width	Round hole
O Company	Indent at flange/body junction	
Paragon Bio-Vent	Stepped screw chamber	Radiolucent band on one side
Sterngold Implamed		Oblong hole, semi-circular apex
Flared flange		
ITI HC	Morse taper	Round holes apically
Tenax	No apical feature	No Morse taper
Wider flange, flat apex		
Biolock	Wavy lateral surface, flange 2 mm	Oblong apical chamber
Minimatic	Flange 1 mm	Semi-circular apical chamber
Wider flange, curved apex		
Sterioss Cyl	Screw chamber 2/3 body length	Round hole and slightly curved apex
3i Cyl	Screw chamber 1/2 body length	Oblong hole and semi-circular apex

that a 5° vertical angle of the x-ray tube to the implant axis did not significantly affect the identification of openings ≤50 μm. A 15° vertical angulation of the x-ray tube, however, significantly affected the identification of 100 to 150 μm openings. Familiarity with images of the apical chamber at various degrees of angulation could help the clinician recognize radiographs with >10° angulation and so avoid misestimating abutment or prosthesis seating.

Application of the in vitro data gathered in this study may be limited by possible variations in film density, film processing, projection angulations, and implant rotations in the clinical setting. Due to resource, space, and time limitations, all implant systems on the market could not be included in this study. The inclusion or exclusion of any particular system is not meant to infer its superiority or inferiority.

CONCLUSIONS

The data gathered in this study should make the identification of unknown nonthreaded implants easier for the clinician. The ability to estimate radiograph angulation may improve clinical judgment about the comparability of radiographs at recall and help confirm abutment and/or prosthesis seating.

The donation of all implants by their respective manufacturers is acknowledged and appreciated.

REFERENCES

1. Sewerin I. Identification of dental implants on radiographs. Quintessence Int 1992;23:611-8.
2. Sewerin I. Radiographic image characteristics of Brånemark titanium fixtures. Swed Dent J 1992;16:7-12.
3. Sewerin IP. Comparison of radiographic image characteristics of Brånemark and IMZ implants. Clin Oral Implants Res 1991;2:151-6.
4. Sahiwal IG, Woody RD, Benson BW, Guillen GE. Macro design morphology of endoseous dental implants. J Prosthet Dent 2002;87:543-51.
5. Sewerin IP. Errors in radiographic assessment of marginal bone height around osseointegrated implants. Scand J Dent Res 1990;98:428-33.
6. Hollender L, Rockler B. Radiographic evaluation of osseointegrated implants of the jaws. Experimental study of the influence of radiographic techniques on the measurement of the relation between the implant and bone. Dentomaxillofac Radiol 1980;9:91-5.
7. Begona Ormaechea M, Millstein P, Hirayama H. Tube angulation effect on radiographic analysis of the implant-abutment interface. Int J Oral Maxillofac Implants 1999;14:77-85.

Reprint requests to:
Dr Indira G. Sahiwal
15, Crystal Springs Terrace
Hillsborough, CA 94010
Fax: (650)343-5080
E-mail: isahiwal@yahoo.com

Copyright © 2002 by The Editorial Council of *The Journal of Prosthetic Dentistry.*
0022-3913/2002/$35.00 + 0. **10/1/124431**

doi:10.1067/mpr.2002.124431

New product news

The January and July issues of the Journal carry information regarding new products of interest to prosthodontists. Product information should be sent 1 month prior to ad closing date to: Dr. Glen P. McGivney, Editor, UNC School of Dentistry, 414C Brauer Hall, CB #7450, Chapel Hill, NC 27599-7450. Product information may be accepted in whole or in part at the discretion of the Editor and is subject to editing. A black-and-white glossy photo may be submitted to accompany product information.

Information and products reported are based on information provided by the manufacturer. No endorsement is intended or implied by the Editorial Council of *The Journal of Prosthetic Dentistry,* the editor, or the publisher.